Agro-Ecology Specific Interventions/Technologies Recommended for Doubling Agricultural Income in Pithoragarh

Agro-Ecological Region: Region A (up to 1000 m)

A.General information about Agroeco-region
District: Pithoragarh
Agro-ecological region: Region A (up to 1000 m)
Main Blocks in Region: Didihat, Munakot, Bin, Dharchula, Munsiyari, Kanalichina, Berinag
Main village cluster in blocks: Didihat: Thal, Dunacot; Munakot: Jhulaghat, Kangri, Baltari; Bin: Ghat, Khatigaon; Dharchula: Baram, Dutibagar; Munsiyari: Nachani, Tejam; Kanalichina: Bagarihat, Pipali Daulishera, Simkholi, Ranua; Berinag: Purana Thal, Chodmaniya, Nagor; Gangolihat: Pokhari, Saun
Irrigated Clusters: NIL
Rainfed Clusters: All are rainfed
Existing rain water management facilities:
1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj)
3. Village pond (Taal and Chaal)
4. Collection from hill slope (Khaal)
5. Hydrum as lift device
6. Roof water harvesting but limited

B. Productivity Enhancement
1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region
1. Roof water harvesting system
2. water harvesting tank for water storage for scattered fields
3. Khanti ‘s on hills slopes/ tops
4. Diversion of perennial springs and streams through guhls
5. Storage tanks (Hauj)
6. Village pond (Taal and Chaal)
7. Collection from hill slope (Khaal)
8. Hydrum as lift device

2. Existing practices for soil health improvement
1. Use of cow urine and Mixing of Forest litter, Animal bedding & Bicchu Ghas , Timura and Walnut leaves in soil
2. Use of undecomposed farmyard manure/compost
3. Meagre/ no use of biofertilizers
4. Imbalanced/ insufficient nutrient use
5. Use of raw/partially decomposed FYM
6. Meagre/ no compost making/recycling of crop residue
7. Mixed cropping of cereal and legume in few pockets
8. Soil health card scheme launched in 2015

3. Specific Action / Interventions recommended to improve soil health in specific agro-ecological region
i) Cereals and oilseeds
1. Integrated fertilizer application
2. Bio-fertiliser/soluble fertiliser based farming
3. Soil test based fertilizer application
4. Promotion of pulse based crop rotation

5. Maximum use of value added compost/FYM/vermicompost
6. Addition of short duration pulses in rice-wheat rotation

Cereals and oilseeds

1. Seed/ soil inoculation with Azotobacter and Phosphorus solubilising microbial culture (250-300g each/ acre for seed inoculation;/ and 1-1.5 kg each mixed in well decomposed 25 kg FYM/ acre for soil inoculation).
2. Soil test based balanced use of fertilizers in irrigated areas as per recommendation; INM shall be preferred
3. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

Pulses and soybean

1. Seed with specific *Rhizobium* inoculant and Phosphorus solubilising microbial culture.
2. Use of recommended dose of phosphatic fertilizer
3. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

Vegetables and spices

1. Seed/ nursery soil inoculation with *Azotobacter*/ *Azospirillum* inoculant and Phosphorus solubilising microbial culture (each of 200 g/m2 for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with *Azotobacte*r/ *Azospirillum* inoculant and Phosphorus solubilising microbial culture at transplanting.
3. Soil test based balanced use of fertilizers; INM shall be preferred
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost.
5. Low availability of Phosphorus in soil can be mitigated by use of Di ammonium phosphate (DAP) or Zinc phosphate application.
6. Recommended doses of FYM/Vermi-compost can be used for better soil health.

4.Existing crop cultivation strategy being adopted under changing climatic condition

1. Regular Occurrence: Frost, Drought, Cold wave
2. Southern part of district receives high amount of rainfall.
3. Approximately 16% cultivable area is irrigated.
4. Rice, wheat, ragi, maize are prominent crops of the district.
5. Local French bean varieties are being grown in summer season.
6. Growing of vegetables and horticultural crops over small area.

5.Specific strategy to be adopted for doubling productivity under changing climatic conditions in the agro-ecological region

1. The climatic projection suggests increasing air temperature and erratic distribution of rainfall. Therefore following strategy should be followed to increased income under changing climatic scenario.
2. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
3. Plenty of rain water (Approximately 1300mm rainfall) is available in rainy season the rain water should be properly stored (polythene tank, farm pond, by forming bunds) and harvested for Kharif season crops.
4. The area of off season vegetable should be increased at least by double by the year 2022.
5. Soil erosion triggered by higher slope gradient is the major issue of Pithoragarh. Therefore water and soil conservation techniques like terrace farming, bunding etc should be encouraged
6. The frost susceptible vegetable crops should only be grown on southern aspect of topography so that availability of radiation increases and the effect of frost could be minimized.
7. Crop residues should be burnt in the previous night if there is forecast of frost.
8. In frost prone regions organic mulch should be used in a vegetable field for enhancing energy

level in field.

9. The summer temperature is falling in the optimum temperature range, while soils are slightly acidic which favours cultivation of French bean as a summer crop in Munsyari and Dharchula blocks of Pithoragarh District. Plantation of litchi/mango orchards
10. Timely sowing of high yielding varieties of cereals, pulses, vegetables and oilseeds
11. Promotion of protected cultivation
12. Adoption of intercropping techniques
13. Use of fertilizer on soil test basis
14. Increase in water and fertilizer use efficiency through drip
15. IPM & INM modules for specific crop and plants
16. Proper storage and marketing

6 A. Name of Field Crop: Wheat

i. Existing varieties being used: VL 832, VL 738, HS 240, UP1109, VL 804, VL 802, UP 2572, VL 616, HPW 251

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS-490, HS-507, HPW-349, UP 2572

iii. Existing package of practices being used:

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2 ploughing + 1 harrowing with mould bold plough upto 10-15 cm
2. Seed rate and seed sowing -100-125kg/ha, line sowing 18-21 cm apart
3. Manure and fertilizer- 10-15 tonne FYM , NPK 100-120:60:40, 50-60:30:20with micronutrients
4. Irrigation-As per irrigation facility 1 irrigation at CRI, jointing stage and 1 at flowering stage.

v. Major insect pests associated with crop: Cutworm ,Termites, Aphids, Jassids

vi. IPM Module for management of insect pests(except organic areas):

Aphids (*Macrosiphum (Sitobion) avenae* or *Macrosiphum miscanthi*)

1. Avoid late sowing of crop to save crop from aphid.
2. Conservation and enhancement of biocontrol agents like coccinellid beetles, Chrysopa, syrphid, Apanteles etc. protects the crop against aphid attack.
3. Spray any of the following insecticides after diluting in 500 litre water/ha when more than 5 aphids are recorded per ear head:

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG	50	21
Quinalphos 25 %EC	1000	

Termites: *Microtermes obesi* and *Odontotermes obesus*)

1. Dismantle termataria (monde) around fields & kill the termite queen.
2. Summer deep ploughing and burning of stubbles/residue of previous crop.
3. Use well rotten cowdung manure/compost to avoid termites.

Name of the Insecticides	(gm/ml) /ha
Thiamethoxam 30% FS (Seed Treatment/Kg)	3.3 per Kg

Cutworm: *Agrotis ipsilon* and *A. segetum*)

Avoid late sowing of crop to save crop from armyworm.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Methyl parathion 50% EC	300	600
Trichlorfon 50% EC	500	1000

vii. Major disease associated with crop: Yellow rust, Powdery mildew, Karnal bunt, Hill bunt

viii. IPM Module for management of disease:

Karnal bunt: *Tilletia indica = Neovossia indica*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carboxin 75% WP (Seed Treatment/Kg)	2-2.5	
Thiram 75% WS (Seed Treatment/Kg)	2.5-3.0	7-10
Propiconazole 25% EC	500	30
Bitertanol 25% WP	2240	
Triadimefon 25% WP	500	25

Hill bunt : *Tilletia foetida* and *Tilletia caries*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Benomyl 50% WP (Seed Treatment/Kg)	1.0	2.0

Loose smut: *Ustilago nuda* f.sp. *tritici*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carbendazim 50% WP (Seed Treatment/Kg)	1.0	2.0
Carboxin 75% WP (Seed Treatment/Kg)	1.5-1.9	2-2.5
Tebuconazole 2% DAS	0.02	1.00
Difenoconazole 3% WS	0.06	2.0

Yellow rust=stripe rust: *Puccinia striiformis=Puccinia glumarum*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Propiconazole 25% EC	500	30

Powdery mildew: *Erysiphe graminis* f. sp. *tritici*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Triadimefon 25% WP	260-520	25
Azoxytrobin 18.2%+Difenoconazole 11.4 %SC	0.1%	35

ix. Major weeds associated with crop: *Anagalis arvensis, Argemone mexicana, Asphodelus tenuifolius, Avena fatua, Chenopodium album , Rananculus , Phalaris minor*

x. IPM Module for management of weeds(except organic areas):

Red chickweed: *Anagalis arvensis* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Carfentrazone ethyl 40 %DF	50	80
2,4-D Sodium salt Technical (80WP)	625-1000	90
Methabenzthiazuron 70 %WP (POE-30DS)	2000-2500	100
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20% WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Medium soil)	4200	
Clodinafop-propargyl 15%+ Metsulfuron methyl 1 %WP	400	100
Mesoulfuron methyl 3+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

Onion weed: *Asphodelus tenuifolius* (annual, monocot, narrow leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38 %EC	1320-2200	
MCPA Amine salt 40 %WSC	2500	

Field bindweed: *Convulvulus arvensis* (perennial, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D Dimethyl amine salt 58% SL	860-1290	
Metsulfuron methyl 20%WG	20	76
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100

Common wild oat: *Avena fatua* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Diclofop methyl 28%EC	2500-3500	90
Isoproturon 50% WP	2000	
Isoproturon 75% WPs	1330	60
Methabenzthiazuron 70 %WP (PE: 2DAS)	1500-2000	100
Methabenzthiazuron 70% WP (POE: 16-18 DAS)	1000-1250	100
Triallate 50% EC	2500	150
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100

Dwarf canary grass: *Phalaris minor* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Clodinafop Propargyl 15% WP	400	110
Diclofop methyl 28% EC	2500-3500	90
Fenoxaprop-p-ethyl 10% EC	1000-1200	110
Isoproturon 50% WP	2000	
Isoproturon 75% WPs	1330	60
Methabenzthiazuron 70 %WP (PE: 2DAS)	1500-2000	100
Methabenzthiazuron 70 %WP (POE: 16-18DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Pendimethalin 30% EC(Light soil)	3300	
Pendimethalin 30% EC (Medium soil)	4200	
Pendimethalin 30% EC (Heavy soil)	5000	
Pinoxaden 5.1 %EC (POE: 30-35DAS)	800+900	90
Sulfosulfuran 75%WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

Bathua/pigweed: *Chenopodium album* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Carfentrazone ethyl 40% DF	50	80
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38% EC	1320-2200	
Methabenzthiazuron 70 %WP (POE: 30DAS)	2000-2500	100
Methabenzthiazuron 70 %WP (POE: 16-18 DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Metsulfuron methyl 20%WP	20	80

Metsulfuron methyl 20%WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Heavy soil)	4200	
Sulfosulfuran 75% WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Wheat-Horse gram/Soybean(rainfed),Wheat-Rice(irrigated),
4. Timely Sowing, Seed treatment, Use of HYV
5. FIRB
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM
8. INM and soluble fertiliser
9. Integrated weed management
10. IPM
11. Good storages conditions
12. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. climate changing,
4. Wild animal damages, Migration,
5. Poor Irrigation facilities,
6. SAAR practice(Shifting area practice)

6B. Name of Field Crop: Rice

i. Existing varieties being used: Pant dhan-11, Govind, HKR-47, Pant Dhan -6, VL-62, VL 91, VL-16, Sarju-52

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:

Irrigated Rice (VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85)*
Rainfed- Chatki Dhan-VL Dhan 206, 207,208
Jethi dhan – Vivek Dhan 154, VL Dhan 157, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355 plus,); in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.

iii. Existing package of practices being used:

1. Preperation of land- 1 or 2 ploughing with local plough no definit depth, Manual puddling
2. Seed rate and seed sowing -150 kg/ha in dirct seeding rice , and in transplanting 60-70 kg/ha
3. More than 45 days seeding used
4. Manure and fertilizer- use of un decomposed FYM (undecomposed FYM 1.5-2.0qt./nail) with small doses of chemical fertiliser by some progreesive farmers (in irrigated conditions)as per availability
5. Irrigation-usually maximum area is rain fed and in valley condition as avalability of irrigation

roaster

6. Butaclore used by few farmers in irrigated
7. No IPM practices

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 1 or 2 ploughing with local plough , puddling
2. Seed rate and seed sowing -100-125/ha in direct seeding rice , and in transplanting 40-50 kg/ha, basmati20kg/ha,hybrid 20kg/ha 25-30days seeding used
3. Manure and fertilizer- -15 tonne FYM , NPK 100-120:60:40, rainfed 50-60:30:20with micronutrients(Zn, Fe)
4. Irrigation-usually maximum area is rain fed and in valley condition as avalability of irrigation roaster
5. Use of pre and post emergence tp herbicide, rainfed- pre emergence, Use of IPM practices

v. Major insect pests associated with crop: Stem borer, Rice leaf folder, rice bug, thrips

vi. IPM Module for management of insect pests:

Stem borer:

1. In the stem borer endemic area raise the nursery away from light source.
2. Raise nursery in narrow strip and mechanically destroy egg masses and moths
3. Remove seedling with Stem borer eggs before transplanting.
4. Use nitrogenous fertilizer moderately and split the application of it over three growth stages to reduce the damage.
5. For the monitoring install the pheromone traps in the field at the rate of 3 trap per acre at a distance of 60 m in a triangular pattern and record the males trapped daily to access the peak population.
6. For the management of yellow stem borer through pheromone mediated mass trapping of male install the pheromone trap in field at the rate of 20 traps/ha in rows maintaining a distance of 20 and 25 meters between traps and rows, respectively. The traps in the first rows are installed 10 m inside from the boundary of the field. The traps are tied on 1.25-1.5m long straight bamboo sticks or poles with the help of jute or plastic strings.The lures containing 3 and 5 mg pheromone are changed after 3 and 4 week, respectively, whereas 10 mg lure work for whole season. Adjust the trap height at 0.5 m and 1.0 m in the early vegetative and reproductive stage of crop, respectively, or 30 cm above crop canopy in all the stages of the crop.To check the escape of trapped males put a tea spoonful insecticidal dust in the polythene sleeve of dry sleeve trap. Dust is not required in funnel type trap. To Ascertain the quality use lures supplied by 2-3 manufacturers in alternate traps initially and after recording their performance replace the ineffective lures by highly effective lure. Relocate the traps displaced in bad weather and replace the polythene sleeve damaged by weather or animals.
7. Mass rearing and release of some parasitoids such as different species of *Trichogramma* have not been found useful in the rice ecosystems in so many countries including India which are inhabited by *Telenomus* and *Tetrastichus* species. Use of trichocard, therefore, increases the cost of cultivation without any gain. The conservation of *Telenomus* and *Tetrastichus* species is self sufficient to naturally reduce the stem borer population.
8. To increase the effectiveness of parasitoides and predators in the rice field
9. Conserve and enhance the natural enemies which are already present in the field.
10. Create favourable condition for natural enemies.
11. Always leave a pest residue in the field at non-economic level, for natural enemy.
12. Reduce the harmful effect of pesticides on natural enemy by:

I. Apply insecticide only when necessary, not regularly.
II. Apply insecticide only when the pest population reaches Economic Threshold Level.
III. Applying a selective insecticide which is less toxic to natural enemy.

IV. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.
V. Use selective formulation and application method.
VI. Application of granular formulation is less harmful to natural enemy

13. Following insecticides may be used to control stem borers of rice when the population or damage of pest is recorded to 1 moth or 1 egg mass/ m^2 or 5% dead heart :

50 Days within transplating (2 inch water in field)

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 0.4 %GR	10000	53
Fipronil 0.3% GR	16670-25000	32
Cartap 4% Gr	18750	
Carbofuron 3% CG	33300	
Carbosulfon 6% G	16700	37

50 Days after tranplanting

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5 %SC	150	47
Fipronil 5% SC	1000-1500	32
Fipronil 80 %WG	50-62.5	19
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75 %SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20% WG	125	30
Thiacloprid 21.7 %SC	500	30
Acephate 75% SP	666-1000	15
Acephate 95 %SG	592	30
Chromafenozide 80% WP	94-125	32
Monocrotophos 36% SL	1400	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Carbosulfon 25 %EC	800-1000	14
Chlorpyriphos 20% + Acetamiprid 0.4% EC	2500	10
Phosphamidon 40% + Imidachlorpid 2 %SP	600-700	22
Flubendamide 4%+ Buprofezin 20% SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

Name of the Bio-Insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5
Azadirachtin 0.03% EC (Neem oil based)	2500-5000	5
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	1500	

Leaf folder:

Following insecticides may be used to control leaf folders of rice

50 Days within transplating (2 inch water in field)

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)

Chlorantraniliprole 0.4% GR	10000	53
Cartap 4% Gr	18750	
Carbosulfon 6% G	16700	37

50 Days after transplating

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	47
Indoxacarb 15.8 %EC	200	14
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75% SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20 %WG	125	30
Chromafenozide 80% WP	94-125	32
Fipronil 80%WG	50-62.5	30
Acephate 75 %SP	666-1000	15
Acephate 95 %SG	592	30
Monocrotophos 36 %SL	1400	
Dichlorovos 76% EC	627	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Quinalphos 25 %EC	1000	40
Flubendamide 4%+ Buprofezin 20 %SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

Name of the Bio-Insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5
Azadirachtin 0.03% EC (Neem oil based)	2500-5000	5
Azadirachtin 5% (Neem extract concentrate containing)	375	5
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	1500	
Beauveria bassiana 1.15%WP Strain BB-ICAR-RJP	2500	
Beauveria bassiana 1.15%WP Strain ICAR	2500	

Rice bug: *Leptocorysa acuta*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Methyl parathion 2% DP	500	25000

Biological control

Parasitoids:

Gryon flavipes, attacking: eggs

Predators:

Micraspis discolor, attacking: nymphs, adults

Neoscona theisi, attacking: nymphs, adults

Neurothemis fluctuans and *N. terminata* attacking: nymphs, adults

Orthetrum sabina, attacking: nymphs, adults

Pathogens:

Beauveria bassiana, attacking: nymphs, adults

Thrips

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Lambda-cyhalothrin 5% EC	250	15

Bio-insecticides

Name of the Bio-Insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5

vii. Major disease associated with crop: Khaira, rice blast ,Brown spot ,leaf blight, False smut

viii. IPM Module for management of disease:

During Nursery Sowing

Deep summer ploughing or soil solarisation

Seed bio priming with bio-control agent (PS @10g/kg seed) or fungicide (Carbendazime 1g/kg seed)

Fertilizers

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

Sheath blight: *Rhizoctonia solani*

1. Drain of water to check spread of sheath blight.

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carbendazim 50 %WP (Seed Treatment)	2	
Carbendazim 50 %WP	250-500	
Propiconazole 25% EC	500	30
Hexaconazole 5% EC	1000	40
Hexaconazole 5% SC	1000	40
Difenoconazole 25% EC	0.05%	25
Flusilazole 40% EC	300	24
Tebuconazole 250% EC (25.9%)	750	10
Validamycin 3% L	2000	14
Iprodione 50% WP	2250	35
Pencycuron 22.9% SC	150-188	600-750
Thifluzamide 24% SC	375	28
Cresoczim-methyl 44.3 %SC	500	30
Tebuconazole 50% +Trifloxystrobin 25% WG	200	21
Carbendazim 12%+Flusilazole 12.5 %SE	800-960	54
Iprodione 25% + Carbendazim 25% WP	500	
Propiconazole 13.9%+ Difenoconazole 13.9% EC	0.07-0.1%	46
Tebuconazole 50% +Trifloxystrobin 25% WGs	200	31

Biofungicides:

Name of the Bio-fungicides	(gm/lit) /ha	Treatment
Trichoderma viride 1% WP (Strain T-14 in house isolate of M/s Indore Biotech Inputs and Research (P) Ltd., Indore)	5 -10 gm/lit water	Foliar spray: Mix 2.5 Kg of *Trichoderma viride* 1% WP in 500 lit.

		of water. Spray three times at 15 days interval uniformly over one hectare land 30 days after planting.

Rice blast: *Magnaporthe grisea*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Picoxystobin 22.52% SC	600	12
Isoprothiolan 40 %EC	750	60
Tricyclazole 75% WP	300-400	30
Tebuconazole 25% WG	750	10
Idifenphos 50% EC	500-600	21
Carpropamid 27.8 %SC	500	
Cresoczim-methyl 44.3 SC	500	30
Hexaconazole 5% EC	1000	40
Casugamycin 3 %SL	1000-1500	30
Carbendazim 50 %WP	250-500	
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Tebuconazole 50% +Trifloxystrobin 25% WG	200	31
Carbendazim 12%+Mancozeb 63% WP	750	57
Azoxystrobin 18.2% + Difenoconazole 11.4%SC	0.1%	5

Bacterial leaf blight: *Xanthomonas oryzae*

1. Do not planting under full or partial shade to avoide bacterial blight (BLB) infection.
2. After bacterial blight infection of drain the water from field and stop the application nitrogenous fertilizer.
3. Drain of water to check spread of bacterial blight

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Streptocyclin (Seed Treatment)	40ppm	
Streptocyclin (Nursary Treatment)	40-100ppm	
Streptocyclin (Spray)	15	Local recommendation
Copper hydroxide 53.8% DF	1500	10
Copper hydroxide 50 %WP	500	Local recommendation

Biofungicides

Name of the Bio-Fungicides	(gm/Kg) /ha	Treatment
Pseudomonas fluorescens 1.5% WP (BIL-331 Accession No. MTCC 5866)	5 gm/Kg seed	Seed Treatment: Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP with minimum volume of water and coat the seed uniformly, shades dry the seeds just before showing.

Brown leaf spot: *Cochiobolus miyabianus*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Propineb 70 %WP	1500-2000	
Idifenphos 50% EC	500-600	21
Captan 75% WP	1000	

Biofungicides

Name of the Bio-fungicides	Kg/ha	Treatment
Pseudomonas fluorescens 1.5% WP (BIL-331 Accession No. MTCC 5866)	2.5 Kg/ha	**Seed Treatment:** Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP with minimum volume of water and coat the seed uniformly, shade dry the seeds just before sowing.

ix. Major weeds associated with crop: *Oxalis, Cyperus* spp*, Echinocloa* sp*, Chenopodium album, Commalina bengalensis, Cynodon* spp*, Digitaria sanguinales, Eclipta* spp*, Eleusine* spp

x. IPM Module for management of weeds(except organic areas):

Creeping Wood Sorrel: *Oxalis* sp. (annual,perennial, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Metsulfuron methyl 20% WG (Transplanted rice)	20	71

Umbrella plant: *Cyperus* sp. (annual, monocot, narrow leaves, sedge)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
MCPA, Amine salt 40% WSC (Transplanted rice)	2000-5000	
Metsulfuron methyl 20 %WP (Transplanted rice)	20	60
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Bensulfuron methyl 0.6% + Pretilachlor 6% G	10000	88 (Transplanted rice)

Bermuda Grass: *Cynodon dactylon* (perennial, dicot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Bensulfuron methyl 0.6 %+ Pretilachlor 6 %G	10000	88(Transplanted rice)

Bamboo grass: *Digitaria sanguinalis* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90

Jungle rice: *Echinochloa colonum, E. crusgali* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Anilofos 18% EC (Transplanted rice)	1660-2500	
Anilofos 2% G (Transplanted rice)	20000-25000	30
Bispyribac Sodium 10% SC (Nursary)	200	
Butachlor 50% EC (Transplanted rice)	2500-4000	90&120
Butachlor 50% EW (Transplanted rice)	2500-3000	

Butachlor 5% G	25000-40000	90&120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Cyhalofop butyl 10% EC	750-800	90
2,4-D Ethyl Ester 38% EC	2500	
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Fenoxaprop-p-ehtyl 9% EC (Transplanted rice)	625	70 Post
Fenoxaprop-p-ehtyl 6.9% EC	812-875	61
Flufenacet 60% DF (Transplanted rice)	200	90-110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiargyl 6% EC (Transplanted rice)	1066	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90
Anilofos 24%+ 2,4-D ethyl ester 32% EC	1000&1500	90 (Transplanted rice)
Bensulfuron methyl 0.6% + Pretilachlor 6 G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Cinmethylin 10% EC (Transplanted rice)	750-1000	60
Paraquat dichloride 24% SL (Before sowing)	1250-3500	

False Daisy: *Eclipta alba* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Azimsulfuron 50% DF (Transplanted & Direct sown)	70	59
Bensulfuron methyl 60%DF (Preemergence)	100	88
Bensulfuron methyl 60%DF (Postemergence)	100	71
Bispyribac Sodium 10% SC (Direct seeded)	200	78

Butachlor 50% EC (Transplanted rice)	2500-4000	90-120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90-120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 WDG (Transplanted rice)	83.3-100	110
Metsulfuron methyl 20 %WG (Transplanted rice)	20	71
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90
Bensulfuron methyl 0.6% + Pretilachlor 6 %G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110(Transplanted rice)
Metsulfuron methyl 10%+ chlorimuron ethyl 10 %WP	20	90(Transplanted rice)

Indian goosegrass: *Eleusine indica* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Butachlor 50% EC (Transplanted rice)	2500-4000	90-120
Butachlor 5% G	25000-40000	90-120

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Jethirice- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Rice- Wheat /onion/berseem(irrigated),
5. Timely Sowing/Trans planting, Seed treatment,
6. Use of HYV,Hybrid (120-125days), Basmati(120-125days)
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products
14. Avoid early Nursery raisingpractice and use of 21-30 days old seedling

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, Wild animal damages, Migration,
4. Poor Irrigation facilities

6C. Name of Field Crop: Finger millet

i. Existing varieties being used: Band mutthi(Garhwali mandua), Khuli muthi(Kumaon mandua)

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VL Mandua 324, and VL Mandua 352

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. undecomposed FYM 1.0-2.0qt./nali,
3. 1-2 weeding

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2 or 3ploughing ,
2. Seed rate and seed sowing -14-16kg/ha, Gapfilling/Transplating
3. Manure and fertilizer- -10 tonne FYM , NPK 20:40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: Stem borer

vi. IPM Module for management of insect pests(except organic areas):

For management of stem borer, cartop hydrochloride 4 G @ 20-25 kg may be applied 10-15 days after planting.

vii. Major disease associated with crop: Blast

viii. IPM Module for management of disease:

1. Grow resistant variety such as VL 149
2. Seed treatment with carbendazim @ 1g/kg seed followed by 2 sprays of carbendazim @ 0.1% (first when 50 per cent ear heads are formed and second 10 days later)
3. For organic farming seed treatment with Bioagents like T. harzianum @ 10g/kg seed followed by 2 sprays of same @ 10g/litre of water (first when 50 per cent ear heads are formed and second 10 days later).

ix. Major weeds associated with crop: *Oxalis latifolia, Phyllanthus niruri ,Amaranthus viridis,Euphorbia hirata, Solanum* sp., *Tribulus sp,Cyperus* sp

x. IPM Module for management of weeds(except organic areas):

For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. INM(Maximum use of value added compost/FYM
9. and soluble fertiliser)
10. Integrated weed management
11. IPM
12. Good storage condition

13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, wild animal damages, migration,
4. Poor Irrigation facilities

6D. Name of the Field crop: Barnyard Millet

i. Existing varieties being used: Non described

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PRJ-1,VL *Madira* 172 and VL *Madira* 207

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nali,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2or 3 ploughing,
2. Seed rate and seed sowing -14-16kg/ha, Gapfilling
3. Manure and fertilizer- -10 tonne FYM , NPK 20:40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: Stem borer

vi. IPM Module for management of insect pests(except organic areas): -

vii. Major disease associated with crop: Blight, smut

viii.IPM Module for management of disease:

Smut

1. Grow resistant variety like PRJ 1.
2. Seed treatment with carbendazim @ 2g/kg seed or carboxin @ 2.5g/kg seed

ix. Major weeds associated with crop: *Oxalis latifolia, Phylanthus niruri , Amaranthus viridis, Euphorbia hirata, Solanum* sp*,Tribulus* sp*,Cyperus* sp

x. IPM Module for management of weeds: Manual weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Barnyardmillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Gapfilling
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs, use of imbalance and un decomposed FYM, climate changing,

2. Wild animal damages
3. Migration specially from border area,
4. Poor Irrigation facilities

6E. Name of Field crop: Maize

i. Existing varieties being used: Lal makka

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Vivek QPM 9, Vivek Maize Hybrid 45, Vivek Maize Hybrid 53,CMVL Sweet Corn 1, CMVL Baby Corn 2

iii. Existing package of practices being used:

1. Sown as mixed cropping
2. Traditional seed variety , un decomposed FYM 1.5-2.0qt./nail, 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Field preparation
2. Maize suffers severely from water logging. It is therefore, desirable to avoid low lying areas and fields with poor drainage.
3. The first ploughing should be done with soil inverting plough so that at least 20-25cm deep soil may become loose. It should be followed by 2 to 3 harrowing.
4. Planking should be done after harrowing.
5. Proper levelling of the field is required for proper drainage and irrigation.
6. Seed Rate/sowing method
   20-25 kg/ ha for hybrids and 18-20 kg /ha for composites.
   10 - 12 kg/ha for sweet corn.
   12 – 14 kg/ha for pop corn.
   45 – 50 kg/ha for baby corn
7. Sowing should be done in lines by keeping row to row spacing either 60cm or 75cm and plant to plant spacing of 25cm or 20cm, respectively.Seed Treatment
8. Sowing time: Lower Hills : Early June – Mid June
9. Fertilizer Doses & time of fertilizer's application
10. Early maturing varieties and pop corn, sweet corn 120 kg N + 60kg P2O5 + 40kg K2O/ha
11. Medium and late maturing variety 150 kg N+ 60kg P2O5 + 40kg K2O/ ha
12. Baby corn 180 kg N+ 60kg P2O5 + 40kg K2O/ ha
13. Application of zinc sulphate @ 20kg/ha
14. Irrigation-usually maximum area is rain fed
15. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: Stem borer,cut worm

vi. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: -

Maize stem borer: *Chilo partellus*

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Thiamethoxam 30 FS (Seed Treatment/Kg)	2.4	8
Carbofuran 3 %CG	1000	33000
Carbaryl 85% WP	1500	1764
Carbaryl 4 %G	250	6250
Dimethoate 30% EC	200	660
Phorate 10% CG	1000	10000

For management of white grub, chlorpyriphos 2 ml per liter of water can be applied in the root zone of the plant on need basis

vii. Major disease associated with crop: Downy mildew ,White rust

viii. IPM Module for management of disease(except organic areas):

1. Disease management strategies
2. Use of disease free certified seeds
3. Deep ploughing during summer
4. Crop rotation
5. Application of bio-agents i.e. Psedumonas fluorescens as seed treatment (10g /kg seed) plus soil application (2.5 kg/ha) and spray @ 0.1% and seed treatment with Trichoderma viride (10g /kg seed) and their stimulation by the addition of amendments can be done.
6. A fertilizer dose of 80 Kg N, 60 Kg P2O5, 40 Kg K2O is generally required. Entire PK and 10% of N is applied as basal. Remaining nitrogen is applied in 4 splits i.e. 20% at 4 leaf stage, 30% at 8 leaf stage, 30% at flowering stage and 10% at grain filling stage.
7. Row spacing should be done at 60-75 cm & plant to plant spacing, 20-25 cm.
8. Cultural practices which includes sufficient availability of plant nutrients, optimum soil pH (6.2-7.0), adequate water in fields, weed control, optimum plant population and use of disease free and high quality seeds are very helpful in reducing the damage caused by various diseases by reducing the plant stress.

Downy mildew: *Peronosclerospora maydis*

Name of the Fungicides	**(gm/ml)/ha**	**Waiting period (days)**
Metalaxyl-M 31.8% ES (Seed Treatment/Kg)	2.4	
Metalaxyl 35% WS (Seed Treatment/Kg)	7.0	
Mancozeb 75% WP	1500-2000	
Metalaxyl 8%+ Mancozeb 64% WP	2000	49
Azoxystrobin18.2%+Difenoconazole 11.4 %SC	0.1%	26

ix. Major weeds associated with crop: *Eleusine indica, Echinocloa* sp, non grassy weeds

x. IPM Module for management of weeds:

Indian goosegrass: *Eleusine indica* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	**(gm/ml)/ha**	**Waiting period (days)**
Alachlor 50 %EC	5000	90
Atrazin 50 %WP	1000-2000	
Diuron 80% WP	1000	

Jungle rice: *Echinochloa* sp. (annual, monocot, narrow leaves, grass)

Name of the Herbiicides	**(gm/ml)/ha**	**Waiting period (days)**
Alachlor 50% EC	5000	90
Alachlor 10 %GR	15000-25000	
Atrazin 50 %WP	1000-2000	
Diuron 80 %WP	1000	
Paraquat dichloride 24% SL (Before sowing)	800-2000	90-120

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of Baby corn and Sweet corn Shot duration hybrid Varieties ,Seed treatment , HYV, Inter cropping, Gap filling ,Weed Management
2. Organic cultivation,
3. Adoption of low-cost based cultivation practices,
4. Maize- Wheat/Lentil/Barley/oat (fodder) (rainfed), Maize+Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),

5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs
2. Use of imbalance and un decomposed FYM
3. Climate changing, wild animal damages, migration
4. Poor Irrigation facilities

7. A Name of the Pulse crop: Horsegram

i. Existing varieties being used: Non described-Paharigahat

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VLG-8,10,15

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nail,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – 20-25kg/ha,spacing 30*10cm
3. Manure and fertilizer- -10 tonne FYM , NPK20:40 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: -

vi. IPM Module for management of insect pests : -

vii. Major disease associated with crop: Rot,syam warn

viii. IPM Module for management of disease: -

ix. Major weeds associated with crop: *Oxalis latifolia,Phylanthus niruri ,Amaranthus viridis,Euphorbia hirata,Solanum* sp*,Tribulus* sp*,Cyperus* sp

x. IPM Module for management of weeds:

1.Apply Fenoxaprop-p-ethyl 9.3% EC @ 56.25-67.5 g a.i/ha at 20-25 days after sowing to control grassy weeds.

2.Apply Quizalafop-ethyl 5% EC @ 37.5-50 g a.i/ha at 15-20 days after sowing to control grasses and some broad leaf weeds.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of Baby corn and Sweet corn Shot duration hybrid Varieties ,Seed treatment , HYV, Inter cropping, Gap filling ,Weed Management
2. Organic cultivation,
3. Adoption of low-cost based cultivation practices,
4. Horsegram- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Horsegram +Maize+Fingermillet - Wheat/Lentil/Barley/oat (fodder) (rainfed),
6. Timely Sowing, Seed treatment,

7. Use of HYV, Gapfilling
8. Contour cultivation and care soil & water conservation measures
9. Maximum use of value added compost/FYM
10. INM and soluble fertiliser
11. Integrated weed management
12. IPM
13. Good storage condition
14. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM, climate changing, Wild animal damages
3. Migration, Poor Irrigation facilities

7 B. Name of Pulse Crop: Arhar (Red gram)

i. Existing varieties being used: UPAS, ICPL-151, AL15

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Arhar-291, VL Arhar 1, Pant Arhar-3

iii. Existing package of practices being used:

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. They also do not follow balance use of chemical fertilizers. It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Timely sowing of crop in from mid of May to June.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: White fly, Pod borer, Thrips

vi. IPM Module for management of insect pests:

Pod borer: *Helicoverpa armigera*)

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	150	29
Chlorantraniliprole 9.3%+ Lambda cyhalothrin 4.6%ZC	200	18
Indoxacarb 14.5% SC	353-400	15
Indoxacarb 15.8% EC	333	12
Thiodicarb 75% WP	625-1000	30
Emamectin benzoate 5% SG	220	14
Flubendamide 480 %SC	100	10
Spinosad 480% SC	125-162	47
Lufenuron 5.5% EC	600	65
Methomil 40% SP	750-1125	7

Lambda cyhalothrin 5% EC	400-500	15
Monocrotophos 36% SL	1250	
Quinalphos 25% EC	1400	

Redgram thrips: *Scirtothrips dorsalis*

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Dimethoate 30%EC	200	660

vii. Major disease associated with crop: Yellow Mosaic, Blast

viii. IPM Module for management of disease:

1. For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.
2. For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid 200 ml/ha

ix. Major weeds associated with crop: Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds:

1. For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.
2. Application of alachlore @ 2 kg ai before one day of sowing of crop.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management,
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop,
4. Cluster based farming, Inter cropping.
5. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Farmers don't follow proper package of practices,
2. Proper market linkage is not available,
3. Improper use of irrigation facilities,
4. Lack of quality input.

7 C. Name of Pulse Crop: Chickpea

i .Existing varieties being used: Avrodhi, Pant G-114, PG-186, Uday

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Kabli chana-1, GNG-1969, Aman, GNG-1958

iii.Existing package of practices being used:

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. They also do not follow balance use of chemical fertilizers. It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Timely sowing of crop in Ist fortnight of October to IInd fortnight of October.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: White fly, Fruit borer, Thrips

vi. IPM Module for management of insect pests:

Pod borer: *Helicoverpa armigera*)

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	29
Chlorantraniliprole 9.3%+ Lambda cyhalothrin 4.6%ZC	200	18
Indoxacarb 14.5% SC	353-400	15
Indoxacarb 15.8% EC	333	12
Thiodicarb 75% WP	625-1000	30
Emamectin benzoate 5% SG	220	14
Flubendamide 480 %SC	100	10
Spinosad 480% SC	125-162	47
Lufenuron 5.5% EC	600	65
Methomil 40% SP	750-1125	7
Lambda cyhalothrin 5% EC	400-500	15
Monocrotophos 36% SL	1250	
Quinalphos 25% EC	1400	

Redgram thrips: *Scirtothrips dorsalis*

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Dimethoate 30%EC	200	660

vii. Major disease associated with crop: Yellow Mosaic, Blast

viii. IPM Module for management of disease:

1. For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.
2. For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid 200 ml/ha

ix. Major weeds associated with crop: Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds:

For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management, Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop,
3. Cluster based farming, Inter cropping.
4. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Farmers don't follow proper package of practices, Proper market linkage is not available,
2. Improper use of irrigation facilities,
3. Lack of quality input.

7D. Name of Pulse Crop: Lentil

i.Existing varieties being used: Chota masur ,lal masur

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PL-4, PL-7, PL-8, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL Masoor 514

iii.Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nail,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – 20-25kg/ha,spacing 30*10cm
3. Manure and fertilizer- -10 tonne FYM , NPK20:40 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: Pod borer

vi. IPM Module for management of insect pests:-

vii. Major disease associated with crop: Wilt

viii. IPM Module for management of disease:

1. Deep ploughing during summer.
2. Select disease resistant/tolerant varieties like PL 5 , PL 6 and PL 7
3. Seed treatment with Carbendazim (1 g) + Thiram (2 g) per kg seed.
4. Foliar spray of Propiconazole (0.1 %) at the appearance of disease and repeated 2-3 times at 15 days interval.

ix. Major weeds associated with crop: -

x. IPM Module for management of weeds:-

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Horsegram/Soybean- Lentil (rainfed),
4. Timely Sowing, Seed treatment,
5. Use of HYV, resowing
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM
8. INM and soluble fertiliser
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Farmers don't follow proper package of practices, Proper market linkage is not available,
2. Improper use of irrigation facilities,
3. Lack of quality input.

7E. Name of Pulse crop: Urd

i.Existing varieties being used: Mas

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PU-19, PU-35

iii.Existing package of practices being used:

1. Broadcasting of seed ,
2. No seed treatment ,
3. Use of un-decomposed FYM

iv.Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – 12-15kg/ha,spacing 30*45cm
3. Manure and fertilizer- -10 tonne FYM , NPK50:20 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v.Major insect pests associated with crop: Whitefly (*Bemisia tabaci*),Bihar Hairy Caterpillar (*Spilarctia obliqua*), Stem flies (*Melanagromyza sozae*), Leafhopper *(Empoasca sp.),* Thrips *(Caliothrips indicus*), Pod sucking bugs (*Riptortus* sp. and *Nezara viridula*)

vi.IPM Module for management of insect pests :

1. Crop rotation,
2. Collect and destroy affected plants with egg masses and gregariously feeding larvae of hairy caterpillar and pod borer,
3. Spray NSKE 5% for controlling defoliators, tobacco caterpillar and bugs.

Fruit Borer

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole18.5% SC	100	20
Flubendamide 480% SC	100	11
Lufenuron 5.4% EC	600	10
Thiodicarb 75% WP	625-750	17
Monocrotophos 36 %SL	625	

White fly

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Phorate 10% CG	10000	

vii.Major disease associated with crop: Yellow mosai virus, cercospora leaf spot

viii.IPM Module for management of disease:

1. Deep ploughing during summer.
2. Select disease resistant/tolerant varieties like Pant Mung 5, Pant Mung 6 , Pant Urd 31 , Pant Urd 35 and Pant Urd 40
3. Seed treatment with Carbendazim (2 g) + Imidacloprid (5 g) per kg seed.
4. Rouging of the YMV infected Plants.
5. Foliar spray of Imidacloprid (0.05 %) at 25 days after sowing.
6. Foliar spray of Propiconazole (0.1 %) at appearance of disease

ix.Major weeds associated with crop: -

x.IPM Module for management of weeds:-

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing,
2. Seed rate and seed sowing 12-15kg/ha,spacing 30x45cm
3. Manure and fertilizer- -10 tonne FYM , NPK50:20 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

xii.Production constraints in agro-ecological region:

1. Lack of HYV,
2. Less availability of agriculture inputs,
3. Use of imbalance and un decomposed FYM,
4. Climate changing, Wild animal damages
5. Migration specially from border area,
6. Poor Irrigation facilities

7F. Name of Pulse/oilseed Crop: Soyabean

i. **Existing varieties being used:** Kala bhatt(Oval)

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65, PS-1092 , PS 1042, PS 1092

iii. **Existing package of practices being used:**

1. Traditional seed variety ,
2. Undecomposed FYM 1.5-2.0qt./nail,
3. 1-2 weeding

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Preperation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing -100-125/ha,
3. Manure and fertilizer- -10 tonne FYM , NPK 20-80:40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. **Major insect pests associated with crop:** Semilooper, Leafy catterpiller,Whitefly, Girdle beetle, stem fly, pod borer, jassid etc.

vi. **IPM Module for management of insect pests(except organic areas):**

Cultural practices: The cultural practices make the environment less favorable for the pests and more favorable for its natural enemies. The following are cultural practices recommended for the management of soybean insect pests.

1. Removal and destruction of infected stubbles followed by deep summer ploughing destroys the pupae of stem fly, girdle beetle, pod borer and tobacco caterpillar present in the soil.
2. Optimal fertilizer dose of NPK and S @ 20:60-80: 30-40:20 kg/ ha should be applied.
3. Application of excessive dose of nitrogen fertilizer causes the infestation of all insect pests on soybean.
4. Crop rotation with non-leguminous plants is recommended for the management of leaf miner.
5. Inter-cropping of soybean with either asafetida (*Ferula assafoetida* L.) or maize or sorghum in the sequence of 4 rows of soybean with 2 rows of intercrop should be practiced. These intercrops help in conservation of bio-control agents, like coccinellid beetles, Chrysoperla etc. In girdle beetle and semilooper endemic areas, intercropping with maize or sorghum should be avoided.
6. Planting of trap crops like castor for tobacco caterpillar, ground-nut for leaf miner, marigold for pod borer and Dhaincha (*Sesbania sesban*) for girdle beetle.
7. Selection of insect resistant or tolerant varieties for cultivation.

Table1: Resistant or tolerant varieties for insect pests of soybean.

Insect pest	Resistant or tolerant variety
Stem fly	Dsb 25, Himso 1685, JS 20-89, MACS 1370, MACS 1410, NRC 97, JS 20-53,PS 1543, SL 983, Dsb 23-2
Girdle beetle	MACS 1410, Dsb 23-2, Himso 1685, JS 20-89, KDS 726
Defoliators	Dsb 23-2, KDS 726, PS 1543, PS 1569
Pod borer	Dsb 25, SL 683, NRC 97, MACS 1370, JS 20-89
Leaf miner	MACS 1370, Himso 1685, MACS 1370, MACS 1410
Pest complex	DS 2708, Dsb 23-2, Dsb 25, Himso 1685, JS 20-53, JS 20-79, JS 20-89, KDS 726, MACS 1370, MACS 1410, NRC 97, SL 983, PS 1543

Mechanical Control: Reduction of insect pest population by means of manual devices or labour is called mechanical control. The following measures are recommended for mechanical practices for soybean insect pests.

1. Collection and destruction of girdle beetle infested plant parts, egg masses and gregariously feeding larvae of Bihar hairy caterpillar and tobacco caterpillar.
2. Hand picking and mechanical destruction of matured pod borer larvae.
3. Erection of bird perches @ 10-12/ha to attract predatory birds for preying on defoliator larvae.

Physical control: Reduction of pest population by using device which affect them physically or alter their physical environment. Manipulation of temperature, humidity, light is used for this purpose. This includes the following:

1. Light traps should be placed at ground level early in the season for collection and destruction of the leaf-miner moths.
2. Installation of light traps in the field for monitoring and collection of adult moths.

Biological Control: The successful management of a pest by means of another living organism (parasitoids, predators and pathogens) is called biological control. The following biological control agents are used in IPM of soybean.

1. Release of *Tricogramma chilonis* @ 50,000/ ha four times at weekly interval against *S. litura*.
2. Spraying of *Bacillus thuringiensis* var. kurstaki @ 0.75 to 1.0 kg/ha for the management of defoliators.
3. Foliar application of HaNPV (*Helicoverpa armigera* Nuclear Polyhedrosis Virus) for *H. armigera* @ 250 LE/ha.
4. The major predators of soybean insect pests are given in the table 2.

Table 2: Major predators of insect pests of soybean

Insect pests attacked	Predator
Whiteflies	Lady bird beetles: *Coccinella septumpunctata* *Coccinella transversalis*
Lepidopterous caterpillars	Pentatomid bug *Eocanthecona furcellata*
Lepidopterous caterpillars and Whiteflies	Spiders: *Lynx* spider and Orb weaver spider

Chemical Control: The control of insects with pesticides/insecticides is known is chemical control. The insecticides are applied only when the population of insect pests crossed the Economic Threshold Level (ETL) (Table 3). The list of insecticides recommended for soybean insect pests are given in table 4.

Table 3: Economic Threshold Level (ETL) of soybean insect pests

Insect Pest	Crop stage	Population/ meter
Green semilooper	Flowering	2 larvae
Tobacco caterpillar	Flowering	4 larvae
Girdle beetle	Flowering	10 % infestation
Pod borer	Podding	3 larvae

Table 4: List of insecticides recommended for soybean insect pests

Insect pests	Insecticides	Dosage
Sucking pests, stem fly	Thiamethoxam 30 FS (Seed treatment)	10ml/kg seed
Sucking pests	Acetamiprid 20 SP	100 ml/ha
Sucking pests	Spiromesifen 22.9 SC	600ml/ha
Sucking pests	Imidacloprid 17.8 SL	500 ml//ha
Sucking pests and girdle beetle	Triazophos 40 EC	800ml/ha
Defoliators	Dichlorovos 76EC	500 ml/ha
Defoliators and pod borer	Quinalphos 25 EC	1500 ml/ha
Sucking pests and defoliators	Monocrotophos 36 SL	800 ml/ha

Pod borer	Indoxacarb 15.8EC	333 ml/ha
Defoliators, stem fly and girdle beetle	Chlorantraniliprole 18.5 SC	150 ml/ha
Leaf miner	Carbaryl 50WP	2.0 kg/ha
Leaf miner and sucking pests	Oxydemeton methyl 25EC	350 ml/ha
Girdle beetle	Phorate 10 G	10 kg/ha
Stemfly and girdle beetle	Carbofuran 3 G	30 kg/ha

Bio-insecticides

Tobacco caterpillar (*Spodoptera litura*)

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

***Hairy caterpillar* (*Spilosoma obliqua*)**

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

Semilooper (*Chrysodeixis acuta*)

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

Soyabean leaf miner (*Odontota horni*)

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

vii. Major disease associated with crop: YMV, leaf spot, blight, Collar rot, rust

viii. IPM Module for management of disease:

Rust: *Phakopsora pachyrhizi*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Hexaconazole 5% SC	500	30
Propiconazole 25% EC	500	26

Collar rot: *Sclerotium rolfsii*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Carboxin 37.5%+ Thiram 37.5% DAS	3.0/Kg	Seed Treatment

ix. Major weeds associated with crop : *Oxalis latifolia, Phylanthus niruri , Amaranthus viridis,Euphorbia hirata, Solanum* sp*,Tribulus* sp*,Cyperus* sp

x. Production constraints in agro-ecological region:

1. Apply Trifluralin 48%EC @ 1.0 kg a.i/ha as pre plant incorporation.
2. Apply Alachlor 50%EC @ 2-2.5 kg a.i/ha or Pendimethalin 30%EC @ 0.75-1.0 kg a.i/ha or Pendimethalin 30% EC + Imazethapyr 2% EC @ 0.75+0.05 kg a.i/ha or Metribuzin 70%WP @ 0.35-0.525 kg a.i/ha or Diclosulam 84% WDG @ 22-26 g a.i/ha within 3 days after sowing.
3. Apply Quizalofop- ethyl 5%EC @ 0.0375-0.05 kg a.i/ha or Fenoxaprop-p-ethy l 9.3% EC 0.1 kg a.i/ha or Haloxyfop 10.5% EC 108-135 g a.i/ha at 20-25 days after sowing to control grassy weeds.
4. Apply Imazethapyr 10%SL @ 0.1 kg a.i/ha or Imazamox 35%+ Imazethapyr 35% @ 0.07 kg a.i/ha at 20-25 days after sowing to control grassy and non grassy weeds.
5. Apply any pre emergence herbicide followed by one hand weeding at 30-35 days after sowing.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,

3. Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Timely Sowing, Seed treatment,
5. Use of HYV,
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM
8. INM and soluble fertilizer
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, wild animal damages, migration,
4. Poor Irrigation facilities

7G. Name of oilseed crop: Toria/sarson

i. Existing varieties being used: Rara,Gharia

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PT-303,507,Uttara, PPS-1

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. un decomposed FYM 1.0-2.0qt./nali,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Land preparation:

a. One ploughing followed by 2-3 harrowings and planking
b. Using Zero till ferti- seed drill will increase farmers' income reducing the costs of planting and improving productivity.

2. Sowing time to improve productivity and income:

a. ***Toria***: Last week of September.
b. **Yellow *sarson* & *rai* (Mustard)**: First fortnight of October.

3. Seed treatment

a. Apron 35 SD @ 5g/kg.
b. Only certified seeds should be used.

4. Seed rate and spacing:

a. ***Toria*:** 4kg/ha about 3-4 cm deep in 30 cm apart rows
b. **Yellow *sarson* & *rai* (Mustard)**: 5 kg/ha with a row spacing of 30-45 cm.

5. **Thinning:**

a. About 20-25 days after sowing maintaining a plant to plant space of 10 cm.
b. The thinned out plants could be used as **green forage**.

6. Nutrient management:

a. **Vermicompost:** 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.
b. **Nitrogen:** 120kg/ha **,**60-80 kg/ha for *toria*
   Half of the N as basal and remaining half be top dressed about 25- 30DAS
   Excess use of nitrogenous fertilizers should be avoided.
c. **Phosphorus**: 40 kg/ha as basal, be applied as SSP
d. **Potassium**: 20 kg/ha as basal
e. **Sulphur:** if SSP is not available, 20 kg/ha Sulphur shall be applied as basal.

7. Water management:

a. Rosette (25-30 days) and pre-flowering stages are the most sensitive to water deficit.
b. Hence, irrigations shall be made at these stages wherever possible.

8. Harvesting and threshing:

a. The crop should be harvested when about 75 % of the siliquae turn yellowish brown.
b. After threshing, seeds should be stored with less than 8% moisture.

v. Major insect pests associated with crop: Aphid, Mustard saw fly, Hairy caterpillar, white fly

vi. IPM Module for management of insect pests:

Mustard aphid: *Lipaphis erysimi*

1. Timely sowing of crop
2. Removal & destruction of Aphid infested twigs at flowering and siliquae formation stages.
3. Release of larvae/adult of lady bird beetle (***Coccinella septempunctata***) @ 50,000/ha

Name of the Insecticdes	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG	50-100	21
Oxydemeton-methyl 25% EC	1000	
Dimethoate 30% EC	660	
Chlorpyriphos 20% EC	500	

Mustard saw fly : *Athalia lugens proxima*

Name of the Insecticides	(gm/ml) /ha
Imidacloprid 70% WS (Seed treatment/Kg)	7.0
Dimethoate 30% EC	660
Quinalphos 25% EC	1200

vii. Major disease associated with crop : Blight, Rust, Downy Mildew

viii. IPM Module for management of disease (except organic areas):

1. Field sanitation *i.e*. collect and burn the diseased plants debris to minimize the primary source of inoculum.
2. Timely sowing of crop
3. Crop rotation with non host crops (like rice or maize) for at least 5 years in case of severe disease problems

Alternaria blight or Leaf spot: *Alternaria brassicae*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Iprodione 50% WP	2250-3000	50

White rust : *Albugo candida*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Metalaxyl 35% WS (Seed treatment/Kg)	6-0	
Metalaxyl 8%+ Mancozeb 64% WP	2500	56
Metalaxyl 4%+ Mancozeb 64% WP	2500	60

Downy mildew: *Peronospora parasitica*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Metalaxyl 4%+ Mancozeb 64% WP	2500	60

ix. Major weeds associated with crop: *Cyperu*s spp.

x. IPM Module for management of weeds:

Umbrella plant: *Cyperus rotundus* (annual, monocot, narrow leaves, sedge)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Chlorimuron ethyl 25% WP	24	60
2,4-D Ethyl Ester 4.5% GR	25000	
MCPA, Amine salt 40% WSC	2000-5000	
Metsulfuron methyl 20 %WP	20	60

xi. Specific workable and sustainable intensification capable of doubling agricultural income

in specific agro-ecological region:

1. Sowing as sole cropping ,
2. Timely Sowing,
3. Seed treatment,HYV,IPM

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, Wild animal damages
4. Migration specially from border area,
5. Poor Irrigation facilities

8A. Name of the Fruit crop: Peach

i. Existing varieties being used: Paradelux, July Elberta, Red June

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Alxander, Red Globe, Crest heaven, Glo Heaven etc
Nectarine- Snow Queen

iii. Existing package of practices being used:

1. Use of old and traditional Varieties
2. Poor knowledge of canopy management practices
3. Organic inputs for crop production
4. No knowledge of high density orcharding
5. Irrigation facilities are rarely used
6. Lack of grading and packing facilities
7. No canning or processing unit
8. No availability of waste management of crop residue

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Need to introduce non-clingstone varities with maturity indices on or before June.
2. Use of High denisty plantation with mulch and supplemetation of drip irrigation.

v. Major insect pests associated with crop: San jose scale, Tent caterpillar, Codlling moth, Peach leaf curl, Peach fruit fly

vi. IPM Module for management of insect pests:

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. Traps Parasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Name of the Insecticdes	(gm/ml) /ha	Waiting period (days)
Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Peach leaf curl aphid

Name of the Insecticdes	(gm/ml) /ha	Waiting period (days)
Carbosulfan 3% CG	1000	33300
Oxydemetonmethyl 25% EC	0.025%	1500-2000

Peach Fruit Fly:

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap.
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

vii. Major disease associated with crop: Gummosis is major problem

viii. IPM Module for management of disease:

Peach leaf curl

Name of the Fungicides	(gm/ml) /ha
Lime sulphur 22% SC	1%

ix. Major weeds associated with crop: *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. High density plantation with (3x3mts) supplemented with drip irrgation system.
2. Intercropping of leguminous crops like rajma, bhat and gahat crops etc.

xii. Production constraints in agro-ecological region:

1. Availability of Quality planting material
2. Need to delineate the table and canning type varieties.

8B.Name of the Fruit crop: Pear

i. Existing varieties being used: Gola, Victoria, China, Baggugosha, Kashmiri, Thumb pear

etc

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Max Bartlette, Red Bartlette, Willium, Starkrimson, Hokoi

iii. **Existing package of practices being used:**

1. Use of old and traditional varieties
2. Less or no use of mulch for water conservation
3. Canopy management is poor
4. Recommended Cultural practices are rarely applied
5. Maturity indices are rarely use
6. Surplus management of fruit are not done
7. Processing industries are not established for Gola nashpati

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Use of new strains or occidental pears are needed for high hills
2. Introduction of new strains with less gritcells in fruits
3. Need to develop Postharvest management system with minimum losses.
4. Processing facilities needs to be strengthened.

v. **Major insect pests associated with crop:** San jose scale, tent caterpillar, codlling moth, peach curl aphid, peach fruit fly

vi. **IPM Module for management of insect pests:**

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.
5. Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Carbosulfan 3% CG	1000	33300
Oxydemetonmethyl 25% EC	0.025%	1500-2000

Peach Fruit Fly:

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap.
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

vii. Major disease associated with crop: Gummosis, peach leaf curl (taphrina)

viii. IPM Module for management of disease: Various systematic and contacts fungicides are used during the cultivation of apple at various stages.

ix. Major weeds associated with crop: *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Introduction of New Strain *viz*. Anjou, Starkrimson in high hills.
2. Intercropping of leguminous crops like rajma, bhat and gahat crops etc.
3. Cultivation of potato as inter crop during the period of beginning of orchard.
4. Cultivation of some vegetable crops as an intercrops i.e. cabbage cauliflower, French bean etc.

xii. Production constraints in agro-ecological region:

1. Availability of quality planting material
2. Excess Rainfall, adverse weather during season hits the spraying schedule of apple.
3. Negligence of drainage cause the root zone decrease.
4. Lesser emphasis on sanitation of orchard which leads the infection of diseases.
5. Lack of adaptation of proper technical knowhow during training and pruning in high /ultra high density orchard .
6. No proper facilities of cold chain.
7. Disaster during monsoon hit the specific workable and sustainable intensification yields.
8. No easily access to marketing facilities.

8C. Name of the Fruit crop: Plum

i. Existing varieties being used: Santa rosa, Beauty, Burbank

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Italian plum, Prunes viz Frontier

iii. Existing package of practices being used:

1. Use of old and traditional varieties
2. Less or no use of pollinizer varieties in plum especially in japnese type varieties
3. Less or no use of mulch for water conservation
4. Canopy management is poor
5. Recommended cultural practices are rarely applied

6. Maturity indices are rarely use
7. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: High density plantation with drip irrigation system.

v. Major insect pests associated with crop:

Coddling moth, Tent caterpillar, San Jose, Leaf Curl Aphid, Peach Fruit Fly.

vi. IPM Module for management of insect pests:

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.
5. Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Carbosulfan 3% CG	1000	33300
Oxydemetonmethyl 25% EC	0.025%	1500-2000

Peach Fruit Fly:

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

vii. Major disease associated with crop: -

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: *Chenopodium album, Cyperous rotundus, Cynodum dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. High density plantation (3x3 mts) with drip irrigation
2. Intercropping of soybean or gahat or lentil in rabi season
3. Mulch technology
4. Post harvest management of perishable with refrigeration system and development of fruit wines factories in the state.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable and elite planting material
2. Poor technical knowledge

8D.Name of the Fruit crop: Mango

i. Existing varieties being used: Dashahari, Langra, local varity

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Dashahari, Langra, Bombay, Amrapali

iii. Existing package of practices being used:

1. Use of old and traditional varieties
2. Canopy management is poor
3. Recommended Cultural practices are rarely applied
4. Maturity indices are rarely use
5. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Improved early varieties like Bombay green, Bombay yellow, Sindur
2. Proper planting distance,
3. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
4. Need to develop Postharvest management system with minimum losses.

v. Major insect pests associated with crop:

Fruit fly, mealy bug, stone weevil, hopper, shoot gall,Hopper, stem borer

vi. IPM Module for management of insect pests:

Mango Hopper:

1. Pruning of dense orchards in the month of December and orchard sanitation.
2. Removal of weeds and alternate host plants like hibiscus, custard apple, guava etc.
3. Avoid dense plantings, maintained open canopy; prune overcrowded, overlapping branches after
4. Rainy season with proper drainage.
5. Avoid excess use of nitrogenous fertilizers
6. Smoking of orchards by burning of crop residues/cow dung cake during evening hours.
7. Application of bio-agents, *Metarhizium anisopliae* @ 1x 108 cfu/ml or *Beauveria bassiana* @ 108 cfu/ml on tree trunk once during off season for second generation of mango hopper in the

months of July-August.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG	100	30
Imidacloprid 17.8 SL (per tree)	2-4	45
Deltamethrin 2.8% EC	0-33-0-5/lit.	1
Lambda cyhalothrin 5% EC	0-5-1-0/lit.	7
Monocrotophos 36% SL	1500-2000	
Oxydemetonmethyl 25% EC	1500-2000	
Dimethoate 30% EC	2475-3300	

Mango mealy bug:

1. Ploughing of orchard in November.
2. Raking of soil around tree trunk to expose the eggs to natural enemies and sun, removal of weeds.
3. Tree banding with 25 cm wide polythene/alkathene sheet (400 gauges) alongwith grease plastering during the first fortnight of December.
4. Releasing 10-15 grubs of coccinellid predator, *Cryptolaemus montrozieri per* tree.
5. Apply insecticides as recommended for mango hopper, if required.

Name of the Insecticides	(gm/ml) /ha
Monocrotophos 36% SL	1500-2000
Dimethoate 30% EC	2475-3300

Mango shoot gall:

1. Pruning of infested gall bearing branches in the months of October.
2. Application of following three sprays at 15 days interval during the months of August and September.
3. Monocrotophos 36%SL @ 2ml/l or Quinolphos 25EC @2ml/l or Dimethoate 30EC @ 2ml/l of water.

Name of the Insecticides	(gm/ml) /ha
Monocrotophos 36% SL	1500-2000

Mango fruit fly:

1. Ploughing of orchard during November-December to expose pupae to sun's heat which kills them.
2. Premature harvesting at firm stage.
3. Collect and dispose off infested and fallen fruits to prevent further infestation.
4. Use methyl eugenol bottle trap: Take wooden block of 5x5x1cm^3 and dipped this block should be in the mixure of Alcohol + Methyl eugenol+ DDVP (6:4:1) for 24 hrs and then hang in plastic bottle.
5. Use bottle trap @ 10 bottles per ha (Replace the wooden block at 2 month interval)

Name of the Insecticides	(gm/ml) /ha
Malathion 50%EC + gur	1+10

Mango stem borer:

1. Pruning of old infested branches.
2. Scraping the loose bark to prevent oviposition by adult beetles.

Insert cotton plug soaked in kerosene or petrol or DDVP into the holes and paste them with mud.

vii. Major disease associated with crop: Mall formation, anthracnose, gummosis

viii. IPM Module for management of disease:

For effective management of mango foliar diseases (malformation, anthracnose, powdery mildew), deblossoming of emerging malformed floral buds and remove the infected leaves/ malformed panicles. **Powdery mildew: *Oidium mangiferae***

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)

Azoxystrobin 23% SC	0.1%	5
Carbendazim 50% WP	0.1%	15
Penconazole 10% EC	0.05%	30
Hexaconazole 5% EC	0.1%	30
Hexaconazole 5% SC	0.2%	27
Sulphur 80% WDG	1875-2500	
Sulphur 80% WP	3130	
Dinocap 48% EC (per tree)	5	

Anthracnose: *Colletotrichum gloeosporioids*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Azoxystrobin 23% SC	0.1%	5
Copper oxychloride 50% WG	0.24%	10

ix. Major weeds associated with crop: *Chenopodium album, Cyperous rotundus, Cynadon dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Proper orchard establishment
2. Proper orchard management practices like fertilizer, irrigation, insect and disease control measures

xii. Production constraints in agro-ecological region:

1. Availability of quality planting material
2. In hilly terrain due to sloppy surface, nutrient loss is more as compared to plains.
3. In rainy season, water logging resulted the canker
4. Early degradation of plant (dieback& physiological disorder) health due to lack of proper nutrient management.

8E.Name of the Fruit crop: Litchi

i. Existing varieties being used: Rose scented, local varity

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Rose scented, calcuttia, early bedana, muzzafarpur shahi, swarnaroopa, dehra rose

iii. Existing package of practices being used:

1. Use of old and traditional varieties
2. Canopy management is poor
3. Recommended Cultural practices are rarely applied
4. Maturity indices are rarely use
5. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Improved varieties like Rose scented, calcuttia, early bedana, muzzafarpur shahi, swarnaroopa, dehra rose
2. Proper planting distance
3. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.

v. Major insect pests associated with crop: Leaf miner, mite, stem borer, leaf roller,fruit borer

vi. IPM Module for management of insect pests:

Litchi mite:

1. Pruning of all the affected twigs / leaves during June just after harvest & destruction.

2. Application of Dicofol @ 0.05% (3ml/liter of water) or dimethoate @2ml/l twice at flush emergence in Sept-Oct at 7days interval.

Litchi fruit borer:

1. Collection and destruction of fallen infested fruits.
2. Use *Trichogramma chilonis* and Bt formulations.
3. At early stage of fruiting which coincides with egg laying, spray carberyl 50WP or Monocrotophos (0.04%) or Phosalone (0.05%). Repeat twice at 10-12 days interval
4. Application of Flubendiamide 39.35 SC (0.008%)@ 1.5ml/5l, Spinosad 45 SC (0.014%)@ 1.5ml/l or Novaluron 10 EC (0.015%)@1ml/l twice at colour brick stage at 7 days interval

Litchi leaf roller:

1. Low infestation can be reduced by destruction of infested rolled leaves.
2. Application of Monocrotophos or Quinolphos @ 2ml/l of water at new flush

vii. Major disease associated with crop: Fruit Rot, Shoot Dying

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: *Chenopodium album, Cyperous rotundus, Cynodum dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Chemical, mechanical and biological control

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Proper orchard establishment
2. Use of micro nutrients specially Zn, B, Cu, Mn
3. Conservation of moisture under the orchard through drip irrigation as well as installation of rain gun during the ripening period of fruits to avoid the fruit cracking.
4. Cultivation of filler crop from the newly established and renovated orchard.
5. Post Harvest Management & marketing to be enhanced.

xii. Production constraints in agro-ecological region:

1. Availability of quality planting material
2. Urbanization affecting the area and production of litchi.
3. Old and Senile Orchard.
4. Application of chemical pesticides restricts the visit of pollinators / beekeeping.

8F. Name of the fodder crop: Guava

i. Existing varieties being used: Lucknow 49, Allahabad safeda

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Lucknow 49, Allahabad safeda, Pant Prabhat, Chittidar

iii. Existing package of practices being used:

1. Canopy management is poor
2. Recommended Cultural practices are rarely applied
3. Maturity indices are rarely use
4. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Proper planting distance,
2. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
3. Need to develop Postharvest management system with minimum losses.

v. Major insect pests associated with crop: Fruit fly, fruit borer.

vi. IPM Module for management of insect pests:

Guava fruit borer/ castor capsule borer:

1. Critical monitoring for early infestation.

2. Proper orchard sanitation.
3. Pruning and training of old branches for proper aeration.
4. Castor should not be cultivated close to guava as this is the most preferred host of this pest.

Guava butterfly:

1. Cover fruits with paper bags in small orchards.
2. Removal and destruction the infested fruits regularly.
3. Pomegranate should not be cultivated close to guava as this is the most preferred host of this pest.
4. Remove weeds of compositae family.
5. Detect early infestation by Installing light trap @ 1/acre to monitor and mechanical collection of insects.

vii. Major disease associated with crop: Canker, wilt

viii. IPM Module for management of disease: Guava wilt disease in guava was effectively controlled by the application of *Bacillus amyloliquefaciens*, Compost and Pant bioagent-3 (Trichoderma harzianum + Pseudomonas fluorescens) in place of systemic fungicides like Carbendazim + Mancozeb, Propiconazole and Propiconazole + Carbendazim.

ix. Major weeds associated with crop: *Chenopodium album, Cyperous rotundus, Cynodum dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Mechanical and chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Proper orchard establishment
2. Proper orchard management practices like fertilizer, irrigation, insect and disease control measures

xii. Production constraints in agro-ecological region:

1. Availability of quality planting material
2. Lack of QPM.
3. Lack of irrigation facilities.
4. Fruit Fly is a major constraint during rainy season crops.

8G. Name of the Fruit crop: Citrus

i. Existing varieties being used: Locally seeded variety

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Malta : Blood red, Valencia; Kinnow; Lemon & lime: Pant lemon 1, Kagzi lime; Orange

iii. Existing package of practices being used:

1. Orchard management is poor
2. Recommended Cultural practices are rarely applied
3. Maturity indices are rarely use
4. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Proper planting distance,
2. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
3. Use of micronutrients.
4. Need to develop Postharvest management system with minimum losses.

v. Major insect pests associated with crop: leaf minor, citrus white fly,fruit fly

vi. IPM Module for management of insect pests:

Citrus psylla

1. Collect and destroy the infested plant parts.

2. Conserve parasitoids such as *Tamarixia radiata, Diaphorencyrtus aligarhensis* and predators *Chrysoperla zastrowi sillemi*, coccinellids, syrphids.
3. At the initiation of new flush, spray monocrotophos (0.025%) or dimethoate (0.03%) or quinalphos (0.025%). If required, repeat the spray at 10-12 days interval, once or twice.
4. Systemic insecticides like imidacloprid 17.8% SL @ 50 ml or thiamethoxam 25% WG @ 40 g in 400 l of water/acre or oxydemeton-methyl 25% EC @ 600-800 ml in 600-800 l of water/acre.
5. Spraying during Feb- March (Spring flush), May- June (Before rain)and July-Aug (After rain)

Lemon butterfly:

1. Hand picking of all stages and destroy.
2. Grow attractant plants: Carrot family, sunfl ower family, buckwheat, alfalfa, corn,shrubs for lacewing attraction.
3. Nectar rich plants with small flowers i.e. anise, caraway, parsley, mustard, sunflower,buckwheat and cowpea for attraction Braconid wasp.
4. Conserve the parasitoids such as *Trichogramma evanescens*, *Telenomus* spp on eggs *Brachymeria* spp*, Cotesia* on larvae and *Pterolus* sp. on pupae.
5. Spraying of entomogenous - fungus, *Bacillus thuringiensis* Berliner, nematode DD-136 strain or neem seed extract (3%) also gives quite high mortality of caterpillars.
6. Spraying with Malathion @ 1 ml/ l or quinalphos 25% EC @ 600-800 ml in 200-400 l of water/acre or 2.0 liters of carbaryl 5OWP in 1250 liters of water/ha during April (after fruit set) and October (after rainy season).

Citrus black/white flies:

1. Close planting, dense canopy structure and water stress should be avoided.
2. In case of localized infestation, affected shoots should be clipped off and destroyed.
3. Excessive irrigation and application of nitrogenous fertilizers shall be avoided to reduce off season flushes.
4. Indigenous natural enemies can be conserved and augmented by avoiding excessive pesticide application.
5. External Parasite *Tamarixia radiata, Encarsia divergens.Tetrastichus radiatus.*
6. Dimethoate (0.03%) or phosphamidon (0.03%) or acephate (0.05%) or neem seed pesticide application. new flush and repeated at 10 days interval once or twice.

Scale insects:

1. Orchard sanitation.
2. Prune the infested shoots and destroy them.
3. Open the tree canopy from centre for better light penetration
4. Spray 1% pongamia oil or 4% neem seed extracts at 21 and 7 days interval, respectively

vii. Major disease associated with crop: Decline, die back

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: *Chenopodium album, Cyperous rotundus, Cynodum dactylon, Parthenium, etc.*

x. IPM Module for management of weeds:

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Proper orchard establishment
2. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
3. Use of micronutrients
4. Control of decline
5. Need to develop Postharvest management system with minimum losses.

xii. Production constraints in agro-ecological region:

Availability of quality planting material, Poor orchard management

9A. Name of the vegetable crop: Cabbage

i. **Existing varieties being used:** Golden acre or mix of varieties

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole Green star, Pride of India

iii. **Existing package of practices being used:**

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Cultivars- In cabbage, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be head formation. Use of hybrid varieties only
8. Transplanting- Farmers practices improper planting distance.
9. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field. Use of organic manures
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
12. Harvesting- The harvesting should not follow as per maturity standards or as per object.

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Promotion of high yielding round shaped, 100% heading percentage, mature within 90 days.

1. Soil Testing- Farmers should test their soils before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to go for deep ploughing before sowing the crop particularly during the hot season or before the snowfall
3. Seed- Farmers should adopt improved varieties/ hybrids
4. Soil solarisation practice should follow in nursery beds.
5. Seed Treatment- To combat the different seed borne diseases to treat the seed by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing
6. Seed Rate- It is recommended to use the seed quantity for different as follows-
   (Early)-600-700g/ ha open pollinated
   (Mid and Late)- 500-550g/ha open pollinated
   (Hybrid)-350-400g/ha
7. Optimum sowing time :Mid Sept- Oct
8. Transplanting- Farmers should transplant seedlings properly as for early (40x45cm), medium (40x45cm),
9. Manures and fertilizers- Farmers should incorporate well rotten cow dung (20-25tonnes/ha) and NPK (120:60:60) in irrigated, half dose of NPK in unirrigated condition.
10. Irrigation- As per requirements. At critical stages such as head initiation and head development
11. Weed control- Farmers must know about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically.
12. Harvesting- The farmer must aware about the maturity stage of a particular crop variety so he can harvest the crop as per their object. In general the heads should be harvested when they attempt the size in between 500-750 gms.

v. **Major insect pests associated with crop:** Diamond black moth, cabbage butterfly, Aphid and Painted bug

vi. IPM Module for management of insect pests :

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Hand picking and destruction of cabbage butterfly eggs and larvae in nursery as well as main crop to reduce the pest multiplication.
3. Growing of African bold seeded mustard as trap crop at 22:2 ratio (Cabbage: Mustard) to attract DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

After Planting

1. Regular Monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Hook out the head borer and destroy mechanically. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT.

Dimond back moth: *Plutella Xyllostella*

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	50	3
Cyantraniliprole 10.26% OD	600	5
Indoxacarb 14.5% SC	200-266	7
Indoxacarb 15.8% EC	266	5
Spinosad 2.5% SC	600-700	3
Chhlorfenapyr 10% SC	750-1000	7
Emamectin benzoate 5% SG	150-200	3
Flubendamide 480% SC	45-60	7
Flubendamide 20% WG	90-120	7
Chlofluazuron 5.4% EC	1500	7
Diafenthiuron 50% WP	600	7
Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	600-1000	
Bacillus thuringiensis serovar kurstaki (3a,3b,3c) 5% WP	500-1000	
Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500	

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7

Fenvalerate 20% EC	300-375	7

Bioinsecticides

Name of the Bio-insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7

Painted bug

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Dimethoate 30% EC	200	660

vii. Major disease associated with crop: Stem rot, black rot, black spot on leaf

viii.IPM Module for management of disease(except organic areas):

***Sclerotenia* stem rot:**

1. Summer deep ploughing,
2. Burn the infected crop debris,
3. Two spray at 10-12 days interval of carbendazim @ 1.0 gm / litre

***Xanthomonas* Black rot:**

1. Seed treatment with Streptocyclin @ 100 mg/kg seed and two spray of Streptocyclin 1.0 gm / 10 litre of water after 10-12 days interval.

ix.Major weeds associated with crop: *Oxalis latifolia, Phyllanthus niruri ,Amaranthus viridis,Euphorbia hirata, Solanum* sp

x. IPM Module for management of weeds:

1. Use of weedicides, if required.
2. Weeding, hoeing
3. Deep ploughing

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Use of hybrid varieties suitable for year round production system for mid or high hills.

xii. Production constraints in agro-ecological region:

1. Less heading in open pollinated cabbage
2. Boron deficiency is becoming serious.
3. Less availability of high quality seeds
4. High prices of hybrid seeds
5. Post-harvest losses are more due to non availability of
6. storage facility
7. High prices of fertilizers
8. Low prices of farm produce
9. Lack of knowledge about the cultivation practices
10. Lack of processing facilities
11. So far no minimum support price is fixed for the crop.

9B. Name of the vegetable crop: Cauliflower

i. Existing varieties being used: Pusa Snowball 16, PSB-35 as open pollinated. Snow Queen and Snow King, Sweta and late group hybrids**,** unknown varieties available in the mandi

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Early- Early Kunwari, Pusa Kartiki, Pusa Early Synthetic; Mid- Pusa Shubhra, Pant Shubhra, Hisar No.1, Snow crown; Late- Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2.

iii. Existing package of practices being used:

Traditional cultural practices
Line spacing is not done
Poor crop geometry
Use of organic manure
Less or no used of organic pesticides.

High incidence of insect and diseases.

1. Soil Testing-Farmers do not test their soil.
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Optimum sowing time
   Early: May- June
   Mid: July – Aug
   Late: Oct
8. Cultivars-In cauliflower, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be curd formation.
9. Transplanting- Farmers practices improper planting distance.
10. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
11. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
12. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
13. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

iv.Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

Need to develop seed production program in cauliflower.

Use of micronutrients especially borax

1. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
3. Seed- Farmers should use improved varieties/ hybrids, Selection of hybrids as per maturity group of crop
4. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
5. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma Viride 4g/kg before sowing.
6. Seed Rate- It is recommended to use the seed quantity for different as follows-
   Cauliflower (Early)-500-750g/ ha open pollinated.
   Cauliflower (Mid and Late)- 300-350g/ha open pollinated.
   Cauliflower (Hybrid)-250-300g/ha.
7. Varieties- Farmers should select proper variety for suitable sowing time as per maturity group. For early crop- Early Kunwari, Pusa Kartiki, Pusa Early Synthetic; Mid- Pusa Synthetic, Pusa Shubhra, Pant Shubhra, Hisar No.1 and Late- Pusa Snowball-16, Pusa Snowball Kt-1, Pusa Hybrid-2.
8. Transplanting- Farmers should transplant seedlings properly as for early (30x30cm), medium (45x30cm), and late (60 x 45 cm).
9. Manures and fertilizers- Farmers should incorporate well rotten cow dung (15-20tonnes/ha) and NPK (150:80:60) in irrigated, half dose of NPK in un irrigated condition.
10. Irrigation- Farmers should apply water in the field at proper stage of the crop. As critical growing stage such as proper growing stage, curd formation and maturity stages.
11. Weed control- Farmers must know about the losses in the production of the crop by weeds, they

should adopt proper weed control management practices either manually or chemically.

12. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

v. Major insect pests associated with crop: Diamond back moth, Aphids are serious problem

vi.IPM Module for management of insect pests :

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Growing of African bold seeded mustard as trap crop at 22:2 ratio to attract DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

After Planting

1. Regular monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT.
5. Spray Dipel 8 SP (Bt var. kurstaki) @ 0.2% at 15 days interval after 22-25 DAT to manage DBM.

Dimond back moth: *Plutella Xyllostella*

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	50	3
Cyantraniliprole 10.26% OD	600	5
Indoxacarb 14.5% SC	200-266	7
Indoxacarb 15.8% EC	266	5
Spinosad 2.5% SC	600-700	3
Chhlorfenapyr 10% SC	750-1000	7
Emamectin benzoate 5% SG	150-200	3
Flubendamide 480% SC	45-60	7
Flubendamide 20% WG	90-120	7
Chlofluazuron 5.4% EC	1500	7
Diafenthiuron 50% WP	600	7
Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	600-1000
Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5

Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

Name of the Bio-insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7

vii.Major disease associated with crop: Damping off , Black rot, Alternaria

viii. IPM Module for management of disease:

***Xanthomonas* Black rot:**

Seed treatment with Streptocyclin @ 100 mg/kg seed and two spray of Streptocyclin 1.0 gm / 10 litre of water after 10-12 days interval.

ix.Major weeds associated with crop: *Anagallis arvensis, Convolvulus arvensis, Chenopodium album , Asphodelus tenuifolius, Avena fatua*

x.IPM Module for management of weeds:

1. Use of weedicide if required.
2. Weeding, hoeing
3. Deep ploughing.

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Advanced technical package and practises regarding crop.
2. Use of trap crop like radish to attract the white butterfly.
   Inter Cropping with coriander and rye in hills.

xii.Production constraints in agro-ecological region:

1. Non availability of suitable varieties as per agro-ecological situation.
2. Buttoning and leafyness are common problem
3. Lack of technical knowledge
4. Less availability of high quality seeds
5. High prices of hybrid seeds
6. Post-harvest losses are more due to non availability of storage facility
7. High prices of fertilizers
8. Low prices of farm produce
9. Lack of knowledge about the cultivation practices
10. Lack of processing facilities
11. So far no minimum support price is fixed for the crop.

9C. Name of the vegetable crop: Radish

i. Existing varieties being used: Dunagiri, Chinese Pink and Pusa Himani, mixture of varieties from unknown source

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Early Mino, Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant, Punjab Pasand

iii. Existing package of practices being used:

1. Mixed cropping
2. Soil Testing-Farmers do not test their soil
3. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
4. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
5. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
6. Sowing time: Sept- Dec
7. Planting distance- Farmers practices improper planting distance and sown through broadcast.
8. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
9. Fertilizers: Farmer use imbalance fertilizer

10. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method..
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
12. Harvesting- The root harvesting should not follow as per maturity standards or as per object.

iv.Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of long white tapering varieties
2. Line sowing and use of less or non-pithy varieties
3. Use of round shaped varieties for culinary purpose.
4. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
5. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
6. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing
7. Seed Rate- The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha
8. Planting distance- Farmers should be sown the seed Asiatic type line to line 45 cm and plant to plant 8cm and European type line to line 30 cm and plant to plant 8 cm
9. Manures and fertilizers- should be used as per soil testing , General recommendation are FYM-250q/ha Nitrogen: 60 kg/ Phosphorus: 100 kg/ha and Potassium: 50kg/ha Micronutrient: should be used as per soil testing,
10. Irrigation- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at 7-8 days interval and in summer 3-4 days interval
11. Harvesting- Depending upon the cultivars, the roots become ready for harvesting in about 25-35 days after sowing. Early and rapid maturing European cultivars reach harvest maturity in 25-30 days after sowing. They become bitter and pithy if the harvesting is delayed. In India, harvesting is done manually. A light irrigation may be given before harvesting to facilitate lifting of roots. In advanced f countries, commercial radish growers use a single row harvester that pulls the plants from the soil, cuts the roots from the tops, and then places them in bags for transportation to a picking shed.

v.Major insect pests associated with crop: Aphids are problem

vi.IPM Module for management of insect pests:

Aphid, *Aphis gossypii* Glover and *Myzus persicae* (Sulzer)

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the numbers considerably without any insecticidal spray.
2. Yellow sticky trap is effective for controlling aphid population.

Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha if needed.

vii. Major disease associated with crop: White rust

viii. IPM Module for management of disease: Use of recommended pesticides in recommended dose

ix. Major weeds associated with crop: Not serious

x. IPM Module for management of weeds: Not applied

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of short duration, non pithy, coloured varieties for year round production.
2. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops

in a year such as Cauliflower early- Radish- Bottlegourd
3. Brinjal-Radish –Chilli
Bottle bourd-radish-French bean

xii. Production constraints in agro-ecological region:

1. Pithyness problem in low hills
2. Less availability of high quality seeds
3. High prices of hybrid seeds
4. Post-harvest losses are more due to non availability of storage facility
5. High prices of fertilizers
6. Low prices of farm produce
7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities
9. So far no minimum support price is fixed for the crop.

9D. Name of the vegetable crop: Tomato

i. Existing varieties being used: Pant T3, Non descriptive varieties as open pollinated, Naveen 2000, Manisha, Private company varieties like Himsona, Rakshhak etc.

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Indeterminate hybrid varieties, Pusa Sheetal, Pusa Gaurave, Pant T-3, Naveen2000+, Avinash (A-2), Himsona and various types of hybrids avalable in the market

iii. Existing package of practices being used:

1. Without soil and seed tretament, Poorly managed nurseries, Subterreaen staking, Non-judicious use of fertilizers,
2. Generally crop grown in open field condition
3. Sowing time- Oct-Nov. And Jan-Feb
4. Sowing space-75x60 cm and 75x45 cm

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of indeterminate, round, optimal fruits weight (+_120) g weight hybrids, use of organic manures, sepcial training and pruning techniques, Upright stacking and earthing up operation, with standard harevsting techniques and stages.
2. Use Inderminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition. Use Zn in deficient soil.
3. Use micronutrient including Ca, B and Mo
4. Crop rotation Tomato-cowpea-Early cauliflower.

v. Major insect pests associated with crop: Fruit borer and white flies in low or mid hills are serious pest

vi. IPM Module for management of insect pests:

1. Use of tall varieties
2. Removal of lower leaves about 45 cm above ground level
3. Staking for upright growth and removal of extra flushes in mature stage.
4. Use of systemic pesticides to manage foliar and fruit diseases.
5. Use of plastic mulch
6. Use of Avant or systemic insecticides for management of insect/ pest.

Tomato fruit borer *Helicoverpa armigera* (Noctuidae: Lepidoptera)

1. Growing trap crop of African tall marigold as border row before 15 days of transplanting is beneficial in reducing egg laying in main crop.
2. Field sanitation and clean cultivation is effective tool to suppress the pest population.
3. Setting of sex pheromone traps @ 5 trap/acre for monitoring is effective.

4. Spray of Ha NPV @ 500 LE/ha mixed with 0.1 per cent UV retardant (Tinopol) and 0.5 per cent jiggery is effective.
5. Use of Bt @ 0.50kg/acre and NSKE 5 per cent to kill early stage larvae. Release of the egg parasitoid, *Trichogramma chilonis* or *T. brasiliensis* @ 1Lakh/ha coinciding with flower initiation at 15 days interval may reduce the pest population.
6. Development of pyridalyl nanocapsule suspension for efficient management of tomato fruit and shoot borer (*Helicoverpa armigera*) is an efficient approach for frequent delivery and effective management.

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Indoxacarb 14.5% SC	400-500	5
Chlorantraniliprole 18.5% SC	150	3
Cyantraniliprole 10.26% OD	900	3
Flubendamide 480% SC	120	5
Flubendamide 20% WG	240	5
Novaluron 10% EC	750	1-3
Novaluron 5.25%+ Indoxacarb 4.5% SC	1700	5
Methomil 40% SP	750-1125	5-6
Lambda cyhalothrin 5% CS	300	5

Management strategies(white fly and other sucking pests)

A. Crop Hygiene

Field hygiene should be a high priority and should be included as an integral part of the overall strategy for managing whitefly populations, Tomato yellow leaf curl virus(TYLCV) incidence, and insecticide resistance. These practices will help reduce the onset of the initial infestation of whitefly, regardless of biotype, and lower the initial infestation level during the cropping period.

B. Other Cultural Control Practices

1. Use proper pre-planting practices.
2. Vegetative propagated ornamental plants (i.e. *Hibiscus, Poinsettia*, etc.) should not be grown at the same location, especially if bringing in plant materials from other areas.
3. Avoid yellow clothing or utensils as these attract whitefly adults.
4. Delay planting new fall crops as long as possible.
5. Do not plant new crops near or adjacent to old, infested crops.
6. Use proper post-planting practices.
7. Apply an effective insecticide to kill whitefly adults prior to cultural manipulations such as pruning, tying, etc. Rogue tomato plants with symptoms of TYLCV.
8. Plants should be treated for whitefly adults prior to rouging and, if nymphs are present, should be removed from the field, preferably in plastic bags, and disposed of as far from production fields as possible.
9. Manage weeds within crops to minimize interference with spraying and to eliminate alternative whitefly and virus host plants.
10. Destroy old crops within 5 days after harvest, destroy whitefly infested abandoned crops.

C. Insecticidal Control Practices.

1. Restricted the use of neonicotinoids (imidacloprid or acetamiprid) in the field only during the first six weeks of the crop thus leaving a neonicotinoid-free period at the end of the crops.
2. Use selective rather than broad-spectrum control products where possible to conserve natural enemies and enhance biological control.
3. Do not apply insecticides on weeds on field perameters. These could kill whitefly natural enemies and, thus, interfere with biological control.
4. Crop rotation is effective tool to prevent pest population.
5. Avoiding of same group of crop in same field for a long time is beneficial.
6. Sticky trap is effective to control whitefly population.

White fly

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Cyantraniliprole 10.26% OD	900	3
Spiromesifen 240% SC	625	3
Thiamethoxam 25% WSG	200	5
Imidacloprid 17.8% SL	150-175	3

Leaf miner, *Liriomyza trifoli*

Name of the Insecticides	(gm/ml) /ha	Waiting period(days)
Cyantraniliprole 10.26% OD	900	3

vii. Major disease associated with crop: Buckeye fruit rot is a major serious disease.

viii. IPM Module for management of disease:

In Nursery

1. Soil Solarization of nursery bed by covering with polythene sheet for 45 to 60 days during April-June.
2. Use resistant cultivars like Arka Rakshak, Arka Samrat, Ramya etc., if possible
3. Grow the nursery under tunnel of poly net of 50 mesh.

On Crop

1. Use of healthy seedling.
2. Roguing of virus infected plants and destruction of weeds followed by need based spraying of systemic insecticides for vector management
3. Remove all previous season tomato plants
4. For the management of soil borne diseases follow crop rotation and rotate crop with maize, rice, wheat, okra or cowpea.

Buck eye rot:

1. Burn the infected fruit, leaves etc. and staking of plants,
2. Remove the leaves upto 9 inches from ground.

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Mancozeb 75% WP	1500-2000	
Propeneb 70% WP	1500	10

ix. Major weeds associated with crop: *Trifolium alaxenderium , Cyperus rotundus, Cynodon dactylon.*

x. IPM Module for management of weeds: Cultural practices.

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of high yielding varieties grown under ventillated polyhouse using standardized technology with fertigation technology in tomato can enhance the productivity of tomato manifold. Polyhouse technology is a boon for small and marginal farmers with fragmented holdings.
2. Reduce number of spray of pesticides.
3. Raise nursery on treated soil.
4. Treat seed with fungicide before sowing.
5. Manage fog during fruiting period.

xii.Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continuous cultivation.
2. Poor nursery management in the crop
3. Poor staking and pruning techniques.
4. Poor technical knowhow
5. Imbalance use of fertilizes.
6. More numbers of pesticides' spay
7. Increase incidences of Bacterial wilt.

9E.Name of the vegetable crop: Potato

i. **Existing varieties being used:** Up-to-date, Kufri Jyoti, Kufri chandramukhi, K. Bahar, K Badshah, and Kufri Jyoti

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3, K. Khyati, K. Pukhraj, K. Ashok, K. Sadabahar, K. Anand, etc

iii. **Existing package of practices being used:**

1. Use of big sized tuber or divion of tuber (50-60 g)
2. No Tuber treatment
3. Use of organic manures, sowing in flat bed.
4. Sowing time is March-April.
5. Limited or no IPM practices
6. Planting time:October
7. Spacing: 50-60 x 15-20 cm
8. Seed rate: 25-30 qtl/ha
9. Farmers are only using FYM along with urea at hills but the farmers in plains are using FYM + 160:100:120kg/ha NPK.

iv.Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with application of organic manures.
2. Fertilizer should be used on soil test basis. Dehaulming practise should be adopted for long duration storage of tubers.
3. Suitable fungicides should be used for control of Late blight disease e.g. mancozeb, cardendazim alone and in combination.

v.Major insect pests associated with crop: Potato tuber moth, Hadda beetle, White grub is a serious and wide spread problem

vi. IPM Module for management of insect pests:

Being organic distt. use of cultural and mechanical methods are used for management of insect-pest in distt

Potato tuber moth: ***Phthorimaea operculella***

1. Heaps of green grasses may be kept at suitable interval in infested field during evening and next day early in the morning along with caterpillars to destroy.
2. Clean cultivation and mechanical destruction of caterpillars also help in reducing pest infestation.
3. Irrigation also brings them on the surface and birds shall predate them.
4. Apply chlorpyriphos 20EC at the rate of 2.5ml/l in the soil before seed sowing.

Epilachna beetle: ***Epilachna viginatioctopunctata***

1. Hand packing of grubs and collection of beetles by hand nets during early stages of attack, helps in reducing the intensity of infestation.
2. Conservation and augmentation of natural parasitoids viz. *Pediobius foveolatus, Pleunotrogrus faveolatus* and *Tetrastichus* sp.
3. Application of Neem, Mahua, ground nut cakes are efficient in suppressing the pest population.
4. Spray of Malathion 50 EC in 200 liters of water per acre provides effective control of this pest

Aphids: ***Myzus persicae***

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the numbers considerably without any insecticidal spray.
2. Yellow sticky trap is effective for controlling aphid population. Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG (Spray)	100	77

Thiamethoxam 25% WSG (Drenching)	200	77
Dimethoate 30% EC	660	
Oxydemeton-methyl 25% EC	1000	
Carbofuran 3% CG	16600	
Phorate 10% CG	10000	

White grub - use of VL Kurmula trap 1,use of WGPSB2 Bio-Formulation @ 10 gm/kg vermicompost or FYM,drenching of Chlorpyriphos @ 2ml/L

vii. Major disease associated with crop: Late blight and common scab disease in the crop and tuber.

viii.IPM Module for management of disease:

1. Only cultural practices are used.
2. Use certified seed / disease free seed.
3. While using own save seed, treat the whole seed tubers (If not treated before cold storage) with Boric Acid @ 3% for 20 minutes for scab.
4. In Zinc deficient soils apply ZnSO4 @ 25 Kg/ha as basal dose or spray ZnSO4 @ 0.25 % at 30 and 45 days crop.
5. Plant improved/ resistant cultivars like Kufri Khyati, K. Pukhraj, K. Satluj and K. Chipsoan-3.
6. Regularly monitor the field and rouge the virus affected plants. Need based spraying of systemic insecticides should be done to check the vector population.
7. On first appearance of blight apply Mancozeb @ 2.5 kg/ha or copper oxy chloride @ 3.0 kg/ha. In severe situation it should be followed by spray of Cymoxanil+Mancozeb 72 WP @ 2.5 kg/ha. Depending upon appearance / development of repeat one more spray of Mancozeb @ 2.5 kg/ha or copper oxy chloride @ 3.0 kg/ha at 10 days interval. Depending upon appearance of late blight and favorable weather conditions, give one more spray of Mancozeb @ 0.25%.
8. Stop irrigation before haulm cutting, leave tubers in soil for skin hardening for 10-15 days.
9. Kill the haulms (on critical date), remove from the field and ensure no regrowth takes place.
10. Treat the seed tubers by dipping in Boric Acid 3% solution for 20 minutes before storage.

ix. Major weeds associated with crop: *Ranunculus,Cyprus* sp and *Chinopodium* etc.

x. IPM Module for management of weeds:

1. Mechanical and cultural method.
2. Proper crop rotation
3. Timely hand weeding
4. Winter/ summer ploughing
5. Apply Pendimethalin 30 EC @ 1 kg a.i/ha or Metribuzin 70% WP @ 0.350 kg a.i/ha or Oxyflurofen 23.5 % EC @ 0.1-0.2 kg a.i/ha within 3 days after planting to control grassy and non grassy weeds.
6. Apply Paraquat dichloride 24% SL @ 0.5 kg a.i/ha at 5% germination of potato.

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Early mature varieties.
2. Use of Kufri Girriraj and Kufri Jyoti varieties supplementation with use of optimal tuber size,
3. Selection of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja.
4. Seed treatment should be followed.
5. Planting of pre-sprouted tubers should be done.
6. Proper crop rotation to should be followed.
7. Winter/ summer ploughing of fields.
8. Use of organic mulching material in appropriate thickness especially under rain fed mid hills agro climatic conditions.
9. Dehaulming practise should be adopted by the farmers for long duration storage of tubers.
10. Medium size whole tuber should be used as planting material.

xii.Production constraints in agro-ecological region:

1. Timely and adequate seed supply.
2. Facility of poor seed storage in the distt.
3. The seed of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja is not available in sufficient quantity.
4. Use of infected planting material by the farmers.
5. Use of un sprouted seed (newly dug tubers)
6. Proper crop rotation is not followed.
7. Cultivation on sloppy land.
8. In situ moisture conservation techniques such as mulching technology are not followed.
9. Dehaulming technique is not followed.
10. Imbalance use of fertilizers.
11. Use of unrecompensed FYM.
12. Lack of storage facilities.
13. Seed production is not done by the farmers.

9F. Name of the vegetable crop: Brinjal

i. Existing varieties being used: Non descriptive or non identified varieties, Pant Rituraj, Pant smrat. Locally available varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Round and purple hybrids like Chhaya, Kanhaya, Ankur etc are hybrid available in local market. Navkiran, Brinjal 704 (SunGro Seed), Navina, VNR212 (VNR Seed), IndameSupriya (Indo-American), Pant Rituraj, Pant Samrat (Pantnagar), Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used:

1. Poorly managed nurseries infected with damping off.
2. Overaged or less vital seedling utilization
3. Tranplanting is done on or before monsoon shower
4. Round and long puple variety use
5. No control measure for shoot and fruit borers and phomopsis blight.
6. Soil Testing-Farmers do not test their soil
7. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
8. Nursery- Nursery soil generally not sterilize by the farmers.
9. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
10. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
11. Sowing time:
    Region A: Dec-Jan, June-July
12. Transplanting- Farmers practices improper planting distance.
13. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
14. Fertilizers: Farmer use imbalance fertilizer
15. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method..
16. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
17. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Availability of purple and round varieties in cropping system.
2. Augmenation of assured irrigation for optimal production.
3. Use of black or plastic mulch in production chain
4. Soil Testing- Farmers should practice for soil test before sowing the crop for proper

recommendation of fertilizers.

5. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
6. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
7. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed orTrichoderma viride 4g/kg before sowing
8. Seed Rate- The recommended seed rate of brinjal: Hybrid-250g/ha, Open pollinated-500-600g/ha
9. Transplanting- Farmers should transplant seedlings properly as for non spreading type varieties-60cm x 60cm, spreading type varieties - 75cm x 60cm.
10. Manures and fertilizers- should be used as per soil testing , General recommendation are FYM-250q/ha Nitrogen: (Hybrid-200kg/ha, Open pollinated-100-120kg/ha) Phosphorus: (Hybrid-100kg/ha, Open pollinated-80kg/ha Potassium: (Hybrid-80/ha, Open pollinated-60kg/h), Micronutrient: should be used as per soil testing,
11. Irrigation- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at7-8days interval and in summer3-4 days interval. Augmenation of assured irrigation for optimal production.
12. Weed control- Farmers must know the about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically. Farmer can control the weeds by hand weeding along with pre-planting surface application @ of 1.0-1.5 kg/ha Alachlor.
13. Growth substances: Use 2,4-D @ 2ppm at flowering stage
14. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

v. Major insect pests associated with crop: Shoot and fruit borers

vi. IPM Module for management of insect pests:

Brinjal fruit & shoot borer: *Leucinodes orbonalis*

1. The damaged portions of the plants and fruits should be removed and destroyed.
2. Early removal of drooping shoots will reduce the fruit infestation.
3. Proper collection of all the infested flower buds, fruits during harvest.
4. Continuous cultivation of brinjal also favors the pest infestation.
5. Varieties like Punjab Barsati, (moderate resistant cultivar) Pusa purple round, Punjab Neelam found to be resistant to brinjal fruit borer.
6. Biological method recommended by IIHR, Bengaluru involving release of *Trichogramma chilonis* @10 to 15 lakh parasites/ha/season along with 2 sprays of *Bt* formulation found to be economically effective.
7. Installation of BSFB (brinjal shoot and fruit borer) pheromone traps Lucinure @3/ha to monitor and mass trap the male moths is effective.
8. Neem Seed Kernal Extract(NSKE)5 % per cent at the time of flowering is effective.
9. Prevent continuous growing of same group of crop at same field.
10. Rotate brinjal with cabbage or other crops

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC -	200	22
Emamectin Benzoate 5% SG	200	3
Thiacloprid 21.7% SC	750	5
Thiodicarb 75% WP	625-1000	6
Lambda cyhalothrin 5% CS	300	5
Cypermethrin 25% EC	150-200	1

Betacyfluthrin 8.49%+ Imidacloprid 19.81% OD	200	7
Triazophos 35% + Deltamethrin 1% EC	1250	3
Pyriproxyfen 5%+ Fenpropathrin15% EC	750	7

vii. Major disease associated with crop: Phomopsis blight and rot (*Phomopsis vexan*) is a serious problem in the hills.

viii. IPM Module for management of disease:

1. Upright nursery beds for seedling production above 10-15 cm above ground to ward off damping off etc.
2. Cover the beds with polythene sheet of 45 gauge (0.45 mm) thickness for three weeks before sowing for soil solarisation which will help in reducing the soil borne pests. Sufficient moisture should be present in the soil for solarisation.
3. Mix 150 gm of fungal antagonist *T. harzianum* in 3 kg of FYM and leave for about seven days for enrichment. After 7 days mix in the soil in a bed of 3 sq. m.
4. Treat the seeds of popular hybrids with *T. viride* @ 4 gm/ kg.
5. Use nylon net of 40 gauge mesh for leaf curl management.

ix. Major weeds associated with crop: Euphorbia hirta, Cynadon dactylon, *Oxalis sp.,Cyperus rotundus, Panicum repens, Amaranthus viridus, Parthenium hysterophorus*

x. IPM Module for management of weeds:

1. Hand weeding.
2. The field should be kept weed-free, especially in the initial stage of plant growth, as weeds compete with the crop and reduce the yield drastically.
3. Frequent shallow cultivation should be done at regular interval so as to keep the field free from weeds and to facilitate soil aeration and proper root development.
4. Deep cultivation is injurious because of the damage of roots and exposure of moist soil to the surface.
5. Two-three hoeing and the earthing up are required to keep the crop free of weeds.
6. Preemergence application of Fluchloralin (1.5 kg a.i./ha) coupled with one hand weeding 30 days after transplanting is effective for control of weeds

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of hybrids can increase productivity 2 to 3 times higher.
2. Use of mulch in rainy season.
3. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Brinjal- Radish-Bottle gourd, Brinjal- spinach-cowpea, Brinjal- Turnip-Amaranthus, Brinjal- Spinach-Bitter gourd etc.

xii. Production constraints in agro-ecological region:

1. Wild animals problems
2. Marketing problem in rainy season
3. Non-availability of suitable hybrids and High prices of hybrid seeds
4. Post-harvest losses are more due to non availability of storage facility
5. High prices of fertilizers
6. Low prices of farm produce
7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities
9. So far no minimum support price is fixed for the crop.

9G. Name of the vegetable crop: Chilli

i. Existing varieties being used: Jwala, Pant C1, Yellow mirch(Lakhaur mirch) local strains and non descriptive varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Agni, Shikha and other hybrids.

iii. Existing package of practices being used:

1. Traditional seeds, No seed treatment, Poor nursery management, Tranplanting on or before rainy or monsoon season, Crop geometry knowledge is poor, Poor dry fruit storage.
2. Growing local varieties.
3. No line transplanting.
4. Generally they plant two over aged seedling at one place.
5. No or very less use of fertilizer.
6. Sowing of untreated seed.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of seed tretment like Pant bioagent 3 for managing seed and soilborne diseases.
2. Earthening up of plants within 45 days after transplantation to get rid off waterlogging
3. Use of tall and cluster bearing type like local strain Lakhaur mirch.
4. Use of high dose of organic manure i.e. 200 q/Ha increases productivity and incidence of dieback and Anthracnose.
5. Grow high yielding varieties.
6. Treat the seed with copper containing fungicides before sowing.
7. Adopt soil testing.
8. Transplant one seedling at one place.
9. Transplant the seedlings when they attain 5-6 leaf stage.
10. Transplant the seedlings at proper spacing-
11. Dwarf varieties like Kashi Anmol at 45 x 30 cm
12. Tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm.
13. Apply recommended dose of fertilizer (15-20 t FYM + 120: 60:60NPK/ha) after soil test in irrigated condition, whereas under unirrigated condition apply half dose of recommended NPK.

v. Major insect pests associated with crop: Thrips problem is major problem

vi. IPM Module for management of insect pests :

Chilli thrips, *Scirtothrips dorsalis* Hood (Thripidae: Thysanoptera)

The thrips *Franklinothrips vespiformis* (Crawford) and *Erythrothrips asiaticus* R. &. M. are predaceous on in nature and their population may be encouraged by avoiding chemical sprays. Yellow or blue sticky trap is effective for controlling this pest. If still the population persist spraying of imidacloprid70%WG@)0.25ml/l or acetamiprid20%SP@ 0.2g/l or thiomethoxum 25%WG@ 0.2g/l or metasystox@1.5ml/l is effective.

vii.Major disease associated with crop: Dieback and anthracnose is major disease of block.

viii.IPM Module for management of disease:

ix.Major weeds associated with crop: *Euphobia hirta*, *Cynodon dactylon* , Cyprus and Oxalis

x. IPM Module for management of weeds:-

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of tall hybrids supplentation of organic packages of practices to be followed
2. Grow high yielding varieties.
3. Treat the seed with copper containing fungicides before sowing.
4. Adopt soil testing.
5. Transplant one seedling at one place.
6. Transplant the seedlings when they attain 5-6 leaf stage.
7. Transplant the seedlings at proper spacing.

xii.Production constraints in agro-ecological region:

1. High incidence of flower and fruit drop in chillies

2. Fruit losses due to high incidence of dieback and anthracnose.
3. Non availability of quality seed.
4. Less irrigation facilities.
5. High cost of hybrid seeds.
6. Unaware about the insect-pest management.

9H. Name of the vegetable crop: Cucumber

i. Existing varieties being used: Local and traditional varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:

Nuri, Malini, No786, Aviva, Majesty and other pathenocarpic cucumber strains available in local market.

1.For open field condition: Pusa Udhay, Pusa Barkha,Shubhangi, Himangi, Punjab Naveen, Tasty, Ruchi, Mandakini, Kumud, Noori, Alamgir, Rani, Don etc,

2. For protected condition: Pant Parthenocarpic Cucumber-2 & 3, Hilton, Kian, Isatis, Malini etc.

iii. Existing package of practices being used:

1. Use of traditional seeds,
2. Planting in rainy season,
3. Traditional stacking method,
4. Long harvest duration season,
5. Sale at local market
6. Absence of crop rotation.
7. Random selection of variety (May or may not be suited to Agroeco-region).
8. Untimely sowing / planting of crop.
9. Use of untreated seed.
10. Unbalanced use of fertilizers.
11. Use of plant protection chemicals having long wetting period.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Glasshouse or polyhouse technology
2. Use of Hybrids or/and Pathenocarpic varieties
3. Management of crop geometry.
4. Use of organic manure or fertigation inside polyhouse.
5. Management of Dacus and other flies.
6. Use of protected cultivation.
7. Adoption of crop/ soil health related crop rotations.
8. Recommended/suitable variety for Agroeco-region.
9. Use recommended spacing eg. 60-200 × 50-100 cm
10. Treating seed before sowing.
11. Balanced use of fertilizers (125: 155: 125 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).
12. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
13. Selection of optimum planting period.
    Region A: (Protected cultivation) : Sept
14. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
15. Adoption of micro irrigation technologies for efficient use of available water.
16. Adoption of fertigation system for efficient use of fertilizers

v. Major insect pests associated with crop: Fruit flies

vi. IPM Module for management of insect pests : -

vii. Major disease associated with crop: Powdery mildew and downy mildew

viii. IPM Module for management of disease(except organic areas):-

ix. Major weeds associated with crop:

x. IPM Module for management of weeds:

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

Polyhouse technology and hybrid cultivars can increase productivity 3-4 times in mid and high hills.

xii. Production constraints in agro-ecological region:

1. Lack of plant growing structures.
2. Monkey, baboon, wild pigs are serious threats.

9I. Name of the vegetable crop: Pea

i. Existing varieties being used: Arkel or mixture of varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pusa Pragati, Vivek Pea 10, Round seeded varieties Pant Sabji Matar 3, Azad Pea 3, Pea 89

iii. Existing package of practices being used:

1. Sowing in Autumn month
2. No line sowing,
3. High seed rate,
4. Mature more than 120 days,
5. Stacking is done for tall varieties,
6. Dual purpose varieties
7. Sowing by broadcasting method, no seed treatment, using own saved seeds to grow crop

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of tall varieties sown in line with effective stacking methods. Mangement of powdery mildew, Aschochyta blight and other diseases and Fusarium wilt in autumn season
2. Sowing early maturing varieties at closer spacing (30 cm plant to plant and about 5-10 cm between plants) and higher seed rate (120 kg/ha).
3. Sowing time:
   Region A: Oct & Mid Nov
   Reigion B: Nov- Dec
   Region C: Mid Aug
4. Seed rate: 100 Kg/ ha
5. Treating the seed with 2 g Thiram /kg of seed and rhizobium culture if being sown in field for first time.
6. If available, at least one ton of farmyard manure per ha should be incorporated in the soil at the time of land preparation. Add fertilizers containing NPK as 30: 70: 50 kg/ha all apply as basal dose.
7. Water the crop as per need especially during flowering and pod setting.

v. Major insect pests associated with crop: Leaf miner

vi. IPM Module for management of insect pests: -

vii. Major disease associated with crop:

1. Powdery mildew in all agroecological situations
2. Fusarium wilt in autumn sown crop
3. Aschochya blight in rainy season in high hills.

viii. IPM Module for management of disease: Use of oganani inputs only; Use of rust and powdery mldew resistant strains.

ix. Major weeds associated with crop: All seasonal weeds

x. IPM Module for management of weeds: Use pendimethaline @ 1kg ai/ha as pre-emergence and one hoeing 25-30 days after sowing.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Increasing crop intensity, Line spacing
2. Use of tall cultivars in cropping system
3. Standardization of time for seed sowing in pea viz. Septemeber sowing in high hills, Mid Nov sowing time for Mid hills can enhance productivity.

xii. Production constraints in agro-ecological region:

1. Monkey Menace
2. Need to increase seed production program in distt.

9J. Name of the vegetable crop: Capsicum

i. Existing varieties being used: Locally produced seed, California wonder, Hathi soond

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: California wonder, Bull nose, Arka mohini, Arka Gaurav, Indira, Bharat, Pusa Dipti

iii. Existing package of practices being used:

1. Poorly managed nurseries infected with damping off.
2. Overaged or less vital seedling utilization
3. No control measure of wilt

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Seed sowing in line in nursery
2. Good nursery management
3. Control of damping off in nursery
4. Mangement of Fusarium and bacterial wilt

v. Major insect pests associated with crop: Fruit borer, aphid, cut worm

vi. IPM Module for management of insect pests: -

vii. Major disease associated with crop: Fusarium and bacterial wilt and anthracnose.

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: -

x. IPM Module for management of weeds: -

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Seed sowing in in line in nursery
2. Control of damping off in nursery
3. Control of fusarium and bacterial wilt
4. Proper fertilizer use
5. Use of mulch

xii. Production constraints in agro-ecological region: Non availability of quality seed, damping off and wilt disease

9K. Name of the vegetable crop: Onion

i.Existing varieties being used: Nasik red, locally grown seed

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Agri found light red, Agri found dark red, Pusa red, Pusa ratnar, VL onion 3

iii.Existing package of practices being used:

1. Poorly managed nurseries.
2. Overaged or less vital seedling utilization
3. No control measure of purple blotch

iv.Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Good quality seed, seed sowing in line in nursery, proper use of fertilizer, control of purple blotch

v.Major insect pests associated with crop: Thrips

vi.IPM Module for management of insect pests:

Onion thrips *Thrips tabaci* Hood (Thripidae: Thysanoptera)

1. Use of sticky trap
2. Overhead irrigation is quite effective to wash off thrips
3. Younger plots should be planted upwind of older plots, relative to prevailing winds, to make it harder for the thrips to find the new plantings
4. Mixed cropping of carrots and onions also may reduce thrips population
5. If thrips population exceed over 5 thrips/plant, following insecticides can be used-

Name of the Insecticides	**(gm/ml) /ha**
Imidacloprid 17.8 %SL	125
Acetamiprid 20%SP	1000
Thiamethoxam 25%WG (15-30 DAT)	100
Fipronil 5%SC	1000
Spinosaid 45%SC	160
Phorate 10% CG	10000

vii. Major disease associated with crop: Purple blotch

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: Non grassy weeds

x. IPM Module for management of weeds: Apply Oxyflurofen 23.5 % EC @ 0.1-0.2 kg a.i/ha within 3 days after planting to control grassy and non grassy weeds.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of good quality seed,
2. Control of thrips and purple blotch

xii. Production constraints in agro-ecological region: Thrips and purple blotch

10A.Name of the fodder crop: Berseem

i. **Existing varieties being used:** Mescavi, Vardan

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: BL-10, UPB-10

iii. Existing package of practices being used: Broadcasting of seed without culture and nutrient application, lack of proper water for irrigation.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

Proper turning of soil and preparation of small fields and sowing of crop in puddle field after treatment of seed with Rhizobium culture. 1st cutting after 1 month of sowing than after every 15-20 days and fertilizer (Urea) application after each cutting

1. Soil : loam to clay soil
2. Field preparation: 3-4 Harrowing + Leveling the field.
3. HYVS. – Mescavi, Warden. BL-10, 22,42, 180, Pusa Gaint & Bundel Berseem 243
4. Seed rate: 25-30 kg/ha
5. Sowing method: a. Wet method-like rice in puddled field
6. Dry method: Without puddled.
7. Sowing time: First an week of October
8. Fertilizer: 30:60:70:: N:P_2O_5 K_2O kg/ha
9. Irrigation: Field should remain at field capacity throughout the crop period after germination.
10. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.

11. Cutting management: First cut -45-50 DAS
12. Other cutting at 25-30 days interval- total 5-6 cutting are taken
13. Yield: 800-1000g/ha. Green forage.

v. **Major insect pests associated with crop:** Aphids
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:**
ix. **Major weeds associated with crop:** Kasni
x. **IPM Module for management of weeds:** Hand weeding
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of rhizobium culture and fertilizer application after each cutting,
2. For seed production the crop should be left after April

xii. **Production constraints in agro-ecological region:**
Irrigation facilities, Culture , Fertilzer, HYV

10B.Name of the fodder crop: Sorghum

i. **Existing varieties being used**: Chari
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** SSG-988, PC-29, MP Chari, PCH-106
iii. **Existing package of practices being used:** Broadcasting
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Line to Line 30 cm. HYV, First cutting at 50% Flowering stage & subsequent 3 cutting after 45 days interval
2. Soil : Loam Soil
3. Field Preparation: 2-3 harrowing followed by leveling
4. High Yielding Varieties
   A.Single cut- Pusa Chari- 1, 6,423
   Pant Chari- 3,4,7 &8
   B. Multi cut- SSG-59-3, PCH-106,
   Safed Moti, PC-5, COFS-29, CSH 20MF, CSH 24MF, Harasona
5. Seed rate: 10 kg/ha
6. Spacing : 30-45 cm line to line
7. Sowing time: June-July- Rainfed condition
   Feb-July- Irrigated condition
8. Fertilizer: 100-120: 60:40::N:P_2O_5 : K_2O kg/ha
9. Irrigation: Rainfed: Not required
   Irrigated: 20-25 days interval
10. Cutting management :
    Single cut: At 50% flowering stage
    Multi cut- 45 days after sowing first cut & subsequent cutting at 25-30 days interval. Total 2-3 cutting are taken
    Note: After each cut, crop should be topdressed with 30 kg/N/ha after irrigation

v. **Major insect pests associated with crop:**
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:**
ix. **Major weeds associated with crop:** Seasonal weed
x. **IPM Module for management of weeds:** Hand weeding
xi. **Specific workable and sustainable intensification capable of doubling agricultural**

income in specific agro-ecological region: Multicut varieties

xii. Production constraints in agro-ecological region: Irrigation facilities, Fertilizer, HYV

10C.Name of the fodder crop: Lobia

i. **Existing varieties being used:** Local

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: UPC-5286, UPC-4200, BL-1

iii. Existing package of practices being used: Broadcasting of seed, Rainfed conditions, Self seeded seed is being used from long time

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: HYV, Mixed cultivation of fodder Maize+Lobia **,** Use of 75-80 kg nitrogen + 50-60kg phosphoros+15 kg Zinc

v. Major insect pests associated with crop: Borer

vi. IPM Module for management of insect pests: -

vii. **Major disease associated with crop:** YMV

viii. IPM Module for management of disease: -

ix. Major weeds associated with crop: Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:
Mixed cropping with Maize+ Lobia
Sorghum+Lobia

xii. Production constraints in agro-ecological region:
Lack HYV

10D.Name of the fodder crop: Fodder Maize

i. Existing varieties being used: Local varieties, , Ganga safed, Naveen, African Tall

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Ganga-2, Ganga-5, QPM

iii. Existing package of practices being used: Broadcasting of seed, no fertilizer used

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. HYV, Line sowing at 25-30cm Line to line and 10cm plant to plant, 80-100 kg N, 40-60 kg P
2. Soil: Well drained alluvial soil with soil PH 5.5-7.5.
3. Field preparation: 4-5 harrowing + leveling
4. HYVS: African Tall, J-1006. Pratap Makka Chari-b.
5. Seed rate: 50kg/ha
6. Spacing : 30-45 cm(row to row distanced)10-15 cm (plant to plant)
7. Sowing time
   Rainfed: Onset of monsoon
   Irrigated : Feb to July
8. Sowing method : Line sowing is proposed over broadcasting
9. Fertilizer : 100-120 : 60:40: 20::
   : P_2O_5 : K_2O: ZnSo4 kg/ha
10. Irrigation: Fodder maize grown under irrigated condition should be irrigated at 20 days interval. Spring/summer crop requires 5-6 irrigations.
11. Weed control: Pendimethalin @ 0.75 kg ai/ha (PE) application.
12. Harvesting: The crop should be harvested at tasseling /silling stage or 50-55 days after sowing.
13. Yield: Green fodder: 350-450q/ha.

v. Major insect pests associated with crop: Borer

vi. IPM Module for management of insect pests: -

vii. **Major disease associated with crop:** YMV

viii. IPM Module for management of disease: -

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:
Mixed cropping with Maize+ Lobia
Sorghum+Lobia

xii. Production constraints in agro-ecological region:
Lack HYV

10E.Name of the fodder crop: Jai (Oat)

i. Existing varieties being used: Local varieties, Kent

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: JHO-851, UPO-94, OS-6

iii. Existing package of practices being used: Broadcasting of seed, no use of NPK, Rainfed conditions

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. HYV, Use of recommended NPK,
2. Soil : Loam soils
3. Field preparation : 2-3 Harrowing + leveling
4. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
5. Seed rate: 100 kg/ha
6. Spacing : 30cm line to line distance
7. Sowing time: first week of October to last October

v. Major insect pests associated with crop: Bore**r**

vi. IPM Module for management of insect pests: -

vii. **Major disease associated with crop:** YMV

viii. IPM Module for management of disease: -

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: HYV, Use of recommended NPK

xii. Production constraints in agro-ecological region:
Lack HYV

10F.Name of the fodder crop: Hybrid Napier

i. **Existing varieties being used:** Pusa giant

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: IGFRI-3,6,10 NB-21

iii. Existing package of practices being used: Planting on bunds and wasteland near gadhera in rainy season

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. LxL-75-90cm; PxP -45cm
2. Rootslip -25000-30000 /ha
   200q FYM, N:P 50kg/ha BD
3. Soil : Loam soils to clay soil
4. Field preparation : 2-3 Harrowing + leveling
5. HYVS: Phule Jaywant, NB-37, CO-3, BAIF-10, PBN-83, PBN 233, Hybrid-3 Napier.
6. Seed rate: 40000 rooted slips or stem cutting (3 buds)/ha
7. Spacing : 75 cm x 50cm

8. Sowing time: Onset of monsoon or month of February
9. Fertilizers: 60kg/ha + 60 kg P_2O_5 + 40kg K_2O/ha at sowing time followed by 30kgN top dressing after each cut.
10. Irrigation: Irrigate crop after each 20-25 days interval during summer season. Normally irrigation is not required during rainy season.
11. Cutting management: First cut after 50-55 days of sowing and subsequent cuttings are taken after 30 days interval.
12. Yield: 1500-2000q/ha green forage

v. Major insect pests associated with crop:
vi. IPM Module for management of insect pests: -
vii. **Major disease associated with crop:**
viii. IPM Module for management of disease: -
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. LxL-75-90cm; PxP -45cm
2. rootslip -25000-30000 /ha
3. 200q FYM, N:P 50kg/ha BD should be grown on waste and community land

xii. Production constraints in agro-ecological region:
Lack HYV

11A.Name of the Medicinal crop: Brahmi

i. **Existing varieties being used:** Local
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Praja shakti, Subodhak
iii. **Existing package of practices being used:** Grown on low productive lands without scientific cultural practices- No proper management after cutting
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** sowing LxL -50cm and PxP- 40cm 100:60:60 kg NPK and 35kg N/after harvesting
60000-65000 plants/ha
v. Major insect pests associated with crop:
vi. IPM Module for management of insect pests:
vii. Major disease associated with crop:
viii. IPM Module for management of disease:
ix. Major weeds associated with crop: Local weeds
x. IPM Module for management of weeds: Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Sowing LxL -50cm and PxP- 40cm 100:60:60 kg NPK and 35kg N/after harvesting; 60000-65000 plants/ha proper management is required.
xii. Production constraints in agro-ecological region: Poor knowledge of package and practices

11B. Name of the Medicinal crop: Tejpatta

i. **Existing varieties being used:** Local
ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Wild / Local collection
iii. Existing package of practices being used: No proper management after cutting
iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Partial harvesting of leaves should be preferred.

2. It propagation in to be done by seeds. It is always advised to protect the seed from birds menace

v. **Major insect pests associated with crop:**

vi. **IPM Module for management of insect pests:**

vii. **Major disease associated with crop:**

viii. **IPM Module for management of disease:**

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Natural reserves and wild nurseries to retain the medical efficacy of plants in their natural habitats

xii. **Production constraints in agro-ecological region:** Absence of local pharmaceutical production; poor knowledge of package and practices

12A. Name of the Floriculture crop: Marigold

i. **Existing varieties being used:** Local varieties

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**

1. African Genda,
2. Pusa Narangi, Pusa Basanti, Moonsoth, Merinar
3. French Genda
4. Tina, Singhnet, Golden boy

iii. **Existing package of practices being used:** only house hold ornamental plant

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Transplanting in mid July and other mid October, and mid February, 3kg seed per hectare , Large size genda line spacing is 45x60 sq cm & small size genda spacing is 25x30 sq cm. 100kg n, 100kg, P and 200 kg K per ha should be mixed in soil in last plough. soil shound be moist always.

v. **Major insect pests associated with crop:** Thrips, leaf and leaf and bud eating caterpillar

vi. **IPM Module for management of insect pests:**

vii. **Major disease associated with crop:** Powdery mildew

viii. **IPM Module for management of disease:**

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Transplanting in mid July and other mid October, and mid February, 3kg seed per hectare , Large size genda line spacing is 45x60 sq cm & small size genda spacing is 25x30 sq cm. 100kg n, 100kg, P and 200 kg K per ha should be mixed in soil in last plough. soil shound be moist always; Proper management of insect pests and diseases

xii. **Production constraints in agro-ecological region:** availability of quality seeds and adequate marketing of flowers.

12B. Name of the Floriculture crop: Rose

i. **Existing varieties being used:** local ornamental and old varieties

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**

For Gulabjal and oil_ Noorjahan, Ranisahiba
For flowers_ First red, Sonia, Noveleze, etc

iii. **Existing package of practices being used:** Plantation of rose cutting

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Spacing

2. Fertilizer:40:20:20 NPK , fertilization using drip irrigation
3. Proper flower storage
4. High yielding varieties.
5. Adequate technological interventions.
6. To be cultivated in polyhouses.

v. **Major insect pests associated with crop:** Aphid, leaf miner, white fly, thrips, stem borer, rat

vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.

vii. **Major disease associated with crop:** blight and comrot, collar rot, leaf spot, Damping off

viii. **IPM Module for management of disease:** As per requirement through recommended pesticides.

ix. **Major weeds associated with crop:** Parthenium, *Chenopodium album*, Krishnil, Teepatiya

x. **IPM Module for management of weeds:**Weeding and Hoeing

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Spacing
2. Fertilizer:40:20:20 NPK , fertilization using drip irrigation
3. Proper flower storage –
4. Elite planting material
5. adaptation of high cultivation practices
6. Marketing
7. High-tech packing and packaging material.

xii. **Production constraints in agro-ecological region:** availability of quality seeds and adequate marketing of flowers. Availability of quality plants and adequate marketing of flowers

12C. Name of the Floriculture crop: Gladiolus

i. **Existing varieties being used:** Local

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** American buty, Oscar friendship, Shobh Sapna Poonam

iii. **Existing package of practices being used:** Plantation of of bulb with ridge bed

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Bulb treatment with Bavistin, 40:20:20 NPK/ ha
2. LxL- 30cm, PxP-15 cm

v. **Major insect pests associated with crop:** Aphid, leaf miner, white fly, thrips, stem borer, rat

vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.

vii. **Major disease associated with crop:** blight, collar rot, leaf spot, Damping off

viii. **IPM Module for management of disease:** As per requirement through recommended pesticides.

ix. **Major weeds associated with crop:** Parthenium, *Chenopodium album*, Krishnil, Teepatiya

x. **IPM Module for management of weeds:**Weeding and Hoeing

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. HYV varieties
2. Bulb treatment with Bavistin,
3. 40:20:20 NPK/ ha
4. LxL- 30cm, PxP-15 cm

5. Flower care and marketing

xii. Production constraints in agro-ecological region: availability of quality seeds and adequate marketing of flowers.

12D. Name of the Floriculture crop: Rajnigandha

i. Existing varieties being used: Local

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Hybrid varieties Subhashin, and Shringar

iii. Existing package of practices being used: Plantation of of bulb with ridge bed

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:
Tubers LxL – 25-30 cm
Plant to plant-15-20cm 200:50:70 NPK/ha

v. Major insect pests associated with crop: Aphid, leaf miner, white fly, thrips, stem borer, rat

vi. IPM Module for management of insect pests: As per requirement through recommended pesticides.

vii. Major disease associated with crop: Clitonia, bud rot

viii. IPM Module for management of disease: As per requirement through recommended pesticides.

ix. Major weeds associated with crop: Parthenium, *Chenopodium album*, Krishnil, Teepatiya

x. IPM Module for management of weeds: Weeding and Hoeing

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:
Hybrid varieties; Tubers LXL-25-30cm; Plant to plant-15-20cm; Fertilizers-200:50:70 NPK/ha

xii. Production constraints in agro-ecological region: availability of quality tubers and adequate marketing of flowers.

C1. Livestock: Buffalo

1.A Existing breeds available: Mostly non-descript, Neeli-Ravi cross, Murraha cross

1.B Specific breeds to be introduced: Murraha, Neeli-ravi,

2.A Existing feeds being used: Wild grasses, paddy straw, wheat straw, wild dried grasses, Leaves of trees such as silver oak, bhemal, khadeek, mulberry

2.B Specific feeds to be introduced / advised:

1. UMBB, Feed blocks, Fodder maize, multi cut chari, multi Barseem, Hybrid napier, tall fascue, Italian rai, cox foot, orchard grass fodder trees etc
2. Fortification of local Fodder, use of Chaff cutter and mangers etc
3. Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

3.A Existing health services:
State animal husbandry department (Vet. Hospital, LEO Centers)
BAIF, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:
Village level workers for first aid, vaccination and AI

4.A Existing management practices:

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,
3. Shortage of feed and fodder,
4. Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-

ecological region of district:

1. Proper scientific housing,
2. Scientific feeding management,
3. Manger and chaff cutter introduction,
4. Proper and timely vaccination and deworming, timely health and breeding facilities

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Poor breeds, shortage of feed and fodder, improper feeding, poor housing and management of animals, Improper health services, mostly unproductive animals,

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Feed and fodder shortage, local breed, low cost of milk

C2. Livestock: Cattle

1.A Existing breeds available: Mostly non-descript, Badri, Cross bred of Jursey, HF, Sahiwal

1.B Specific breeds to be introduced: Jursey, HF, Sahiwal

2.A Existing feeds being used: Wild grasses, paddy straw, wheat straw, dry grasses, Leaves of trees as silver oak, bhemal, khadeek, mostly rearing on grazing

2.B Specific feeds to be introduced / advised:

Fodder maize, multi cut sorgam (chari), Barseem, Hybrid napier, fodder trees etc
Fodder treatment, Chaff cutter, mangers etc

3.A Existing health services:

State animal husbandry department,
BAIF, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination and AI

4.A Existing management practices:

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,
3. Shortage of feed and fodder,
4. Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:

1. Proper scientific housing,
2. Scientific feeding management,
3. Manger and chaff cutter introduction,
4. Proper and timely vaccination and deworming, timely health and breeding facilities

5.A Problems of Livestock system- Goatary, Poultry, Fisheries:

Poor breeds, shortage of feed and fodder, improper feeding, poor housing and management of animals, Improper health services, mostly unproductive animals

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Feed and fodder shortage, local breed, low cost of milk

C3. Livestock: Goat

1.A Existing breeds available: Mostly non-descript,Chobarkha, Udaipuri

1.B Specific breeds to be introduced: Barbari, Jamunapari

2.A Existing feeds being used: Grazing

2.B Specific feeds to be introduced / advised: Grazing

3.A Existing health services: State animal husbandry department

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination

4.A Existing management practices:

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,

3. Shortage of feed and fodder,

4.Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Development of pasture land, scientific management

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Lack of range land management

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of range land management, managemantal problems as proper vaccination, ecto and endo parasite control, breed improvement

C4. Livestock: Poultry

1.A Existing breeds available: Poultry: Local, Croiler, RIR, uttara fowl

1.B Specific breeds to be introduced: Poultry: Croiler, Kadaknath, Cob, Cari-davendra, cari-nirbheek

2.A Existing feeds being used: kitchen waste

2.B Specific feeds to be introduced / advised: Starter, grower, finisher feed according to age

3.A Existing health services: State animal husbandry department, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Specific poultry management services

4.A Existing management practices: Mostly backyard

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: High yielding breeds, proper feeding and management practices

5.A Problems of Livestock system- Goatary, Poultry, Fisheries:

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing:

C6. Livestock: Fisheries

1.A Existing breeds available: Local, Silver carp, grass carp and common carp

1.B Specific breeds to be introduced: Silver carp, grass carp and common carp

2.A Existing feeds being used: House hold waste

2.B Specific feeds to be introduced / advised: Pelleted fish feed having 25-30% protein

3.A Existing health services: State fisheries deptt. (fisheries inspector at district level)

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:

4.A Existing management practices:

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:

5.A Problems of Livestock system- Goatary, Poultry, Fisheries:

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Non availability of quality fish seed is major problem

Availability of Medicines/ Vaccines

Specific health services to be required/ advised for doubling income in specific agro-ecological zone:

1. Nutritional gap needs to be filled. Farmers should be provided feed & fodder supplements at subsidised rates.
2. Minimum support prize should be fixed for the farm products.
3. Improved market infrastrusture and market scope.

Any other suggestions to improve the quality of Vety. Health services:

1. Need restructuring of the department especially for the hilly areas so as to fulfil the staff requirement.
2. Refresher course should be organised for the doctors.

Problems of Animal Husbandry

Specific problems due to which income is not increasing	Poor accessibility	yes
	Water scarcity	Almost in the whole district
	Natural disasters	Frequency is low
	Wild life conflicts	Yes frequency is very high due to which farming intensity is decreased to a significant level
	Marketing of animals	No availability of structured market
	Marketing of products	Low production due to which there is no surplus to be marketed and the transportation cost is also very high thus making is not feasible
	Budget	Allocation is low
	Manpower shortage	Yes. Monopoly gender role in livestock activity
	Capacity building	Para veterinary staff and refreshal courses of vetenarians is required
	Equipment & Implements (old/ shortage, etc.)	Adequate
	Mobility	Huge Problem. Dependence on the public vehicle is very high. Difficult terrain. Difficult road connectivity.
	Risk cover (Insurance)	Not given but should be given
	Relook to policies	-

D. Integrating Farming system

1.A Existing farming system: Animal husbandry+crop/Vegetable

1.B Specific farming system for doubling income in specific agro-ecological region:

1 **Agri-HortAnimal-processing based farming system**

Activity	Area
A. **Cropping system:**	**8 nali**
Paddy-whear/yellow saron/lentil-moong/grain cowpea	
Capsicum-radish-cauliflower	
Paddy-Radish-garden pea-Frenchbean	
Maize+cowpea-Berseem/Oat+cabbage	
B . Horticulture	**8 nali**
Mango/ Guava/Pomegranate+ (Cucurbits-Cabbage/cauliflower/onion/moong/cowpea/ginger/turmeric) as intercrop upto 6 years.	
Polyhouse(for growing cut flowers -01no.)+ polytunnel-for growing seasonal vegetable seedling	
Mushroom Production Unit	
C Livestock	**2 nali**
a. Cow/buffalo 2no.	
b. Backyard poultry 25 Birds	
c. Beekeeping	
D. Vermicomposting/Processing-	**2 nali**
Washing and cleaning of season vegetables, biogas/vermicompost/biopesticides	

Total cost : Rs 75,000.0

Total income : Rs 1.75 lakhs

Net income : Rs 1.00 lakh (Approx.)

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: Not available in area

1.B Grading facilities to be advised/ setup for doubling income in the agro-ecological region of district:

Establishment of minimal processing plants in various location based on crop and area specific.

For grains:

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

For horticultural crops:

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

2.A Existing processing facilities: Food proccessing units of Deptt of Horticulture. Units of some NGOs

2.B Processing facilities to be advised/ setup for doubling income in the agro-ecological region of district:

Fruits –juice,squaes, candy, jam, finger millets,Soybean-flour, Soybean -tofu& soya chunk preparation , millets-biscuits

For grains:

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity

For horticultural crops:

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

3.A Existing packing facilities: Few farmers

3.B Packing facilities to be advised/ setup for doubling income in the agro-ecological region of district:

Fruit –juice,squaes, candy, jam, finger millets,Soybean-flour, Soybean –tofu & soya chunk preparation , millets-biscuits

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity
3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)
4. IRRI bags for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables
3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed
8. Litchi peeling and shredding unit

4.A Existing storage facilities: At present no storage facilities are available in the distt.

4.B Storage facilities to be advised/ setup for doubling income in the agro-ecological region of district: A Cold storage for hill potato is required.

For grain:

1. Multipurpose (small to medium size) warehouse with mechanical drying and fumigation facility
2. Drying cum storage silo
3. Modified atmosphere and Hermetic storage structure
4. Kothar, metal bins for small capacity

For Horticultural crop:

1. Air/water pre-cooling chambers on farm level for removal of field heat
2. Evaporative cool chamber for chilling sensitive crops
3. Modified or control atmospheric storage structures
4. Cold storage structures
5. Zero energy cool chamber for hilly areas
6. Solar power cooling chambers
7. Jaggery storage bin

F. Waste land development and waste water

1.A Existing practices of soil water conservation: Using indegeneous technology use for water conservation include formations of bund, growing of Napier and other parennial grasses, multiple forest species as per need are requirement.

1.B Package of practices to be advised/ developed for management of wasteland and wastewater in the agro-ecological region of district:

1. Storage of wastewater by using low cost water harvesting technology as *kuchha* and *Pucca* tank. Polytank cane be constructed as (5x3x2m) capacity to meet the lean season demand of seasonal vegetables and for non agricultural use also.
2. In wasteland, a wide scope of fodder plantation of Morus, Chhanchru, Melilotus sp can be utilized. In dry and unirrigated situation there is scope of bael, amla can be included. There is need to put fodder trees and grasses in wasteland.

2.A Existing plantation: Tun, shirish, Bheemal, Kachnar, Kharik, shisham in low and mid hills Utis, banj,chhanchru, leucinia, Mulberry.

2.B Plantation suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:

1. Morus, Shirish, Kharik, Utis,Oak, Bheemal,Kachnar, Vilyati khair etc are useful as dual purpose species to meet fodder, firewoodr and other requiremnt of the farmes. Sufficient plants are avaialble at forest nurseries for planations.
2. Stabilization of eroded land using biological/engineering measures;
3. Plantation of suitable trees/brushes in waterlogged and eroded areas;
4. All agricultural operations should be done on contours i.e. across the existing land slope.
5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway)

should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.

7. Diversion of runoff through ditches from upper slopes to safer places.
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
10. Contour trenching (staggered/continuous).
11. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
12. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
13. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
14. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

3.A Existing fodder production: Crop stobbers, wild grasses, Forest leaves etc.

3.B Fodder suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:

Napier grass
Kikyui grass
Dinnanath Grass

Waste Water Management

1. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
2. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
3. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
4. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

4.A Type of waste water:

1. Effluent from kitchen and bathroom
2. Effluent from industries;
3. Sewage water from cities being discharged into surface and groundwater resources

4.B Existing treatment facilities: NA

4.CTreatment facilities to be advised/ developed for waste water treatment and utilization in the agro-ecological region of district:

1. Multistage filteration unit should be established to recycle the waste water for multiple use.
2. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
3. Industrial wastewater should not be used for irrigation directly; and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.
4. Sewage water from cities should be treated by municipal corporations or other agencies.

G. Reduced cultivation cost

1.A Existing inputs being given:

1. Traditional and unprocessed inputs are used in agricultural practices. Drudgery prone implements/tools are in practice for various operations.
2. Chemical Fertilizers, Insecticides, Pesticides, Farm Yard Manure, Seed, Water and Tillage Implements

1.B Soil test based inputs to be suggested in the specific agro-ecological region of district:

Application of nutrients based on soil test basis as major and micro elements.

1. Encourage use of well decomposed organic manures and biofertilizers; avoid excessive use of chemical fertilizers.
2. Reduce the dose of chemical fertilizers and avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
3. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
4. Need based application of insecticides and pesticides, preferably enhanced the use of bio-agents; avoid the use of costly chemicals.
5. Follow line sowing of seed instead of broadcasting.
6. Encourage water harvest technology for irrigation.
7. Sprinkler and drip method for irrigation should be encouraged to improve water use efficiency.
8. Use of mulches and available composts/organic manures
9. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
10. Promote reduced tillage operations.

2.A Existing mechanization:

Limited use of power driven implements in land preparation. Small tools like sickle, handhoe etc are being adopted by progressive farmers.

2.B Mechanization required for reducing cost of cultivation in the specific agro-ecological region of district:

Power tiller, power weeder, shrub cutter, Multiple crops threshers are becoming popular and are available in pockets. Old wooden based impelents are being replaced with iron/alloy (Plough, danalla,) based tools are available.

3.A Existing collective inputs: Community pasture land, Service bulls, Irrigation channel and source, Irrigation tanks, Chemical Fertilizers, Insecticides, Pesticides, Farm Yard Manure, Seed, Water and Tillage Implements

3.B Collective inputs suggested for reducing cost of cultivation in the specific agro-ecological region of district:

1. Custom hiring energy based implements viz. Small tractor, tiller, Power spryers, Mandua thresher, Hydrum irrigation can reduce the cost of cultivation along with reduction of farm labour.
2. Encourage use of well decomposed organic manures and biofertilizers; avoid excessive use of chemical fertilizers.
3. Reduce the dose of chemical fertilizers and avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
4. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
5. Need based application of insecticides and pesticides, preferably enhanced the use of bio-agents; avoid the use of costly chemicals.
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10. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
11. Promote reduced tillage operations.

Factors responsible for increasing cost of cultivation in the specific agro-ecological region of district:

Irrigated valleys and lower hills

1. Represent subtropical climate with moderating high temperature (18-30 ^{0}C) medium rainfall,

low humidity (40-50%) and experiences no snowfall. 80% of total precipitation is received during June to September.

2. Sal in outer Himalayas and pine and oak in middle and inner Himalayas are the predominant vegetation. Soils are alluvial sandy loam to loam.

Factors responsible for increasing cost of cultivation

1. Heterogeneous soils, soils of each situation differ widely in their physical, physico-chemical characteristics as they are developed from a variety of rocks and minerals under joint influence of vegetation, physiography and climate.
2. Sloping lands with high rate of removal of soil and nutrients from surface through erosion resulting to depletion of soil fertility.
3. Scattered holding and marginal land size.
4. 90 % of areas of mid and high hills are rainfed.
5. High rates of migration from hills to plains of males and young boys in search of jobs.
6. Women based farming system without technical knowledge – how and inputs.
7. Low efficiency of conventional farm tools and implement.
8. Indigenous breed of livestock with low production and working efficiency.
9. Poor quality of FYM. The method of preparation and application of FYM are defective generally heaped in an open area resulting into loss of nutrients.
10. Mostly soils are slightly to strongly acidic in nature depending upon elevation, vegetation and development of soil from rocks and minerals causing nutrient imbalance in soil and impose hidden nutrient toxicity and deficiency symptoms in crops retard growth and yield.
11. Minimum use of fertilizers: farmers are mostly small and marginal economically backward, not able to apply recommended doses of fertilizers. The average consumption is < 10 kg N:P:K ha-1.
12. Non availability of quality seeds of varieties recommended for rainfed upland situations.
13. The inputs are costly and therefore, the small and marginal farmers are not able to adopt the improved technology.
14. Non availability of inputs at right time and right place.
15. Sowing of crops is at the mercy of rains which are erratic. Thus planting is delayed and not done on suitable time. Sowing are done more than once either because of insufficient moisture mostly in rabi crops or due to crust formation in kharif.
16. Farmers follow practice of dry sowing. In such situation the seeds are eaten by birds and grubs resulting in inadequate plant population.
17. Due to limited moisture and nutrient supply the growth of crops is not proper and vegetative phase of growth (flowering and fruiting) are advanced.
18. Improper seed bed preparation: in order to utilize moisture, the farmers do not wait for fine preparation of fields and rush for sowing. This results in improper germination and infestation of weeds.
19. Severe infestation of insect-pest: white grubs and cut worms are the serious polyphagous pests, kill plants and reduce plant population up to 70-80 %. Due to non availability of suitable plant protection chemicals as well as high cost they are beyond the means of farmers. Besides, non availability of water for solution also pose problems.
20. Weeds; common weeds of the upland rainfed areas are Tipatiya (Oxalis latifolia), Pardeshi(Galensojaparviflora), Gajar grass (Parthenium Sp.)Kuni(Lantena camera) Kala bansa (Eupatorium sp.).The loss in general in food crops is high from 50-75 %.
21. Improper terrace management: most of terraces developed by farmers are on steep slopes with outward gradient.
22. Lack of proper drainage system for safe disposal of excess rainwater. The heavy runoff of water washes away the top fertile soil lead to steady depletion of nutrients and organic matter.
23. Coarse textured soils (charty/gravely) with low moisture and nutrient retention capacity.

24. Lack of proper storage facilities for crops (cold storage).
25. Lack of awareness for protected cultivation techniques and facilities for commercial high value crops (poly houses, poly tunnels, poly for raising nursery and cash crops.
26. No good marketing facilities.
27. Lack of proper irrigation facilities for minor irrigation and drip irrigation with fertigation.
28. Poor connectivity of road transport system.
29. Lack of farmer's participatory approach models for crop production technologies under hill agricultural system for the state. No storage facilities for perishable product
30. No chilling plant for milk

H. off-farm income

1.A Existing SHGS operative in specific agro-ecological region of district:

HIMANI, ATMA, CHIRAG, AAJIVIKA, NABARD, Tripura Sundri Utpadak group,Nidhi svuyam sahata group

1.B SHGS to be created/ encouraged in the specific agro-ecological region of district for doubling agricultural income:

Vegetable collection and procurement group
Vegetable and fruits processing groups
Gola Nashpati group
Malta collection and procurement group
Cheura collection and extraction group
Milk collection and chilling group
Goat production group

1. There is need to have regular monitoring and follow up of SHG's by the forming agencies and time to time evaluation of the group.
2. Regular monitoring by the concerned agency must be ensured like ensuring regular meeting of the SHG, checking their register, regular collection of the money, help during conflicts, solving problems occurring during banking etc. and submitting the monitoring report to their concerned officials so that steps can be taken by the high officials to ensure regular continuity of the SHG.
3. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
4. A large number of groups discontinued as they were not having knowledge regarding income generating activities that can be started (what activities can be taken up, how to operate it, where to market the produce etc.) So there is need of encouragement, motivation along with imparting knowledge, skills and linking them to market.
5. Trainings should be provided to the rural women on income generating activities as per the need of rural women, marketing potential and availability of locally available resources.
6. Loan procedure should be made more flexible with less interest rate.
7. As there were problems like non-cooperation among members, confusion regarding money matter, lack of confidence on office bearers with respect to group money etc., there is need of organizing training on good governance, democratic election and how to solve financial and administrative issues.
8. SHG's formed should be grouped into clusters, federations and registered cooperatives so as to converge with govt. schemes, facilitate collective purchase of input and marketing of products.
9. To encourage people to form and sustain SHG's so that new enterprise developed, intensive work needs to be done with them in sustainable manner.
10. Enterprises need to be identified depending upon local resources- human and material.
11. Market linkages need to be developed so that people can sell their produce gainfully.

1.C Problems related with SHG:

1. Not interested in continuing the group
2. Non-cooperation among the members

3. Problem in getting loan
4. Lack of resources like money, space
5. Lack of knowledge regarding various income generating activities,
6. Lack of trainings
7. Lack of follow-up and monitoring from the forming agencies.
8. In hills farm holdings are very small and large part is rainfed depending upon rains with very low and uncertain productivity.
9. Young people do not stay in villages and move to other areas or take up other profession such as tourism, transport, hospitality etc.
10. People remaining in villages are not very enterprising.
11. It is seen in the survey that all individuals who took loan increase their livestock only that is their traditional work and did not start any other enterprises.

2.A Existing Micro-entrepreneur employment:

Five groups are working for collection of small fruits for juice preparation

Dairy, aipan designing, handloom weaving, candle making

2.B Micro-entrepreneur employment to be generated in the specific agro-ecological region of district for doubling agricultural income:

1. Improved hill agriculture implements
2. Kumaoni and local food products for tourism
3. Mushroom production and processing units
4. Honey and honey products unit
5. Milk and milk products shops
6. Survey need to be conducted regarding locally available crops, fruits, vegetables and other things. On the basis of these enterprise can be generated. Aipan designing can be promoted in cloth, paper in the form of greeting cards, envelops, calenders etc. That has market value at national and international level.

3.A Existing skill development facilities: Extension training institute

3.B Skill development facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Mushroom production and training facilities
2. Development of advanced horticultural handling units
3. Fish ponds
4. Dairy/Poultry/ gottary units
5. Value addition and food chain centre
6. Storage, grading and Packaging centre
7. Silk worm based skill development units
8. Bioagant and biofertilizers production lab
9. Tissue culture lab for massive production of elite planting material
10. Medicinal plant growing and processing units
11. Development of rosary and extraction units
12. Training centre, processing and packaging units as per the locally available resources

4.A Existing women skilling facilities: NA

4.B Women skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Khadi and Kargha training for women skill
2. Drugery reduction practices for high efficiency
3. Herbal dye based skill training and skill for local textiles.
4. Value addition skill for women
5. Training centre, processing and packaging units as per the locally available resources

5.A Existing youth skilling facilities: Extension training institute

5.B Youth skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Nursery, Mechanic, Mushroom, Beekeeping, Dairy, Fodder production, Preservation/Value addition
2. Training centres processing, packaging units and market outlet as per the locally available resources

Beekeeping

Beekeeping is an environment friendly and agro-forestry based occupation. It provides enormous potential for income generation, poverty alleviation and sustainable use of forest resources. Beekeeping is one of the oldest traditions in India for collecting the honey. Honey bee farming is becoming popular due its demand in national and international markets as well. *Apis cerana indica* is the indigenous bee, is known to be the ideal pollinator for organically grown mountain crops due to its capacity to significantly enhance agricultural productivity. India has a potential to keep about 120 million bee colonies that can provide self-employment to over 6 million rural and tribal families. In terms of production, these bee colonies can produce over 1.2 million tons of honey and about 15,000 tons of beeswax.

Less Investment: Bee Farming is not a manufacturing activity, as such costly machine and tools are not required. There is nothing like production capacity as well. Only small wooden frames with boxes are needed. Their sizes are also standardized. To begin with around 15 such sets/boxes can be purchased or assembled at rate of Rs.1500.00 per box that would cost Rs.22, 500/- for 15 Boxes. Honey extractors would cost to the tune of Rs.5, 000/- each with filtration facilities. For other miscellaneous expenditures including training and consultancy services a sum of Rs.5000.00 can be earmarked. That means total of Rs.32, 000.00 would be required to start Bee Farming with 15 Boxes which is equivalent or less than the cost of cultivation of one acre of paddy field.

More Returns: As per the established norms, each box comprises 7-8 hives which is able to harvest around 30-35 kg of honey in a year. The annual harvest of honey starting with 15 bee boxes could be 450-525 kg depending on the flowering season. Even after considering very conservative selling price of Rs. 150/- per kg; the annual realisation would be to the tune of Rs. 67,500/- to Rs.78,750/-. Therefore, Bee Farming can be considered as an excellent, profitable agro-based green enterprise for landless farmers and entrepreneurs.

Beekeeping in Uttarakhand: Beekeeping has been an integral part of human society since centuries in hill regions of Uttarakhand state. The state of Uttarakhand has a predominantly agrarian economy and large number of small and marginal farmers in the mountainous state call for augmenting agricultural production by organic means. The indigenous bee sub-species *Apis cerana indica* commonly is ideal pollinator for organically grown mountain crops, with the capacity to significantly enhance agricultural productivity with an indirect but vital role in combating soil degradation by pollinating wild plants thereby enabling improved regeneration of bio mass, to be returned to the soil. Beekeeping with *Apis cerana indica F*. is a common practice in hills of Garhwal and Kumoun Himalaya which is carried out mostly by using traditional methods since long past and is stationary in nature. In these regions, beekeeping is also carried out with *Apis mellifera,* but in winter season, due to temperature lower than 20ºC, colonies are being migrated to plains. According to report given by KVK Jeolikot(2017), in Uttarakhand, there are about 4,790 beekeepers with 45,247 number of *A. cerana indica* colonies yielding 546.70 mt of honey production. Whereas, in Almora region of Uttarakhand, there are about 400 beekeepers with 1,165 number of *A. cerana indica* colonies yielding 16.4 mt of honey production. The Uttarakhand state has extremely rich bee forage plants. In most of the remote areas where *Apis cerana indica* beekeeping is common, the use of pesticides and chemicals is negligible, the level of dangerous chemicals in the atmosphere is insignificant and the environmental pollution is at minimal level. Honey produced from such areas is purely natural, free of any residues and can be sold as an organic product. There is vast potential for beekeeping in the country. However, due to

lack of knowledge, scientific beekeeping is not being practiced by, most of the beekeepers. It is necessary for beekeepers to participate in the trainings / other capacity building programmes on the subject to gain scientific knowledge on the subject. Selection of good apiary site, good quality bees and proper management are the main keys for success of beekeeping. Following are the important points to start beekeeping and further management practices.

1. Selection of good apiary site: Select apiary site by considering the following:

1. Apiary ground should be clean & free from dry leaves etc. to avoid fire during summer
2. Apiary site should be away from power station, brick kilns, highway and train tracks
3. Site should be open & at dry place having shade
4. Site should be easily accessible by road
5. Fresh running water should be easily available near the apiary
6. It should have natural / artificial wind breaks
7. Site should receive early morning and afternoon sunshine
8. There should not be other commercial apiary within 2-3 kilometers from the apiary site
9. There should not be any source of stagnant / dirty water, chemical industry/ sugar mill, etc., nearby the apiary
10. Area should be rich in bee flora

2. Selection of good quality bees: Beekeeping depends on floral resources, climatic conditions, management and also quality of bees, particularly queen. Therefore, the following should be kept in mind to select the bee colonies:

1. Buy disease free bee colonies from existing reputed beekeepers after getting training on the subject.
2. Select and multiply honey bee colonies only from disease resistant, high honey yielding, young, healthy and high egg laying capacity queen, less swarming tendency etc.
3. Keep colonies with good prolific queens
4. Capture few bee colonies from their natural abodes in forests which may be used for further breeding/ multiplication to prevent inbreeding.

3. Management of apiary:

A. Placement of colonies in apiary

1. Hives should be as per specification of BIS/ISI and should be of locally available seasoned light weight wood. Unseasoned and heavy wood should be avoided
2. Avoid nailing the bottom board with the brood chamber
3. Restrict number of bee colonies in a apiary from 50-100
4. Keep row to row and box to box distance as10 and 3 feet, respectively

Hives used for traditional beekeeping in hilly areas are

Wall hives: Wall hives locally known as 'Khadra', 'Jaala' or 'Jalota' are rectangular structures made in the walls of houses and 'Chhaan' or 'Sunni' (cattle sheds) at the time of construction. Each hive has a small round or rectangular opening on the outer side as an entrance for bees. The size of 'Jalotas' varies in different locations; usually they are 45-60 cm in length, 25-30 cm in width and 20-30 cm in height . Generally one hive is made in each wall, but numbers may vary from 2-4. The interiors of hives are smoothed with cow dung and clay. In winters due to lack of floral resources and extreme cold in the hills, the population of *Apis cerana* colonies decreases to a great extent. Thick wall hives provide considerable insulation in such conditions.

Log hives: Two types of log hives are found, Type I: These are made up of cylindrical hollowed pieces of tree trunk 60-100cm long and 20-40 cm in diameter; however size depends upon the circumference of available trunks. This type of log hives is usually made from the trunk of *Quercus leucotrichophora, Q. floribunda, Rhododendron arboreum and Pinus roxburbhii.* The entrance is made at the mid front side. Both sides are plastered with a mixture of cow dung and clay. Type II: Old cooperages locally known as 'Pariya' or 'Dokha' when rendered useless for milk products, are used as hives. These are about 70-90 cm long with the diameter at top from 25-35 cm and thickness

of log 3-5cm. An entrance is made towards the outside and the hive is placed horizontally on a raised platform of stones or the wall of a courtyard. It is mainly made up of the wood of *Ougeinia oogeinesis, Rhododendron arboreum, Toona* spp. A stripe of old comb is fixed to the upper part, inside the hive, and is plugged with a wooden or metal cover, then sealed with a mixture of clay and cow dung. The wooden lid is fixed at the top with an entrance on it.

Miscellaneous Types: These are rectangular box hives made up of separate wooden boards with movable top cover . Their size varies in different localities. Usually these are 80-110 cm long, 25-30 cm wide and 40-50 cm high. During extraction, the top cover is removed along with attached combs and bees, and taken away from the hive, then each comb is smoked and shaken gently. Bees return to the hive and beekeepers cut combs easily.

All hives are made from locally available materials, thus are economically cheaper and environmentally friendly. These hives have thicker walls as compared to modern hives thus provide protection to bees from extremely low and high temperatures. In higher hills traditional hives are more suitable than modern hives but for the drawback in colony management.

B. Inspection of colonies

1. Adopt general colony and personal hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board, top cover, etc. frequently
2. Check the colonies periodically for any abnormalities or changes in behaviour of bees
3. Inspect colonies on clear sunny days preferably at temperatures between 20 and 30°C
4. Do not inspect colonies in cold, windy and cloudy days
5. Use smoker when needed to subdue the bees
6. Use protective dress and veil while inspecting colonies
7. Handle colonies gently, avoid jerks
8. Avoid crushing bees as it could lead to stinging
9. Isolate the diseased colonies from healthy ones.
10. Handle diseased and healthy colonies separately

C. Provision of fresh water in the apiary

Ensure availability of fresh water preferably in shallow containers near the apiary to maintain a healthy apiary. Water is needed for the following

1. Maintenance of adequate humidity in a colony to ensure proper incubation of eggs
2. For feeding bee bread by nurse bees, the mixture of honey and pollen of certain consistency is required for which water is needed
3. When temperature in the apiary increases beyond 37°C, water is used by bees to evaporate and cool the colony

D. Dearth period management

1. Provide 50% sugar syrup to the colonies during dearth periods when honey stores in the colonies is not adequate and nectar is not available in the area. The syrup should be prepared by boiling clean water in the vessel and sugar added with slow stirring for few minutes. Cover the vessel with lid and let it cool. Feed cooled syrup.
2. Sugar syrup should be kept in such a way that the bees should not drown in it. This should be ensured by using shallow vessels with straw to facilitate easy feeding
3. Do not prepare the feed in open in the apiary and avoid dripping on the ground to prevent robbing by bees and ants
4. Feed the colonies in the evening preferably after sunset
5. Feeding should be given to all colonies in the apiary at one time
6. Pollen substitute comprising of fat free soyabean flour (3 parts) + Brewer's yeast (1 part) + skimmed milk powder (1 part) + sugar (22 parts) +honey (50 parts) made in the form of patties should be provided when pollen stores in the colonies is not adequate and pollen is not available in the area
7. Provide fresh water near the colony in shallow vessels

8. Extra frames should be stored in air tight chambers and fumigated with sulphur powder regularly
9. Old and dark combs should be discarded

E. Care during honey extraction

1. Use honey extractor, containers and other bee hive tools /equipments made of stainless steel / food grade plastic. Don't use tins & containers made of other degraded material
2. Wash all the equipments / containers etc. thoroughly with warm water before honey extraction
3. Extract honey from super chambers only
4. Select frames only with 75% sealed cells with ripened honey for extraction
5. Cover the entrance gate of the colony with small branches or twigs to avoid robbing
6. Extract honey in a closed room and not in the open to avoid robbing
7. Do not leave super and brood frames, after extraction of honey open in the apiary;
8. Do not spill honey in the apiary

F. Care during migration

1. Migrate colonies during non-availability of flora to areas with abundant flora.
2. Before migration survey the area to assess the availability of the flora to locate the colonies
3. Ensure honey extraction before migration
4. Close the entrance gates of the colonies in the evening after all worker bees are inside the colony
5. Pack the colonies internally and externally before migration to avoid jerking
6. Colonies in the vehicle should be packed in such a way that the entrance side should face the front side of the vehicle
7. Start migration late in the evening and ensure the colonies reach the destination within 10-12 hrs. the next day morning and entrance gates are opened after landing in the new location
8. Avoid jerking in the way while transporting bee colonies

G. Seasonal management of apiary

a**) Summer Management**

1. Keep the colonies in thick shade
2. Regulate the microclimate of the apiary by using wet gunny bags over top cover and sprinkling water around the colonies in the apiary during noon hours.
3. Provide fresh water in/near the apiary

b) Monsoon management

1. Clean and bury deep the debris lying on the bottom board
2. Keep the surroundings of the colony clean by cutting the unwanted vegetation which may hamper free circulation of the air
3. Provide artificial feeding (sugar syrup and/or pollen substitute) as per requirement of the colony
4. Check the robbing within the apiary
5. Unite weak/laying worker colonies
6. Control predatory wasps, ants, frogs, lizards in the apiary

c) Post monsoon season management

1. Provide sufficient space in the colony
2. Strengthen the colonies to stimulate drone brood rearing
3. Control ectoparasitic mites, wax moth and predatory wasps

(d) Winter management

1. Examine the colonies and provide winter packings in weak colonies specially in hilly areas
2. Feed sugar/pollen substitute to weak colonies as stimulative feeding to provide energy and initiate brood rearing
3. Shift the colonies to sunny places
4. Protect the colonies from chilly winds by using wind breaks

5. Unite the weak colonies with stronger ones

e) Spring management

1. Unpack the colonies, clean the bottom board, replace the worn out hive parts and provide sufficient space
2. Provide stimulative sugar/pollen substitute to increase brood rearing
3. Equalise the colonies
4. Extra frames should be raised by providing comb foundation sheets
5. Replace the old queens with new ones through mass queen rearing or divide the colonies
6. Manage the colonies in such a way to prevent swarming
7. Monitor regularly for ectoparasitic mites and adopt control measures

H. Protecting colonies from pesticides

1. Persuade the farmers not to use pesticides or use selective pesticides that are less harmful to bees at recommended concentrations
2. Avoid the use of dust formulations as they are more harmful to bees than spray formulations
3. Prior information about spraying would help in reducing poisoning of bees
4. Avoiding spraying of pesticides during flowering of the crop and peak foraging time of the bees would help in reduction in the mortality of foraging bees
5. Spraying may be done in the evening after sun set when bees do not forage
6. Colonies may be temporarily shifted if heavy spraying schedule is fixed
7. If shifting of the colonies is not possible, feed with 200 ml sugar syrup and close the gate by using wire screen for the day of spraying.

I.Methods of attracting and catching swarms

1. Swarming is a natural process for propagation of honey bees. Swarms are the lone source of bees in traditional beekeeping of *Apis cerana* while only a few empty hives are inhabited by absconded or feral colonies.
2. Empty hives are cleaned and smeared with clay, cow dung or both. Honey or jaggery are put inside hive to be used as bait to attract the swarm.
3. Flowering shoots of *Brassica campestris, or Raphanus sativus* can also be used just above the hive entrance, hoping that scout bees will find their home in the empty hive.
4. When swarms is found in the vicinity, water can be sprinkled and soil or ash can be thrown to settle them. 'Tofri' or 'Garori' (special baskets) made up of 'Ringal' (bamboos); 'Jhola' (bag) can be used to catch and carry swarms. 'Kutrine' (burning cotton cloth) is used as a traditional smoker and 'Talikh' (a cloth) to save faces while catching the swarm.
5. To catch a swarm layer of jaggery or honey is applied at the inner base of the basket and hang it inverted near the settled cluster. The cluster is gently displaced from the other side with smoke to direct the bees towards the basket. As the swarm makes a cluster on the basket, it is transferred to the hive. When the bees are settled the basket is removed. Finally the hive is closed with its wooden cover and be smeared with a mixture of cow dung and clay.

J. Management of Honey Bee Diseases and pest

Honey bees could be affected by diseases and the real cause of abnormality or any disease present in the honey bee broods need to be ascertained before taking up any control measures. It is best to contact the researchers/scientists/beekeeping experts at the nearest centre or university or Government department working on honey bees. After the exact diagnosis of the causal agent of the particular disease, the guidelines/ recommendations given by the expert should be followed in true letter and spirit. However, general advisory for the management of common diseases of honey bees is given below:

1. Select good site to locate the apiary preferably in an open, dry place with shade.
2. Adopt general colony hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board frequently.
3. Select and multiply honey bee colonies only from disease resistant stocks.

4. Keep colonies with good prolific queens.
5. Create broodlessness in colony for at least 15 days by enclosing the queen in a queen cage.
6. Check the colonies periodically for any abnormalities or changes in behaviour of bees.
7. If you observe any colonies with disease, isolate them from healthy ones. Handle diseased and healthy colonies separately.
8. Keep the colonies strong by adding sealed brood comb or worker population only from healthy colonies and also by providing adequate food during dearth periods.
9. Prevent robbing, drifting, absconding and avoid migration of bee colonies when you notice disease symptoms.
10. Follow 'Shook Swarm' or shaking method to remove contaminated combs completely by transferring entirely new combs in one operation to the colonies with disease symptoms. Destroy the removed combs by burning.
11. Sterilise the combs and equipments by any one of the following methods:

a. Disinfect the empty combs and equipments with 80 per cent acetic acid @ 150 ml per hive body in piles for few days at a protected place. Air the treated materials before use.
b. Dip the contaminated equipments and combs in soap solution containing 7 per cent formalin for 24 hours. Then wash the treated material with water, dry and use.

12. Use of antibiotics to control honey bee diseases is likely to result in contamination of honey causing problems in export of honey.
13. The traditional method to check the entry of ants is spreading ash or turmeric powder in
14. their way.

K. Honey Extraction

The main honey seasons in hilly areas are '*Chait*' (April), '*Baisakh*' (May) and '*Ashaad*' (July-August). In some localities, an additional extraction during '*Kartik*' (October) is also done. Colonies yield most honey in '*Chait*'-'*Baisakh*' and the least in '*Kartik*'. Traditional tools used are '*Dathule*'. (sickle) to open the cover or wooden plug and '*Buwan*' (traditional brush) made up of '*Babul*' (*Eriophorum comosum*) to brush off bees. Besides these traditional smokers, large pans for keeping combs, a pot with water and '*Parunla*' or knife for cutting '*Faur*' or '*Fwar*' (bee combs) are required at the time of harvest. Honey is mostly extracted at night but a few beekeepers do it in day time also. Combs are cut down, leaving the innermost comb for feeding and to attract swarms the next year. Honey combs are squeezed after removing the brood area from the cut combs. The harvested honey has many impurities like insect body parts, wax cells, etc. Usually, squeezed combs are thrown away after extraction, which can be fed to cattle especially bulls. Honey is stored in plastic or metal containers and in bottles.

The beekeepers doing beekeeping with modern hives should use honey extractors to harvest honey. The quality of honey extracted using honey extracting machine is much better than squeezing method.

I. Enabling Policies

1.A Existing policies related with agriculture and animal husbandry:

Subsidies and incentives are given on all agricultural inputs. 50 to 90% subsidies are granted on all inputs and implements.

1.B Policies to be suggested for doubling income in the specific agro-ecological region:

1. Section of crop and area specific crop production program
2. Timely and assured supply of agricutural inputs to farmers at door.
3. Popularization of polyhouse technogy for vegetables and flower production
4. Inclusion of hybrid seed programe for crop production.
5. Establishment of seed production units for temperate crops.
6. Need to establish more food processing unts.
7. Availabilities of credit at minimum rate.
8. Assured byback policy for agricultural produce.

2.A Existing Institutions: ICAR Institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK, NGOs

2.B Institutions to be suggested for doubling income in the specific agro-ecological region of district:

1. Establishment of food proceesing units at distt level to procure and marketing of surplus.
2. Need to develop or establish animal breeding/Grading up program
3. Testing of new crops in nontraditional areas for doubling the crop production.

3.A Existing Incentives:

3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district:

1. An assured bonus to farmers to grow new crop or higher production potental
2. Selection of farmers at village for trendsetter for dessimination of technical knowlwdege and technolgy may be awarded
3. Free access to libraray and one institute at least once in a year.

4.A Existing risk coverage facilities: Crop and Animal Insurance Schemes

4.B Risk coverage facilities to be suggested for doubling income in the specific agro-ecological region:

1. Risk coverage may be applicable for all agricultural products and animals
2. Declaration and minimum support price be fixed well in time

J. Marketing and value addition in specific agro-ecological region

1.A Existing marketing facilities: No organized procurement agency/mandi

1.B Marketing facilities to be suggested for doubling income in the specific agro-ecological region:

1. Contractual farming,
2. Linkages with MNCs and NCs,
3. Mahila hat, local hat, weekly bazaar and local mandi,
4. AC van,
5. Online portal for sale

2.A Existing grading facilities: Nil

2.B Grading facilities to be suggested for doubling income in the specific agro-ecological region:

For grains:

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

For horticultural crops:

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

2.C Processing facilities to be created for better marketing and value addition in the district:

Modern and cost effective Grading and packaging facilities, small scale fruit and vegetable processing units

For grains:

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity

6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity
10. Sugarcane crusher, open pan evaporator, moulds for jaggery, packaging unit at village level

For horticultural crops:

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

2.D Packing facilities to be created for better marketing and value addition in the district : Packing facilities for packing of processed food item like tetra pack. can packing. Ecofriendly packing material for small and big quantities etc are required.

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity
3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)
4. IRRI bags for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables
3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed
8. Litchi peeling and shredding unit

3. Existing marketing and value addition problems in the specific agro-ecological region: No marketing facility, No value addition facility, High transportation cost

K. Online Management and Evaluation

1.A: Existing online management structure available: Internet etc.

1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district: Each village should be connected by Internet facility with proper device, awareness about internet user.

2.A: Existing evaluation procedure: Manual

2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district: Internet , GPS, Email, Whatup, ITC tools

3.A: Existing monitoring system: Physical and through regular visits at village level

3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district: Regular visits and online report submission, farmer's feed back ,pre and post evaluation system should be there

4.A: Existing feedback system: Manually, group meeting gosthis

4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district: Internet portal and proper software for evaluating ongoing activities

5.A: Existing reading system: Literature, Booklets, Hindi Extension Journals etc

5.B: Reading system required for online management and evaluation in specific agro-climatic region of district: Farm advisery portal, online helpdesk services, mobile advisory

Specific action plan for doubling agricultural income in agro-ecological region

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties for increasing productivity

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS-490, HS-507, HPW-349, UP 2572),
2. Paddy

a. Irrigated Rice (VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85)*

b. Rainfed- Chatki Dhan-VL Dhan 206, 207,208

c. Jethi dhan – Vivek Dhan 154, VL Dhan 157, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355 plus,); in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.

3. Promotion of high yielding varieties of corn (Vivek QPM 9, Vivek Maize Hybrid 45, Vivek Maize Hybrid 53,CMVL Sweet Corn 1, CMVL Baby Corn 2)
4. Promotion of high yielding varieties of finger millets (VL Mandua 324, and VL Mandua 352) and Barnyard millet (PRJ-1,VL *Madira* 172 and VL *Madira* 207) in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.
5. Promotion of high yielding variety of lentil (PL-4, PL-7, PL-8, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL *Masoor 514*), horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19), soybean (VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65, PS-1092 , PS 1042, PS 1092) and Pigeon pea (Pant Arhar-291, VL Arhar 1, Pant Arhar-3) in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.
6. Promotion of high yielding varieties of vegetable pea (Vivek Matar 10, and Vivek Matar 12, Pusa Pragati, Round seeded varieties, Pant Sabji Matar 3, Azad Pea 3, Pea 89), Capsicum (VL Shimla Mirch 3, California wonder, Bull nose, Arka mohini, Arka Gaurav, Indira, Bharat, Pusa Dipti), Cabbage (T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole Green star, Pride of India), tomato (Himsona, Naveen 2000, Avinash 2, NP 7730, VL Tamatar 4), Onion (Agri found light red, Agri found dark red, Pusa red, Pusa ratnar, VL Piaz 3) in Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat blocks.
7. Promotion of high yielding varieties of Citrus (Malta : Blood red, Valencia; Kinnow; Lemon & lime: Pant lemon 1, Kagzi lime, Orange), Peach (Alxander, Red Globe, Crest heaven, Glo Heaven etc Nectarine- Snow Queen), Pear (Max Bartlette, Red Bartlette, Willium, Starkrimson, Hokoi, Sukoi (Low Hills),Plum (Italian plum, Prunes viz Frontier), Mango (Dashahari, Langra, Bombay, Amrapali), Litchi (Rose scented, calcuttia, Early bedana, muzzafarpur shahi, swarnaroopa, dehra rose) in Bin, Munakot, Kanalicheena, Dharchula, Didihat, Barinag and Gangolihaat blocks.
8. Promotion of high yielding variety of fodder crop berseem (BL-10, UPB-10), Oat (JHO-851, UPO-94, OS-6), Fodder maize (Ganga-2, Ganga-5, QPM) in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Barinag and Gangolihaat* blocks.

Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Strengthening of existing Hydrum system of irrigation in *Kanalichhinna, Bin, Dharchula and Munakot*.
2. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
3. Creation of rain water harvesting structure in private as well as government buildings in all

blocks.

4. Creation of trenches for high percolation of water in most of the area of *Kanalichhinna, Didihat, Munakot and Dharchula* blocks.
5. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in low or valley areas of all the blocks of this region.

Adoption of cluster approach for holistic development

1. Rejuvenation of existing orchards of Litchi, Mango, Pear, Peach and Plum in Munsyari, Didihat, Kannalichinna, Bin, Munakot and Dharchula.
2. Promotion of onion, potato and garlic cultivation in all *blocks of the region*.
3. Promotion of off season vegetables (tomato, capsicum, cole crops etc.,) cultivation in *all blocks*.
4. Promotion of production of vegetable pea, in Bin, Munakot and *Kannalichhina* block.
5. Promotion of production of pigeon pea and hybrid rice in *Kannalichhinna, Dharchula, Bin and Munakot* block.
6. Promotion of production of Urd, Mung and lentil in Kannalichhinna, Dharchula, Bin and Munakot block.
7. Promotion of organic production of basmati rice in Munakot, Bin and Kannalichinna.

Management of wild animal problem

1. Promotion of live fencing of Jatropha, Cheura, lime/ lemon at larger scale in fruit crops, ginger or turmeric in shady areas, Lemon grass to ward off wildlife in cultivated field.
2. Enacting legislative measures for protection of crop from wild animals.
3. Promotion of protected cultivation of vegetables (Tomato, Capsicum, Cabbage, Cauliflower and Cucumber) in *all blocks*.
4. Promotion of cultivation of Kilmaru, Ber, wild Aonla, Kafal, Hishalu and other wild fruits in different pockets in forest areas for wild animals.

Adoption of Farm mechanisation (Power tiller, thresher etc)

1. Popularization of multi crop thresher and Power Weeder at Nyay Panchayat level in all the blocks.
2. Promotion of improved Naveen sickle, Dung collector, maize sheller, Vivek Millet thresher cum pearler, VL Paddy thresher and Vivek small tool kit for reduction in drudgery of hill farmers.

Management of soil health in low or valley areas

1. Popularization of soil testing in intensive mode and distribution of soil health card to farmers for judicious use of fertilisers.
2. Promotion of Forti fication of composting unit, adoption of legume based cropping system and green manuring techniques in concern areas of all blocks.
3. Organic cultivation of rice, millets, spices and local grains in all blocks.

Others

1. Cluster approach for holistic development.
2. Promotion of timely and local availability of high yielding varieties of all the cereal, pulse, High Value Crops like vegetable, fruits, spices, etc.
3. Cultivation of fodder crops (oats, fodder maize, berseem) & medicinal (*Aloe vera* and Brahmi) plants.
4. Adoption of only well decomposed FYM/ value added compost.
5. Promotion of efficient and timely use of INM, IPM and IDM modules.
6. Compulsion of seed treatment through bio agent/ chemical in the cluster.
7. Adoption of moisture conservation practices like mulching with local straw or black mulch in all blocks.
8. Promotion to focus on integrated weed management.

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of high milk breeds of cows (Jursey, HF, Sahiwal), buffaloes (Murrah, Neeli-ravi) and goats (Barbari, Jamunapari) in *Bin, Munakot, Kannalichhinna, Didihat, Dharchula, Berinag*

and Gangolihat block

2. Establishment of Fodder Bank in *Bin, Dharchula, Munsyari, gangolihat and Berinag* particularly during lean period.
3. Establishment of milk chilling plant at *Munakot , kannalichinna* and *Bin* block.
4. Promotion of Urea, Molasses, and Mineral mixer blocks at *all blocks.*
5. Establishment of hatcheries for need of broilor or croilor in Didihat, Dharchula and Munsyari blocks.
6. Availability of feed material with low prices & Timely health check-ups of animals.
7. Introduction and promotion of Cross breed milch breed of animal for increasing income of marginal farmer.

Strategy 3 : Integrating Farming system

Following Integrated farming system model may be developed in all blocks:

Agri-HortAnimal-processing based farming system

Activity	Area
B. **Cropping system:**	8 nali
Paddy-wheat/yellow saron/lentil-moong/grain cowpea	
Capsicum-radish-cauliflower	
Paddy-Radish-garden pea-Frenchbean	
Maize+cowpea-Berseem/Oat+cabbage	
B . Horticulture	8 nali
Mango/ Guava/Pomegranate+ (Cucurbits-Cabbage/cauliflower/onion/moong/cowpea/ginger/turmeric) as intercrop upto 6 years.	
Polyhouse(for growing cut flowers -01no.)+ polytunnel-for growing seasonal vegetable seedling	
Mushroom Production Unit	
C Livestock	2 nali
d. Cow/buffalo	2no.
e. Backyard poultry	25 Birds
f. Beekeeping	
D. Vermicomposting/Processing-	2 nali
Washing and cleaning of season vegetables, biogas/vermicompost/biopesticides	

Total cost : Rs 75,000.0

Total income : Rs 1.75 lakhs

Net income : Rs 1.00 lakh (Approx.)

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of mini fruit grading plant for mango, plum, peach, guava and pear in all blocks.
2. Establishment of Food Processing Units for mango at Kannalichinna, *&* Malta and citrus at *Bin, Munakot, kannalichinna, Berinag and Dharchula* blocks.
3. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all the blocks.
4. Promotion of common resources on custom hire basis viz. Power weeder/tiller, Mini thresher and other equipments at Nyay Panchayat level in *all blocks*.
5. Establishment of Food and Processing Units at Bin, Munakot, Kannalichinna, Gangolihat and Dharchula fo*r* pickle making using wild *Aonla, chilli, mango & lemon*.
6. Establishment of Food and Processing Units at Bin, Munakot, Kannalichinna, Didihat, Gangolihat and Dharchula fo*r* Ketch up of Tomato and jam- jellies of local fruits
7. Promotion of common resources on custom hire basis viz. Power tiller in *all blocks.*

Strategy 5 : Waste land development and waste water

1. Contour making for arable purpose in waste land in Bin, Munakot, Kannalichinna, Gangolihat and Dharchula and other and other high hills areas.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in all

blocks.

3. Plantation of Mulberry plants, Wild fruit plants, Fodder trees (*Grewia*, *Alnus*, *Quercus*etc.) may be promoted in *all blocks*
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland of all blocks.
5. Popularization of trenches or silages for percolation of water to avoid surface run off in Bin, Munakot, Kannalichinna, Didihat, Gangolihat and Dharchula blocks.
6. Construction of check dam and artificial structure to maximize water percolation rate all blocks.
7. Construction of tank for storage of water for lean season in all blocks.
8. Establishment of storage system for rain water in monsoon season.
9. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Adaption of integrated nutrient management techniques and promotion of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc.
2. Provision of mechanization (Use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers etc.)
3. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in all blocks.
4. Promotion of line sowing and balanced fertilizers application in crops.
5. Sowing of crops with recommended seed rate, spacing and depth.
6. Promotion of need based application of pesticides and other agricultural inputs. `
7. Promotion of hand tools in agricultural and horticultural operations.
8. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
9. Promotion of pressurized irrigation techniques in horticultural crops.

Strategy 7 : Off-farm income

1. Promotion of apiculture/ mushroom/poultry for small and landless farmers in all blocks.
2. Promotion of cultivation and collection of medicinal plants in *Kannalichinna, Didihat, Berinag, Gangolihat, Dharchula, Munsyari* blocks.
3. Promotion of skill development in women and youth in all blocks.
4. Creation of new SHGs in other villages of all blocks.
5. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Pickle making, Jam & Jelly making, Spice cultivation, Ghee making & packing, etc. may be provided for better performance in all blocks.

Strategy 8 : Enabling Policies

1. Ensure Buy back of farmer's produce through common agencies.
2. Announcement of Minimum Support Price of crop in each block by the government before sowing.
3. Land consolidation is essentially required.
4. Implementation of policies for control of wild animal menace in agricultural areas.
5. Implementation of Soil Health Card Scheme in each block.
6. Increasing institutional support by providing subsidises and incentives to small and marginal farmers in all blocks.
7. Labelling of organic inputs and certification mechanism for various crops in all three blocks.
8. Popularization of Udhyan and KCC for widespread use of government incentives/ subsidies to farmers.
9. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.

10. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.

Strategy 9 :Marketing and value addition in specific agro-ecological region

1. Development of local hats at Block level on weekly basis.
2. Establishment of linkages of farmers with the different private companies to ensure proper marketing.
3. Farmer's produce collection center should be developed at road head of the villages.
4. Creation of better transportation facilities with cool chain van at Block level.
5. Creation of direct linkages with food processing industries for better prices.
6. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
7. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
8. Installation of mini grading machines at village level.
9. Establishment of godowns with latest technology in all blocks.
10. Development of proper marketing network to check the interference of middle men in marketing of agricultural produce of the farmers.

Strategy 10 : Online Management and Evaluation

1. Development of Mobile apps/ software for online management and evaluation at district level.
2. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
3. Organization of monthly review meeting at district to solve the problems related with farmers.
4. Promotion of use of community radio, TV talks and Whatsapp etc. for effective implementation of programme.

Agro-ecological region: Region B (1000 to 1500 m

A.General information about Agroeco-region
District: Pithoragarh
Agro-ecological region: Region B (1000 to 1500 m)
Main Blocks in Region: Didihat, Munakot, Bin, Dharchula, Munsiyari, Kanalichina, Berinag
Main village cluster in blocks:
Didihat:, Garali, Koli
Munakot: Gaina, Marsoli, Shilling
Bin: Thercot, Balacot, Jakhpuran, Maledungri
Dharchula: Dharchula Dehat, Kalika, Ramtoli
Munsiyari: Madkot, Golma, Kotal
Kanalichina: Dungri,Chadandev, Sangdi, Matdi
Berinag: Baret,, Basaligaon
Gangolihat: Futsil, Uproda
Irrigated Clusters: NIL
Rainfed Clusters: All are rainfed
Existing rain water management facilities:

1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj)
3. Village pond (Taal and Chaal)
4. Collection from hill slope (Khaal)
5. Hydrum as lift device

B. Productivity Enhancement
1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region

1. Low cost lining material to check seepage
2. Efficient water application systems (sprinkler and drip)
3. Rejuvenation and popularisation of traditional water harvesting systems
4. Cost effective lifting devices
5. Roof top water harvesting system
6. Poly tank for water storage for scattered fields

2. Existing practices for soil health improvement

1. Mixing of Bicchu Ghas ,Timura and Walnut leaves in soil
2. Use of undecomposed farmyard mannure/compost
3. Meagre/ no use of biofertilizers
4. Imbalanced/ insufficient nutrient use
5. Use of raw/partially decomposed FYM
6. Meagre/ no compost making/recycling of crop residue
7. Mixed cropping of cereal and legume in few pockets
8. Soil health card scheme launched in 2015

3. Specific Action / Interventions recommended to improve soil health in specific agro-ecological region
ii) Cereals and oilseeds

1. Soil test based fertilizer application
2. Bio-fertiliser/soluble fertiliser based farming
3. Integrated fertilizer application
4. Promotion of pulse based crop rotation
5. Maximum use of value added compost/FYM

Cereals and oilseeds

1. Seed/ soil inoculation with Azotobacter and Phosphorus solubilising microbial culture (250-300g each/ acre for seed inoculation;/ and 1-1.5 kg each mixed in well decomposed 25 kg FYM/ acre for soil inoculation).
2. Soil test based balanced use of fertilizers in irrigated areas as per recommendation; INM shall be preferred
3. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

Pulses and soybean

1. Seed with specific *Rhizobium* inoculant and Phosphorus solubilising microbial culture.
2. Use of recommended dose of phosphatic fertilizer
3. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

Vegetables and spices

1. Seed/ nursery soil inoculation with *Azotobacter*/ *Azospirillum* inoculant and Phosphorus solubilising microbial culture (each of 200 g/m2 for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with *Azotobacte*r/ *Azospirillum* inoculant and Phosphorus solubilising microbial culture at transplanting.
3. Soil test based balanced use of fertilizers; INM shall be preferred
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost.
5. Low availability of Phosphorus in soil can be mitigated by use of Di ammonium phosphate (DAP) or Zinc phosphate application.
6. Recommended doses of FYM/Vermi-compost can be used for better soil health.

4.Existing crop cultivation strategy being adopted under changing climatic condition

1. Regular Occurrence: Frost, Drought, Cold wave
2. Southern part of district receives high amount of rainfall.
3. Approximately 16% cultivable area is irrigated.
4. Rice, wheat, ragi, maize are prominent crops of the district.
5. Local French bean varieties are being grown in summer season.
6. Growing of vegetables and horticultural crops over small area.

5.Specific strategy to be adopted for doubling productivity under changing climatic conditions in the agro-ecological region

1. The climatic projection suggests increasing air temperature and erratic distribution of rainfall. Therefore following strategy should be followed to increased income under changing climatic scenario.
2. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
3. Plenty of rain water (Approximately 1300mm rainfall) is available in rainy season the rain water should be properly stored (polythene tank, farm pond, by forming bunds) and harvested for Kharif season crops.
4. The area of off season vegetable should be increased at least by double by the year 2022.
5. Soil erosion triggered by higher slope gradient is the major issue of Pithoragarh. Therefore water and soil conservation techniques like terrace farming, bunding etc should be encouraged
6. The frost susceptible vegetable crops should only be grown on southern aspect of topography so that availability of radiation increases and the effect of frost could be minimized.
7. Crop residues should be burnt in the previous night if there is forecast of frost.
8. In frost prone regions organic mulch should be used in a vegetable field for enhancing energy level in field.
9. The summer temperature is falling in the optimum temperature range, while soils are slightly acidic which favours cultivation of French bean as a summer crop in Munsyari and Dharchula

blocks of Pithoragarh District. Plantation of litchi/mango orchards
10. Timely sowing of high yielding varieties of cereals, pulses, vegetables and oilseeds
11. Promotion of protected cultivation
12. Adoption of intercropping techniques
13. Use of fertilizer on soil test basis
14. Increase in water and fertilizer use efficiency through drip
15. IPM & INM modules for specific crop and plants
16. Proper storage and marketing

6 A. Name of Field Crop: Wheat

i. Existing varieties being used: Mundaria, Lal Mishri, VL-738, VL-616,dal bakhani

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: UP-2572, VL-804, VL-904,VL -829,VL 832 , VL-907

iii. Existing package of practices being used:

1. Preparation of land- 1 or 2 ploughing with local plough no definite depth
2. Seed rate and seed sowing -150-175 kg/ha, Broad casting
3. Manure and fertilizer-
4. use of undecomposed FYM (rainfed) and undecomposed FYM with small doses of chemical fertiliser by some progressive farmers (in irrigated conditions)as per availability
5. Irrigation-usually maximum area is rain fed and in valley condition 1 or 2 irrigation

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2 ploughing + 1 harrowing with mould bold plough upto 10-15 cm
2. Seed rate and seed sowing -100-125kg/ha, line sowing 18-21 cm apart
3. Manure and fertilizer- 10-15 tonne FYM , NPK 100-120:60:40, 50-60:30:20with micronutrients
4. Irrigation-As per irrigation facility 1 irrigation at CRI, jointing stage and 1 at flowering stage.

v. Major insect pests associated with crop: Cutworm ,Termites, Aphids, Jassids

vi. IPM Module for management of insect pests(except organic areas):

Aphids (*Macrosiphum (Sitobion) avenae* or *Macrosiphum miscanthi*)

1. Avoid late sowing of crop to save crop from aphid.
2. Conservation and enhancement of biocontrol agents like coccinellid beetles, Chrysopa, syrphid, Apanteles etc. protects the crop against aphid attack.
3. Spray any of the following insecticides after diluting in 500 litre water/ha when more than 5 aphids are recorded per ear head:

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG	50	21
Quinalphos 25 %EC	1000	

Termites: *Microtermes obesi* and *Odontotermes obesus*)

1. Dismantle termataria (monde) around fields & kill the termite queen.
2. Summer deep ploughing and burning of stubbles/residue of previous crop.
3. Use well rotten cowdung manure/compost to avoid termites.

Name of the Insecticides	(gm/ml) /ha
Thiamethoxam 30% FS (Seed Treatment/Kg)	3.3 per Kg

Cutworm: *Agrotis ipsilon* and *A. segetum*)

Avoid late sowing of crop to save crop from armyworm.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Methyl parathion 50% EC	300	600
Trichlorfon 50% EC	500	1000

vii. Major disease associated with crop: False smut, Rust, Loose smut

viii. IPM Module for management of disease:

Loose smut: *Ustilago nuda* f.sp. *tritici*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carbendazim 50% WP (Seed Treatment/Kg)	1.0	2.0
Carboxin 75% WP (Seed Treatment/Kg)	1.5-1.9	2-2.5
Tebuconazole 2% DAS	0.02	1.00
Difenoconazole 3% WS	0.06	2.0

Yellow rust=stripe rust: *Puccinia striiformis=Puccinia glumarum*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Propiconazole 25% EC	500	30

ix. Major weeds associated with crop: *Anagalis arvensis, Argemone mexicana, Asphodelus tenuifolius, Avena fatua, Chenopodium album , Rananculus , Phalaris minor*

x. IPM Module for management of weeds(except organic areas):

Red chickweed: *Anagalis arvensis* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Carfentrazone ethyl 40 %DF	50	80
2,4-D Sodium salt Technical (80WP)	625-1000	90
Methabenzthiazuron 70 %WP (POE-30DS)	2000-2500	100
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20% WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Medium soil)	4200	
Clodinafop-propargyl 15%+ Metsulfuron methyl 1 %WP	400	100
Mesoulfuron methyl 3+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

Onion weed: *Asphodelus tenuifolius* (annual, monocot, narrow leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38 %EC	1320-2200	
MCPA Amine salt 40 %WSC	2500	

Field bindweed: *Convulvulus arvensis* (perennial, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D Dimethyl amine salt 58% SL	860-1290	
Metsulfuron methyl 20%WG	20	76
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100

Common wild oat: *Avena fatua* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Diclofop methyl 28%EC	2500-3500	90
Isoproturon 50% WP	2000	
Isoproturon 75% WPs	1330	60
Methabenzthiazuron 70 %WP (PE: 2DAS)	1500-2000	100
Methabenzthiazuron 70% WP (POE: 16-18 DAS)	1000-1250	100
Triallate 50% EC	2500	150
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100

Dwarf canary grass: *Phalaris minor* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Clodinafop Propargyl 15% WP	400	110

Diclofop methyl 28% EC	2500-3500	90
Fenoxaprop-p-ethyl 10% EC	1000-1200	110
Isoproturon 50% WP	2000	
Isoproturon 75% WPs	1330	60
Methabenzthiazuron 70 %WP (PE: 2DAS)	1500-2000	100
Methabenzthiazuron 70 %WP (POE: 16-18DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Pendimethalin 30% EC(Light soil)	3300	
Pendimethalin 30% EC (Medium soil)	4200	
Pendimethalin 30% EC (Heavy soil)	5000	
Pinoxaden 5.1 %EC (POE: 30-35DAS)	800+900	90
Sulfosulfuran 75%WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

Bathua/pigweed: *Chenopodium album* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Carfentrazone ethyl 40% DF	50	80
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38% EC	1320-2200	
Methabenzthiazuron 70 %WP (POE: 30DAS)	2000-2500	100
Methabenzthiazuron 70 %WP (POE: 16-18 DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20%WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Heavy soil)	4200	
Sulfosulfuran 75% WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Wheat-Horse gram/Soybean(rainfed),Wheat-Rice(irrigated),
4. Timely Sowing, Seed treatment, Use of HYV
5. FIRB
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM
8. INM and soluble fertiliser
9. Integrated weed management
10. IPM

11. Good storages conditions
12. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. climate changing,
4. Wild animal damages, Migration,
5. Poor Irrigation facilities,
6. SAAR practices (Shifting area practice)

6B. Name of Field Crop: Rice

i. Existing varieties being used: China-4, lal dhan, lal –safed rikhua, Saket 4

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:

Irrigated condition(>1500 msm)-VL 85,81, 86,62
Rainfed- Chatki Dhan-VL 206,207,208
Jethi dhan –VL 154

iii. Existing package of practices being used:

1. Preperation of land- 1 or 2 ploughing with local plough no definit depth, Manual puddling
2. Seed rate and seed sowing -150 kg/ha in dirct seeding rice , and in transplanting 60-70 kg/ha
3. More than 45 days seeding used
4. Manure and fertilizer- use of un decomposed FYM (undecomposed FYM 1.5-2.0qt./nail) with small doses of chemical fertiliser by some progreesive farmers (in irrigated conditions)as per availability
5. Irrigation-usually maximum area is rain fed and in valley condition as avalability of irrigation roaster
6. No IPM practices

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 1 or 2 ploughing with local plough , puddling
2. Seed rate and seed sowing -100-125/ha in direct seeding rice , and in transplanting 40-50 kg/ha, basmati20kg/ha,hy 20kg/ha
3. 25-30days seeding used
4. Manure and fertilizer- -15 tonne FYM , NPK 100-120:60:40, rainfed 50-60:30:20with micronutrients(Zn, Fe)
5. Irrigation-usually maximum area is rain fed and in valley condition as avalability of irrigation roaster
6. Use of pre and post emergence tp herbicide, rainfed- pre emergence, Use of IPM practices

v. Major insect pests associated with crop: Stem borer, Rice leaf folder, rice bug, thrips

i. IPM Module for management of insect pests:

Stem borer:

1. In the stem borer endemic area raise the nursery away from light source.
2. Raise nursery in narrow strip and mechanically destroy egg masses and moths
3. Remove seedling with Stem borer eggs before transplanting.
4. Use nitrogenous fertilizer moderately and split the application of it over three growth stages to reduce the damage.
5. For the monitoring install the pheromone traps in the field at the rate of 3 trap per acre at a distance of 60 m in a triangular pattern and record the males trapped daily to access the peak population.
6. For the management of yellow stem borer through pheromone mediated mass trapping of male install the pheromone trap in field at the rate of 20 traps/ha in rows maintaining a distance of 20

and 25 meters between traps and rows, respectively. The traps in the first rows are installed 10 m inside from the boundary of the field. The traps are tied on 1.25-1.5m long straight bamboo sticks or poles with the help of jute or plastic strings.The lures containing 3 and 5 mg pheromone are changed after 3 and 4 week, respectively, whereas 10 mg lure work for whole season. Adjust the trap height at 0.5 m and 1.0 m in the early vegetative and reproductive stage of crop, respectively, or 30 cm above crop canopy in all the stages of the crop.To check the escape of trapped males put a tea spoonful insecticidal dust in the polythene sleeve of dry sleeve trap. Dust is not required in funnel type trap. To Ascertain the quality use lures supplied by 2-3 manufacturers in alternate traps initially and after recording their performance replace the ineffective lures by highly effective lure. Relocate the traps displaced in bad weather and replace the polythene sleeve damaged by weather or animals.

7. Mass rearing and release of some parasitoids such as different species of *Trichogramma* have not been found useful in the rice ecosystems in so many countries including India which are inhabited by *Telenomus* and *Tetrastichus* species. Use of trichocard, therefore, increases the cost of cultivation without any gain. The conservation of *Telenomus* and *Tetrastichus* species is self sufficient to naturally reduce the stem borer population.
8. To increase the effectiveness of parasitoides and predators in the rice field
9. Conserve and enhance the natural enemies which are already present in the field.
10. Create favourable condition for natural enemies.
11. Always leave a pest residue in the field at non-economic level, for natural enemy.
12. Reduce the harmful effect of pesticides on natural enemy by:
    A. Apply insecticide only when necessary, not regularly.
    B. Apply insecticide only when the pest population reaches Economic Threshold Level.
    C. Applying a selective insecticide which is less toxic to natural enemy.
    D. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.
    E. Use selective formulation and application method.
    F. Application of granular formulation is less harmful to natural enemy
13. Following insecticides may be used to control stem borers of rice when the population or damage of pest is recorded to 1 moth or 1 egg mass/ m^2 or 5% dead heart :

50 Days within transplating (2 inch water in field)

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 0.4 %GR	10000	53
Fipronil 0.3% GR	16670-25000	32
Cartap 4% Gr	18750	
Carbofuron 3% CG	33300	
Carbosulfon 6% G	16700	37

50 Days after tranplanting

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5 %SC	150	47
Fipronil 5% SC	1000-1500	32
Fipronil 80 %WG	50-62.5	19
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75 %SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20% WG	125	30
Thiacloprid 21.7 %SC	500	30
Acephate 75% SP	666-1000	15

Acephate 95 %SG	592	30
Chromafenozide 80% WP	94-125	32
Monocrotophos 36% SL	1400	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Carbosulfon 25 %EC	800-1000	14
Chlorpyriphos 20% + Acetamiprid 0.4% EC	2500	10
Phosphamidon 40% + Imidachlorpid 2 %SP	600-700	22
Flubendamide 4%+ Buprofezin 20% SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

Name of the Bio-Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5
Azadirachtin 0.03% EC (Neem oil based)	2500-5000	5
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	1500	

Leaf folder:

Following insecticides may be used to control leaf folders of rice

50 Days within transplating (2 inch water in field)

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 0.4% GR	10000	53
Cartap 4% Gr	18750	
Carbosulfon 6% G	16700	37

50 Days after transplating

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	150	47
Indoxacarb 15.8 %EC	200	14
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75% SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20 %WG	125	30
Chromafenozide 80% WP	94-125	32
Fipronil 80%WG	50-62.5	30
Acephate 75 %SP	666-1000	15
Acephate 95 %SG	592	30
Monocrotophos 36 %SL	1400	
Dichlorovos 76% EC	627	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Quinalphos 25 %EC	1000	40
Flubendamide 4%+ Buprofezin 20 %SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

Name of the Bio-Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.15% EC (Neem seed kernel	2500-5000	5

based)		
Azadirachtin 0.03% EC (Neem oil based)	2500-5000	5
Azadirachtin 5% (Neem extract concentrate containing)	375	5
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	1500	
Beauveria bassiana 1.15%WP Strain BB-ICAR-RJP	2500	
Beauveria bassiana 1.15%WP Strain ICAR	2500	

Rice bug: *Leptocorysa acuta*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Methyl parathion 2% DP	500	25000

Biological control

Parasitoids:

Gryon flavipes, attacking: eggs

Predators:

Micraspis discolor, attacking: nymphs, adults

Neoscona theisi, attacking: nymphs, adults

Neurothemis fluctuans and *N. terminata* attacking: nymphs, adults

Orthetrum sabina, attacking: nymphs, adults

Pathogens:

Beauveria bassiana, attacking: nymphs, adults

Thrips

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Lambda-cyhalothrin 5% EC	250	15

Bio-insecticides

Name of the Bio-Insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5

vii. Major disease associated with crop: Khaira, rice blast ,Brown spot ,leaf blight, False smut

viii. IPM Module for management of disease:

During Nursery Sowing

Deep summer ploughing or soil solarisation

Seed bio priming with bio-control agent (PS @10g/kg seed) or fungicide (Carbendazime 1g/kg seed)

Fertilizers

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

Khaira disease: Due to Zinc deficiency)

Name of the Fungicides	(gm/ml) /ha
Zinc sulphate (Apply in soil at the time of plot preparation)	25000
Zinc sulphate spray (2.5 Kg Quick lime & 20 Kg Urea in 1000 lit. water	5000

Sheath blight: *Rhizoctonia solani*

Drain of water to check spread of sheath blight.

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)

Carbendazim 50 %WP (Seed Treatment)	2	
Carbendazim 50 %WP	250-500	
Propiconazole 25% EC	500	30
Hexaconazole 5% EC	1000	40
Hexaconazole 5% SC	1000	40
Difenoconazole 25% EC	0.05%	25
Flusilazole 40% EC	300	24
Tebuconazole 250% EC (25.9%)	750	10
Validamycin 3% L	2000	14
Iprodione 50% WP	2250	35
Pencycuron 22.9% SC	150-188	600-750
Thifluzamide 24% SC	375	28
Cresoczim-methyl 44.3 %SC	500	30
Tebuconazole 50% +Trifloxystrobin 25% WG	200	21
Carbendazim 12%+Flusilazole 12.5 %SE	800-960	54
Iprodione 25% + Carbendazim 25% WP	500	
Propiconazole 13.9%+ Difenoconazole 13.9% EC	0.07-0.1%	46
Tebuconazole 50% +Trifloxystrobin 25% WGs	200	31

Biofungicides:

Name of the Bio-fungicides	**(gm/lit) /ha**	**Treatment**
Trichoderma viride 1% WP (Strain T-14 in house isolate of M/s Indore Biotech Inputs and Research (P) Ltd., Indore)	5 -10 gm/lit water	Foliar spray: Mix 2.5 Kg of *Trichoderma viride* 1% WP in 500 lit. of water. Spray three times at 15 days interval uniformly over one hectare land 30 days after planting.

Rice blast: *Magnaporthe grisea*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Picoxystobin 22.52% SC	600	12
Isoprothiolan 40 %EC	750	60
Tricyclazole 75% WP	300-400	30
Tebuconazole 25% WG	750	10
Idifenphos 50% EC	500-600	21
Carpropamid 27.8 %SC	500	
Cresoczim-methyl 44.3 SC	500	30
Hexaconazole 5% EC	1000	40
Casugamycin 3 %SL	1000-1500	30
Carbendazim 50 %WP	250-500	
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Tebuconazole 50% +Trifloxystrobin 25% WG	200	31
Carbendazim 12%+Mancozeb 63% WP	750	57
Azoxystrobin 18.2% + Difenoconazole 11.4%SC	0.1%	5

Bacterial leaf blight: *Xanthomonas oryzae*

1. Do not planting under full or partial shade to avoide bacterial blight (BLB) infection.

2. After bacterial blight infection of drain the water from field and stop the application nitrogenous fertilizer.
3. Drain of water to check spread of bacterial blight

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Streptocyclin (Seed Treatment)	40ppm	
Streptocyclin (Nursary Treatment)	40-100ppm	
Streptocyclin (Spray)	15	Local recommendation
Copper hydroxide 53.8% DF	1500	10
Copper hydroxide 50 %WP	500	Local recommendation

Biofungicides

Name of the Bio-Fungicides	(gm/Kg) /ha	Waiting period (days)
Pseudomonas fluorescens 1.5% WP (BIL-331 Accession No. MTCC 5866)	5 gm/Kg seed	Seed Treatment: Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP with minimum volume of water and coat the seed uniformly, shades dry the seeds just before showing.

Brown leaf spot: *Cochiobolus miyabianus*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Propineb 70 %WP	1500-2000	
Idifenphos 50% EC	500-600	21
Captan 75% WP	1000	

Biofungicides

Name of the Bio-fungicides	(gm/ml) /ha	Waiting period (days)
Pseudomonas fluorescens 1.5% WP (BIL-331 Accession No. MTCC 5866)	2.5 Kg/ha	**Seed Treatment:** Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP with minimum volume of water and coat the seed uniformly, shade dry the seeds just before sowing.

ix. Major weeds associated with crop: *Oxalis, Cyperus* spp*, Echinocloa* sp*, Chenopodium album, Commalina bengalensis, Cynodon* spp*, Digitaria sanguinales, Eclipta* spp*, Eleusine* spp

x. IPM Module for management of weeds(except organic areas):

Creeping Wood Sorrel: *Oxalis* sp. (annual,perennial, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Metsulfuron methyl 20% WG (Transplanted rice)	20	71

Umbrella plant: *Cyperus* sp. (annual, monocot, narrow leaves, sedge)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
MCPA, Amine salt 40% WSC (Transplanted rice)	2000-5000	
Metsulfuron methyl 20 %WP (Transplanted rice)	20	60
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Bensulfuron methyl 0.6% + Pretilachlor 6% G	10000	88 (Transplanted rice)

Bermuda Grass: *Cynodon dactylon* (perennial, dicot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Bensulfuron methyl 0.6 %+ Pretilachlor 6 %G	10000	88(Transplanted rice)

Bamboo grass: *Digitaria sanguinalis* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90

Jungle rice: *Echinochloa colonum, E. crusgali* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Anilofos 18% EC (Transplanted rice)	1660-2500	
Anilofos 2% G (Transplanted rice)	20000-25000	30
Bispyribac Sodium 10% SC (Nursary)	200	
Butachlor 50% EC (Transplanted rice)	2500-4000	90&120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90&120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Cyhalofop butyl 10% EC	750-800	90
2,4-D Ethyl Ester 38% EC	2500	
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Fenoxaprop-p-ehtyl 9% EC (Transplanted rice)	625	70 Post
Fenoxaprop-p-ehtyl 6.9% EC	812-875	61
Flufenacet 60% DF (Transplanted rice)	200	90-110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiargyl 6% EC (Transplanted rice)	1066	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90
Anilofos 24%+ 2,4-D ethyl ester 32% EC	1000&1500	90 (Transplanted rice)
Bensulfuron methyl 0.6% + Pretilachlor 6 G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Cinmethylin 10% EC (Transplanted rice)	750-1000	60
Paraquat dichloride 24% SL (Before sowing)	1250-3500	

False Daisy: *Eclipta alba* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Azimsulfuron 50% DF (Transplanted & Direct sown)	70	59
Bensulfuron methyl 60%DF (Preemergence)	100	88
Bensulfuron methyl 60%DF (Postemergence)	100	71
Bispyribac Sodium 10% SC (Direct seeded)	200	78
Butachlor 50% EC (Transplanted rice)	2500-4000	90-120

Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90-120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 WDG (Transplanted rice)	83.3-100	110
Metsulfuron methyl 20 %WG (Transplanted rice)	20	71
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90
Bensulfuron methyl 0.6% + Pretilachlor 6 %G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110(Transplanted rice)
Metsulfuron methyl 10%+ chlorimuron ethyl 10 %WP	20	90(Transplanted rice)

Indian goosegrass: *Eleusine indica* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Butachlor 50% EC (Transplanted rice)	2500-4000	90-120
Butachlor 5% G	25000-40000	90-120

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Jethirice- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Rice- Wheat /onion/berseem(irrigated),
5. Timely Sowing/Trans planting, Seed treatment,
6. Use of HYV,Hybrid (120-125days), Basmati(120-125days)
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products
14. Avoid early Nursery raisingpractice and use of 21-30 days old seedling

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, Wild animal damages, Migration,
4. Poor Irrigation facilities

6C. Name of Field Crop: Finger millet

i. Existing varieties being used: Band mutthi(Garhwali mandua), Khuli muthi(Kumaon mandua)

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VLM-324, VLM-315, VLM-149, VLM-146

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. undecomposed FYM 1.0-2.0qt./nali,

3. 1-2 weeding

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2 or 3ploughing ,
2. Seed rate and seed sowing -14-16kg/ha, Gapfilling/Transplating
3. Manure and fertilizer- -10 tonne FYM , NPK 20:40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v. Major insect pests associated with crop

vi. IPM Module for management of insect pests(except organic areas):

vii. Major disease associated with crop: Blast

viii. IPM Module for management of disease:

1. Grow resistant variety such as VL 149
2. Seed treatment with carbendazim @ 1g/kg seed followed by 2 sprays of carbendazim @ 0.1% (first when 50 per cent ear heads are formed and second 10 days later)
3. For organic farming seed treatment with Bioagents like T. harzianum @ 10g/kg seed followed by 2 sprays of same @ 10g/litre of water (first when 50 per cent ear heads are formed and second 10 days later).

ix. Major weeds associated with crop: *Oxalis latifolia, Phyllanthus niruri ,Amaranthus viridis,Euphorbia hirata, Solanum* sp., *Tribulus sp,Cyperus* sp

x. IPM Module for management of weeds(except organic areas):

For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. INM(Maximum use of value added compost/FYM
9. and soluble fertiliser)
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, wild animal damages, migration,
4. Poor Irrigation facilities

6D. Name of the Field crop: Barnyard Millet

i. Existing varieties being used: Non described

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PRJ-1,VL Madira -172

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nali,

3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2or 3 ploughing,
2. Seed rate and seed sowing -14-16kg/ha, Gapfilling
3. Manure and fertilizer- -10 tonne FYM , NPK 20:40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: Stem borer

vi. IPM Module for management of insect pests(except organic areas): -

vii. Major disease associated with crop: Smut

viii.IPM Module for management of disease:

1. Grow resistant variety like PRJ 1.
2. Seed treatment with carbendazim @ 2g/kg seed or carboxin @ 2.5g/kg seed

ix. Major weeds associated with crop: *Oxalis latifolia, Phylanthus niruri , Amaranthus viridis, Euphorbia hirata, Solanum* sp*,Tribulus* sp*,Cyperus* sp

x. IPM Module for management of weeds: Manual weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Barnyardmillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Gapfilling
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs, use of imbalance and un decomposed FYM, climate changing,
2. Wild animal damages
3. Migration specially from border area,
4. Poor Irrigation facilities

6E. Name of Field crop: Maize

i. Existing varieties being used: Lal makka

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Surya ,Kanchan ,Naveen,Vivek 31. 50 kg seed of maize single cross hybrid DH 296 is available with Maize Breeder of the University. Maize hybrid DH 296 is a potential high yielding hybrid and is final stage of testing in SVT.

iii. Existing package of practices being used:

1. Sown as mixed cropping
2. Traditional seed variety , un decomposed FYM 1.5-2.0qt./nail, 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – composit-18-20 kg/ha, hy 20-25kg/ha, , Gapfilling,spacing 60*20cm
3. Manure and fertilizer- -10 tonne FYM , NPK 100:120:60 :40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v. Major insect pests associated with crop: Stem borer,cut worm

vi. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: -

Maize stem borer: *Chilo partellus*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 30 FS (Seed Treatment/Kg)	2.4	8
Carbofuran 3 %CG	1000	33000
Carbaryl 85% WP	1500	1764
Carbaryl 4 %G	250	6250
Dimethoate 30% EC	200	660
Phorate 10% CG	1000	10000

For management of white grub, chlorpyriphos 2 ml per liter of water can be applied in the root zone of the plant on need basis

vii. Major disease associated with crop: Downy mildew ,White rust

viii. IPM Module for management of disease(except organic areas):

1. Disease management strategies
2. Use of disease free certified seeds
3. Deep ploughing during summer
4. Crop rotation
5. Application of bio-agents i.e. Psedumonas fluorescens as seed treatment (10g /kg seed) plus soil application (2.5 kg/ha) and spray @ 0.1% and seed treatment with Trichoderma viride (10g /kg seed) and their stimulation by the addition of amendments can be done.
6. A fertilizer dose of 80 Kg N, 60 Kg P2O5, 40 Kg K2O is generally required. Entire PK and 10% of N is applied as basal. Remaining nitrogen is applied in 4 splits i.e. 20% at 4 leaf stage, 30% at 8 leaf stage, 30% at flowering stage and 10% at grain filling stage.
7. Row spacing should be done at 60-75 cm & plant to plant spacing, 20-25 cm.
8. Cultural practices which include sufficient availability of plant nutrients, optimum soil pH (6.2-7.0), adequate water in fields, weed control, optimum plant population and use of disease free and high quality seeds are very helpful in reducing the damage caused by various diseases by reducing the plant stress.

Downy mildew: *Peronosclerospora maydis*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Metalaxyl-M 31.8% ES (Seed Treatment/Kg)	2.4	
Metalaxyl 35% WS (Seed Treatment/Kg)	7.0	
Mancozeb 75% WP	1500-2000	
Metalaxyl 8%+ Mancozeb 64% WP	2000	49
Azoxystrobin18.2%+Difenoconazole 11.4 %SC	0.1%	26

ix. Major weeds associated with crop: *Eleusine indica, Echinocloa* sp

x. IPM Module for management of weeds:

Indian goosegrass: *Eleusine indica* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Alachlor 50 %EC	5000	90

Atrazin 50 %WP	1000-2000	
Diuron 80% WP	1000	

Jungle rice: *Echinochloa* sp. (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Alachlor 50% EC	5000	90
Alachlor 10 %GR	15000-25000	
Atrazin 50 %WP	1000-2000	
Diuron 80 %WP	1000	
Paraquat dichloride 24% SL (Before sowing)	800-2000	90-120

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of Baby corn and Sweet corn Shot duration hybrid Varieties ,Seed treatment , HYV, Inter cropping, Gap filling ,Weed Management
2. Organic cultivation,
3. Adoption of low-cost based cultivation practices,
4. Maize- Wheat/Lentil/Barley/oat (fodder) (rainfed),
   Maize+Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs
2. Use of imbalance and un decomposed FYM
3. Climate changing, wild animal damages, migration
4. Poor Irrigation facilities

7A. Name of the Pulse crop: Horsegram

i. Existing varieties being used: Non described-Paharigahat

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VLG-8,10,15

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nail,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – 20-25kg/ha,spacing 30*10cm
3. Manure and fertilizer- -10 tonne FYM , NPK20:40 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v. Major insect pests associated with crop: -

vi. IPM Module for management of insect pests : -

vii. Major disease associated with crop: Rot,syam warn

viii. IPM Module for management of disease: -

ix. Major weeds associated with crop: *Oxalis latifolia,Phylanthus niruri ,Amaranthus viridis,Euphorbia hirata,Solanum* sp*,Tribulus* sp*,Cyperus* sp

x. IPM Module for management of weeds:

1. Apply Fenoxaprop-p-ethyl 9.3% EC @ 56.25-67.5 g a.i/ha at 20-25 days after sowing to control grassy weeds.
2. Apply Quizalafop-ethyl 5% EC @ 37.5-50 g a.i/ha at 15-20 days after sowing to control grasses and some broad leaf weeds.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Horsegram- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Horsegram +Maize+Fingermillet - Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM, climate changing, Wild animal damages
3. Migration, Poor Irrigation facilities

7 B. Name of the Pulse crop: Lentil

i. Existing varieties being used: Non described-Paharigahat

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VLG-8,10,15

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nail,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – 20-25kg/ha,spacing 30*10cm
3. Manure and fertilizer- -10 tonne FYM , NPK20:40 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v. Major insect pests associated with crop: Pod borer

vi. IPM Module for management of insect pests : -

vii. Major disease associated with crop: Wilt

viii. IPM Module for management of disease: -

1. Deep ploughing during summer.
2. Select disease resistant/tolerant varieties like PL 5 , PL 6 and PL 7
3. Seed treatment with Carbendazim (1 g) + Thiram (2 g) per kg seed.

4. Foliar spray of Propiconazole (0.1 %) at the appearance of disease and repeated 2-3 times at 15 days interval.

ix. Major weeds associated with crop: *Oxalis latifolia,Phylanthus niruri ,Amaranthus viridis,Euphorbia hirata,Solanum* sp*,Tribulus* sp*,Cyperus* sp

x. IPM Module for management of weeds:

1. Apply Fenoxaprop-p-ethyl 9.3% EC @ 56.25-67.5 g a.i/ha at 20-25 days after sowing to control grassy weeds.
2. Apply Quizalafop-ethyl 5% EC @ 37.5-50 g a.i/ha at 15-20 days after sowing to control grasses and some broad leaf weeds.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Timely Sowing, Seed treatment,
4. Use of HYV
5. Contour cultivation and care soil & water conservation measures
6. Maximum use of value added compost/FYM
7. INM and soluble fertiliser
8. Integrated weed management
9. IPM
10. Good storage condition
11. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM, climate changing,
3. Wild animal damages

7 C. Name of Pulse Crop: Arhar (Red gram)

i. Existing varieties being used: UPAS, ICPL-151, AL15

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Arhar-291, VL Arhar 1, Pant Arhar-3

iii.Existing package of practices being used:

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. They also do not follow balance use of chemical fertilizers. It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Timely sowing of crop in from mid of May to June.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: White fly, Pod borer, Thrips

vi. IPM Module for management of insect pests:

Pod borer: *Helicoverpa armigera*)

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	29
Chlorantraniliprole 9.3%+ Lambda cyhalothrin 4.6%ZC	200	18
Indoxacarb 14.5% SC	353-400	15
Indoxacarb 15.8% EC	333	12
Thiodicarb 75% WP	625-1000	30
Emamectin benzoate 5% SG	220	14
Flubendamide 480 %SC	100	10
Spinosad 480% SC	125-162	47
Lufenuron 5.5% EC	600	65
Methomil 40% SP	750-1125	7
Lambda cyhalothrin 5% EC	400-500	15
Monocrotophos 36% SL	1250	
Quinalphos 25% EC	1400	

Redgram thrips: *Scirtothrips dorsalis*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Dimethoate 30%EC	200	660

vii. Major disease associated with crop: Yellow Mosaic, Blast

viii. IPM Module for management of disease:

1. For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.
2. For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid 200 ml/ha

ix. Major weeds associated with crop: Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds:

1. For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.
2. Application of alachlore @ 2 kg ai before one day of sowing of crop.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management,
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop,
4. Cluster based farming, Inter cropping.
5. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Farmers don't follow proper package of practices,
2. Proper market linkage is not available,
3. Improper use of irrigation facilities,
4. Lack of quality input.

7 D. Name of Pulse Crop: Chickpea

i .Existing varieties being used: Avrodhi, Pant G-114, PG-186, Uday

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Kabli chana-1, GNG-1969, Aman, GNG-1958

iii.Existing package of practices being used:

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.

2. They also do not follow balance use of chemical fertilizers. It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Timely sowing of crop in Ist fortnight of October to IInd fortnight of October.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: White fly, Fruit borer, Thrips

vi. IPM Module for management of insect pests:

Pod borer: *Helicoverpa armigera*)

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	29
Chlorantraniliprole 9.3%+ Lambda cyhalothrin 4.6%ZC	200	18
Indoxacarb 14.5% SC	353-400	15
Indoxacarb 15.8% EC	333	12
Thiodicarb 75% WP	625-1000	30
Emamectin benzoate 5% SG	220	14
Flubendamide 480 %SC	100	10
Spinosad 480% SC	125-162	47
Lufenuron 5.5% EC	600	65
Methomil 40% SP	750-1125	7
Lambda cyhalothrin 5% EC	400-500	15
Monocrotophos 36% SL	1250	
Quinalphos 25% EC	1400	

Redgram thrips: *Scirtothrips dorsalis*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Dimethoate 30%EC	200	660

vii. Major disease associated with crop: Yellow Mosaic, Blast

viii. IPM Module for management of disease:

1. For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.
2. For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid 200 ml/ha

ix. Major weeds associated with crop: Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds:

For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management, Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop,

3. Cluster based farming, Inter cropping.
4. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Farmers don't follow proper package of practices, Proper market linkage is not available,
2. Improper use of irrigation facilities,
3. Lack of quality input.

7E. Name of Pulse crop: Urd

i.Existing varieties being used: Mas

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PU-19, PU-35

iii.Existing package of practices being used:

1. Broadcasting of seed
2. No seed treatment
3. Use of un-decomposed FYM

iv.Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing
2. Seed rate and seed sowing – 12-15kg/ha, spacing 30*45cm
3. Manure and fertilizer- -10 tonne FYM , NPK50:20 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v.Major insect pests associated with crop: Bihar Hairy Caterpillar (*Spilarctia obliqua*), Stem flies (*Melanagromyza sozae*), Leafhopper *(Empoasca sp.),* Thrips *(Caliothrips indicus*), Pod sucking bugs (*Riptortus* sp. and *Nezara viridula*)

vi.IPM Module for management of insect pests :

1. Crop rotation,
2. Collect and destroy affected plants with egg masses and gregariously feeding larvae of hairy caterpillar and pod borer,
3. Spray NSKE 5% for controlling defoliators, tobacco caterpillar and bugs.

Fruit Borer

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole18.5% SC	100	20
Flubendamide 480% SC	100	11
Lufenuron 5.4% EC	600	10
Thiodicarb 75% WP	625-750	17
Monocrotophos 36 %SL	625	

White fly

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Phorate 10% CG	10000	

vii.Major disease associated with crop: Yellow mosai virus, Cercospora leaf spot

viii.IPM Module for management of disease:

1. Deep ploughing during summer.
2. Select disease resistant/tolerant varieties like Pant Mung 5, Pant Mung 6 , Pant Urd 31 , Pant Urd 35 and Pant Urd 40
3. Seed treatment with Carbendazim (2 g) + Imidacloprid (5 g) per kg seed.
4. Rouging of the YMV infected Plants.
5. Foliar spray of Imidacloprid (0.05 %) at 25 days after sowing.
6. Foliar spray of Propiconazole (0.1 %) at appearance of disease

ix.Major weeds associated with crop: - Local

x.IPM Module for management of weeds:- Hand weeding

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

Use of IPM practices

xii.Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, Wild animal damages
4. Migration specially from border area,
5. Poor Irrigation facilities

7F. Name of Pulse crop: Rajma

i.Existing varieties being used: Different local varities with different colour like Red rajma, White , Brown, Black, Spoted white etc are being grown in Munsyari and Dharchula.

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VL-63, VL-125,genetic improvement of local varieties

iii.Existing package of practices being used:

1. Broadcasting of seed
2. No seed treatment
3. Use of un-decomposed FYM

iv.Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing
2. Seed rate and seed sowing – 12-15kg/ha, spacing 30*45cm
3. Manure and fertilizer- -10 tonne FYM , NPK50:20 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v.Major insect pests associated with crop: Stem flies, Pod borer, Sucking pests, white grub

vi.IPM Module for management of insect pests :

1. Crop rotation,
2. Collect and destroy affected plants with egg masses and gregariously feeding larvae of hairy caterpillar and pod borer,
3. Spray NSKE 5% for controlling defoliators, tobacco caterpillar and bugs.

Pod borer

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole18.5% SC	100	20
Flubendamide 480% SC	100	11
Lufenuron 5.4% EC	600	10
Thiodicarb 75% WP	625-750	17
Monocrotophos 36 %SL	625	

vii.Major disease associated with crop: Angular leave spot, anthrochnose, powdery mildew, root rot

viii.IPM Module for management of disease:

ix.Major weeds associated with crop: - Local

x.IPM Module for management of weeds:- Hand weeding

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Genetic improvement of local varieties
2. Preparation of land- 1 or 2 ploughing ,
3. Seed rate and seed sowing – 75-80 kg/ha, spacing 30*10cm
4. Manure and fertilizer- -10 tonne FYM , NPK100:80 :40,,

5. Irrigation-usually maximum area is rain fed
6. Use of pre emergence herbicide (As per moisture availability), rainfed- pre emergence,
7. Use of IPM practices

xii.Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, Wild animal damages
4. Migration specially from border area,
5. Poor Irrigation facilities

6G. Name of Pulse/oilseed Crop: Soyabean

i. Existing varieties being used: Kala bhatt(Oval)

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PS 1042, VLS 21, VLS 47, VLS 59, PS 1092

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Undecomposed FYM 1.5-2.0qt./nail,
3. 1-2 weeding

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing -100-125/ha,
3. Manure and fertilizer- -10 tonne FYM , NPK 20-80:40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: Semilooper, Leafy caterpiller, Whitefly, Girdle beetle, stem fly, pod borer, jassid etc.

vi. IPM Module for management of insect pests(except organic areas):

Cultural practices: The cultural practices make the environment less favorable for the pests and more favorable for its natural enemies. The following are cultural practices recommended for the management of soybean insect pests.

1. Removal and destruction of infected stubbles followed by deep summer ploughing destroys the pupae of stem fly, girdle beetle, pod borer and tobacco caterpillar present in the soil.
2. Optimal fertilizer dose of NPK and S @ 20:60-80: 30-40:20 kg/ ha should be applied.
3. Application of excessive dose of nitrogen fertilizer causes the infestation of all insect pests on soybean.
4. Crop rotation with non-leguminous plants is recommended for the management of leaf miner.
5. Intercropping of soybean with either asafetida (*Ferula assafoetida* L.) or maize or sorghum in the sequence of 4 rows of soybean with 2 rows of intercrop should be practiced. These intercrops help in conservation of biocontrol agents, like coccinellid beetles, Chrysoperla etc. In girdle beetle and semilooper endemic areas, intercropping with maize or sorghum should be avoided.
6. Planting of trap crops like castor for tobacco caterpillar, groundnut for leaf miner, marigold for pod borer and Dhaincha (*Sesbania sesban*) for girdle beetle.
7. Selection of insect resistant or tolerant varieties for cultivation.

Table1: Resistant or tolerant varieties for insect pests of soybean.

Insect pest	Resistant or tolerant variety
Stem fly	Dsb 25, Himso 1685, JS 20-89, MACS 1370, MACS 1410, NRC 97, JS 20-53,PS 1543, SL 983, Dsb 23-2
Girdle beetle	MACS 1410, Dsb 23-2, Himso 1685, JS 20-89, KDS 726
Defoliators	Dsb 23-2, KDS 726, PS 1543, PS 1569

Pod borer	Dsb 25, SL 683, NRC 97, MACS 1370, JS 20-89
Leaf miner	MACS 1370, Himso 1685, MACS 1370, MACS 1410
Pest complex	DS 2708, Dsb 23-2, Dsb 25, Himso 1685, JS 20-53, JS 20-79, JS 20-89, KDS 726, MACS 1370, MACS 1410, NRC 97, SL 983, PS 1543

Mechanical Control: Reduction of insect pest population by means of manual devices or labour is called mechanical control. The following measures are recommended for mechanical practices for soybean insect pests.

1. Collection and destruction of girdle beetle infested plant parts, egg masses and gregariously feeding larvae of Bihar hairy caterpillar and tobacco caterpillar.
2. Hand picking and mechanical destruction of matured pod borer larvae.
3. Erection of bird perches @ 10-12/ha to attract predatory birds for preying on defoliator larvae.

Physical control: Reduction of pest population by using device which affect them physically or alter their physical environment. Manipulation of temperature, humidity, light is used for this purpose. This includes the following:

1. Light traps should be placed at ground level early in the season for collection and destruction of the leafminer moths.
2. Installation of light traps in the field for monitoring and collection of adult moths.

Biological Control: The successful management of a pest by means of another living organism (parasitoids, predators and pathogens) is called biological control. The following biological control agents are used in IPM of soybean.

1. Release of *Tricogramma chilonis* @ 50,000/ ha four times at weekly interval against *S. litura*.
2. Spraying of *Bacillus thuringiensis* var. kurstaki @ 0.75 to 1.0 kg/ha for the management of defoliators.
3. Foliar application of HaNPV (*Helicoverpa armigera* Nuclear Polyhedrosis Virus) for *H. armigera* @ 250 LE/ha.
4. The major predators of soybean insect pests are given in the table 2.

Table 2: Major predators of insect pests of soybean

Insect pests attacked	Predator
Whiteflies	Lady bird beetles: *Coccinella septumpunctata* *Coccinella transversalis*
Lepidopterous caterpillars	Pentatomid bug *Eocanthecona furcellata*
Lepidopterous caterpillars and Whiteflies	Spiders: *Lynx* spider and Orb weaver spider

Chemical Control: The control of insects with pesticides/insecticides is known is chemical control. The insecticides are applied only when the population of insect pests crossed the Economic Threshold Level (ETL) (Table 3). The list of insecticides recommended for soybean insect pests are given in table 4.

Table 3: Economic Threshold Level (ETL) of soybean insect pests

Insect Pest	Crop stage	Population/ meter
Green semilooper	Flowering	2 larvae
Tobacco caterpillar	Flowering	4 larvae
Girdle beetle	Flowering	10 % infestation
Pod borer	Podding	3 larvae

Table 4: List of insecticides recommended for soybean insect pests

Insect pest	Insecticide	Dosage
Sucking pests, stem fly	Thiamethoxam 30 FS (Seed treatment)	10ml/kg seed

Sucking pests	Acetamiprid 20 SP	100 ml/ha
Sucking pests	Spiromesifen 22.9 SC	600ml/ha
Sucking pests	Imidacloprid 17.8 SL	500 ml//ha
Sucking pests and girdle beetle	Triazophos 40 EC	800ml/ha
Defoliators	Dichlorovos 76EC	500 ml/ha
Defoliators and pod borer	Quinalphos 25 EC	1500 ml/ha
Sucking pests and defoliators	Monocrotophos 36 SL	800 ml/ha
Pod borer	Indoxacarb 15.8EC	333 ml/ha
Defoliators, stem fly and girdle beetle	Chlorantraniliprole 18.5 SC	150 ml/ha
Leaf miner	Carbaryl 50WP	2.0 kg/ha
Leaf miner and sucking pests	Oxydemeton methyl 25EC	350 ml/ha
Girdle beetle	Phorate 10 G	10 kg/ha
Stemfly and girdle beetle	Carbofuran 3 G	30 kg/ha

Bio-insecticides

Tobacco caterpillar (*Spodoptera litura*)

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

***Hairy caterpillar* (*Spilosoma obliqua*)**

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

Semilooper (*Chrysodeixis acuta*)

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

Soyabean leaf miner (*Odontota horni*)

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

vii. Major disease associated with crop: YMV, leaf spot, blight, Collar rot, rust

viii. IPM Module for management of disease:

Rust: *Phakopsora pachyrhizi*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Hexaconazole 5% SC	500	30
Propiconazole 25% EC	500	26

Collar rot: *Sclerotium rolfsii*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Carboxin 37.5%+ Thiram 37.5% DAS	3.0/Kg	Seed Treatment

ix. Major weeds associated with crop : *Oxalis latifolia, Phylanthus niruri , Amaranthus viridis,Euphorbia hirata, Solanum* sp,*Tribulus* sp,*Cyperus* sp

x. Production constraints in agro-ecological region:

1. Apply Trifluralin 48%EC @ 1.0 kg a.i/ha as pre plant incorporation.
2. Apply Alachlor 50%EC @ 2-2.5 kg a.i/ha or Pendimethalin 30%EC @ 0.75-1.0 kg a.i/ha or Pendimethalin 30% EC + Imazethapyr 2% EC @ 0.75+0.05 kg a.i/ha or Metribuzin 70%WP @ 0.35-0.525 kg a.i/ha or Diclosulam 84% WDG @ 22-26 g a.i/ha within 3 days after sowing.
3. Apply Quizalofop- ethyl 5%EC @ 0.0375-0.05 kg a.i/ha or Fenoxaprop-p-ethy l 9.3% EC 0.1 kg a.i/ha or Haloxyfop 10.5% EC 108-135 g a.i/ha at 20-25 days after sowing to control grassy weeds.
4. Apply Imazethapyr 10%SL @ 0.1 kg a.i/ha or Imazamox 35%+ Imazethapyr 35% @ 0.07 kg a.i/ha at 20-25 days after sowing to control grassy and non grassy weeds.
5. Apply any pre emergence herbicide followed by one hand weeding at 30-35 days after sowing.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in

specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Timely Sowing, Seed treatment,
5. Use of HYV,
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM
8. INM and soluble fertilizer
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, wild animal damages, migration,
4. Poor Irrigation facilities

7H. Name of oilseed crop: Toria/sarson

i. Existing varieties being used: Rara,Gharia

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PT-303,507,Uttara, PPS-1

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. un decomposed FYM 1.0-2.0qt./nali,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Land preparation:

a. One ploughing followed by 2-3 harrowings and planking
b. Using Zero till ferti- seed drill will increase farmers' income reducing the costs of planting and improving productivity.

2. Sowing time to improve productivity and income:

a. ***Toria***: Last week of September.
b. **Yellow *sarson* & *rai* (Mustard)**: First fortnight of October.

3. Seed treatment

a. Apron 35 SD @ 5g/kg.
b. Only certified seeds should be used.

4. Seed rate and spacing:

a. ***Toria*:** 4kg/ha about 3-4 cm deep in 30 cm apart rows
b. **Yellow *sarson* & *rai* (Mustard)**: 5 kg/ha with a row spacing of 30-45 cm.

5. **Thinning:**

a. About 20-25 days after sowing maintaining a plant to plant space of 10 cm.
b. The thinned out plants could be used as **green forage**.

6. Nutrient management:

a. **Vermicompost:** 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.
b. **Nitrogen:** 120kg/ha **,**60-80 kg/ha for *toria*
Half of the N as basal and remaining half be top dressed about 25- 30DAS
Excess use of nitrogenous fertilizers should be avoided.
c. **Phosphorus**: 40 kg/ha as basal, be applied as SSP

d. **Potassium**: 20 kg/ha as basal
e. **Sulphur:** if SSP is not available, 20 kg/ha Sulphur shall be applied as basal.

7. Water management:

a. Rosette (25-30 days) and pre-flowering stages are the most sensitive to water deficit.
b. Hence, irrigations shall be made at these stages wherever possible.

8. Harvesting and threshing:

a. The crop should be harvested when about 75 % of the siliquae turn yellowish brown.
b. After threshing, seeds should be stored with less than 8% moisture.

v. Major insect pests associated with crop: Aphid, Mustard saw fly, Hairy caterpillar, white fly

vi. IPM Module for management of insect pests:

Mustard aphid: ***Lipaphis erysimi***

1. Timely sowing of crop
2. Removal & destruction of Aphid infested twigs at flowering and siliquae formation stages.
3. Release of larvae/adult of lady bird beetle (***Coccinella septempunctata***) @ 50,000/ha

Name of the Insecticdes	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG	50-100	21
Oxydemeton-methyl 25% EC	1000	
Dimethoate 30% EC	660	
Chlorpyriphos 20% EC	500	

Mustard saw fly : ***Athalia lugens proxima***

Name of the Insecticides	(gm/ml) /ha
Imidacloprid 70% WS (Seed treatment/Kg)	7.0
Dimethoate 30% EC	660
Quinalphos 25% EC	1200

vii. Major disease associated with crop : Blight, Rust, Downy Mildew

viii. IPM Module for management of disease (except organic areas):

1. Field sanitation *i.e*. collect and burn the diseased plants debris to minimize the primary source of inoculum.
2. Timely sowing of crop
3. Crop rotation with non host crops (like rice or maize) for at least 5 years in case of severe disease problems

Alternaria blight or Leaf spot: ***Alternaria brassicae***

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Iprodione 50% WP	2250-3000	50

White rust : ***Albugo candida***

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Metalaxyl 35% WS (Seed treatment/Kg)	6-0	
Metalaxyl 8%+ Mancozeb 64% WP	2500	56
Metalaxyl 4%+ Mancozeb 64% WP	2500	60

Downy mildew: ***Peronospora parasitica***

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Metalaxyl 4%+ Mancozeb 64% WP	2500	60

ix. Major weeds associated with crop: *Cyperu*s spp.

x. IPM Module for management of weeds: Hand weeding; Pre –emergence application of Pendimethalin @ 1kg ai/ha within two days of sowing. About 20-25 days after sowing a hand weeding be done along with the thinning operation to take out the emerged weeds

Umbrella plant: ***Cyperus rotundus*** **(annual, monocot, narrow leaves, sedge)**

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Chlorimuron ethyl 25% WP	24	60

2,4-D Ethyl Ester 4.5% GR	25000	
MCPA, Amine salt 40% WSC	2000-5000	
Metsulfuron methyl 20 %WP	20	60

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing as sole cropping ,
2. Timely Sowing,
3. Seed treatment,HYV,IPM

xii. Production constraints in agro-ecological region:

1.Less availability of agriculture inputs,
2.Use of imbalance and un decomposed FYM,
3.Climate changing, Wild animal damages
4.Migration specially from border area,
5.Poor Irrigation facilities

8A. Name of the Fruit crop: Peach

i. Existing varieties being used: Paradelux, July Elberta, Red June

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Alxander, Red Globe, Crest heaven, Glo Heaven etc Nectarine- Snow Queen

iii. Existing package of practices being used:

1. Use of old and traditional Varieties
2. Poor knowledge of canopy management practices
3. Organic inputs for crop production
4. No knowledge of high density orcharding
5. Irrigation facilities are rarely used
6. Lack of grading and packing facilities
7. No canning or processing unit
8. No availability of waste management of crop residue

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Need to introduce non-clingstone varities with maturity indices on or before June.
2. Use of High denisty plantation with mulch and supplemetation of drip irrigation.

v. Major insect pests associated with crop: San jose scale, Tent caterpillar, Codlling moth, Peach leaf curl, Peach fruit fly

vi. IPM Module for management of insect pests:

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. Traps Parasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Name of the Insecticdes	(gm/ml) /ha	Waiting period (days)
Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.

4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella* sp. Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Peach leaf curl aphid

Name of the Insecticdes	(gm/ml) /ha	Waiting period (days)
Carbosulfan 3% CG	1000	33300
Oxydemetonmethyl 25% EC	0.025%	1500-2000

Peach Fruit Fly:

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap.
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

vii. Major disease associated with crop: Gummosis is major problem

viii. IPM Module for management of disease:

Peach leaf curl

Name of the Fungicides	(gm/ml) /ha
Lime sulphur 22% SC	1%

ix. Major weeds associated with crop: *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. High density plantation with (3x3mts) supplemented with drip irrgation system.
2. Intercropping of leguminous crops like rajma, bhat and gahat crops etc.

xii. Production constraints in agro-ecological region:

1. Availability of Quality planting material

2. Need to delineate the table and canning type varieties.

8B.Name of the Fruit crop: Pear

i. Existing varieties being used: Gola, Victoria, China, Baggugosha, Kashmiri, Thumb pear etc

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Max Bartlette, Red Bartlette, Willium, Starkrimson, Hokoi, Sukoi (Low hills)

iii. Existing package of practices being used:

1. Use of old and traditional varieties
2. Less or no use of mulch for water conservation
3. Canopy management is poor
4. Recommended Cultural practices are rarely applied
5. Maturity indices are rarely use
6. Surplus management of fruit are not done
7. Processing industries are not established for Gola nashpati

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of new strains or occidental pears are needed for high hills
2. Introduction of new strains with less gritcells in fruits
3. Need to develop Postharvest management system with minimum losses.
4. Processing facilities needs to be strengthened.

v. Major insect pests associated with crop: San jose scale, tent caterpillar, codlling moth, peach curl aphid, peach fruit fly

vi. IPM Module for management of insect pests:

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Name of Insecticides	(gm/ml)/ha	Waiting period (days)
Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.
5. Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent

release at weekly interval.

9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Name of Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Carbosulfan 3% CG	1000	33300
Oxydemetonmethyl 25% EC	0.025%	1500-2000

Peach Fruit Fly:

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap.
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

vii. **Major disease associated with crop:** Fruit rot

viii. IPM Module for management of disease: Applications of contact and systematic fungicides

ix. Major weeds associated with crop: *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

Introduction of New Strain *viz*. Anjou, Starkrimson in high hills.

xii. Production constraints in agro-ecological region:

1. Availability of quality planting material
2. Excess Rainfall, adverse weather during season hits the spraying schedule of apple.
3. Negligence of drainage cause the root zone decrease.
4. Lesser emphasis on sanitation of orchard which leads the infection of diseases.
5. Lack of adaptation of proper technical knowhow during training and pruning in high /ultra high density orchard.
6. No proper facilities of cold chain.
7. Disaster during monsoon hit the specific workable and sustainable intensification yields.
8. No easily access to marketing facilities.

8C. Name of the Fruit crop: Plum

i. Existing varieties being used: Santa rosa, Beauty, Burbank

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Italian plum, Prunes viz Frontier

iii. Existing package of practices being used:

1. Use of old and traditional varieties
2. Less or no use of pollinizer varieties in plum especially in japnese type varieties
3. Less or no use of mulch for water conservation
4. Canopy management is poor

5. Recommended cultural practices are rarely applied
6. Maturity indices are rarely use
7. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: High density plantation with drip irrigation system.

v. Major insect pests associated with crop: Coddling moth, Tent caterpillar, San Jose, Leaf Curl Aphid, Peach Fruit Fly.

vi. IPM Module for management of insect pests:

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators, *Chilocorus bijugus* Mulsant*, Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Name of the insecticides	(gm/ml)/ha	Waiting period (days)
Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.
5. Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Name of the insecticides	(gm/ml)/ha	Waiting periods (days)
Carbosulfan 3% CG	1000	33300

Oxydemetonmethyl 25% EC	0.025%	1500-2000

Peach Fruit Fly:

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

vii. Major disease associated with crop: -

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: *Chenopodium album, Cyperus rotundus, Cynodum dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. High density plantation (3x3 mts) with drip irrigation
2. Intercropping of soybean or gahat or lentil in rabi season
3. Mulch technology
4. Post harvest management of perishable with refrigeration system and development of fruit wines factories in the state.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable and elite planting material
2. Poor technical knowledge

8D.Name of the Fruit crop: Kiwi

i. Existing varieties being used: Allison, Bruno, Hayward, Tomari, Abbott, Monty

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Allison, Bruno, Hayward, Tomari, Abbott, Monty

iii. Existing package of practices being used:

1. Canopy management is poor
2. Recommended Cultural practices are rarely applied
3. Maturity indices are rarely use
4. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Proper planting distance,
2. Proper training and pruning
3. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
4. Need to develop Postharvest management system with minimum losses.

v. Major insect pests associated with crop: -

vi. IPM Module for management of insect pests: -

vii. Major disease associated with crop:

viii. IPM Module for management of disease:

ix. **Major weeds associated with crop:** Local

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Proper orchard establishment
2. Proper training and pruning
3. Proper orchard management practices like fertilizer, irrigation, insect and disease control

measures

v. **Production constraints in agro-ecological region:**
Availability of quality planting material

8E.Name of the Fruit crop: Citrus

i. **Existing varieties being used:** Locally seeded variety

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**
Malta : Blood red, Valencia
Kinnow
Lemon & lime: Pant lemon 1, Kagzi lime
Orange

iii. **Existing package of practices being used:**
1. Orchard management is poor
2. Recommended Cultural practices are rarely applied
3. Maturity indices are rarely use
4. Processing industries are not established

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
1. Proper planting distance,
2. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
3. Use of micronutrients
4. Need to develop Postharvest management system with minimum losses.

v. **Major insect pests associated with crop:** Leaf miner,

vi. **IPM Module for management of insect pests:**

Lemon butterfly:
1. Hand picking of all stages and destroy.
2. Grow attractant plants: Carrot family, sunfl ower family, buckwheat, alfalfa, corn, shrubs for lacewing attraction.
3. Nectar rich plants with small flowers i.e. anise, caraway, parsley, mustard, sunflower, buckwheat and cowpea for attraction Braconid wasp.
4. Conserve the parasitoids such as *Trichogramma evanescens*, *Telenomus* spp on eggs *Brachymeria* spp*, Cotesia* on larvae and *Pterolus* sp. on pupae.
5. Spraying of entomogenous - fungus, *Bacillus thuringiensis* Berliner, nematode DD-136 strain or neem seed extract (3%) also gives quite high mortality of caterpillars.

Name of the Insecticides	**(gm/ml)/ha**	**Waiting periods (days)**
Quinalphos 25% EC	0.025%	1500-2000

Scale insects:
1. Orchard sanitation.
2. Prune the infested shoots and destroy them.
3. Open the tree canopy from centre for better light penetration
4. Spray 1% pongamia oil or 4% neem seed extracts at 21 and 7 days interval, respectively.

Name of the Insecticides	**(gm/ml)/ha**
Quinalphos 25% EC	4200-5600

Citrus leaf miner: *Phyllocnistis citrella*

Name of the Insecticides	**(gm/ml)/ha**	**Waiting periods (days)**
Phorate 10% CG	15000	
Carbofuron 3% CG	50000	
Imidacloprid 17.8% SL	50	15

vii. Major disease associated with crop: Canker , Dieback, Gummosis, Scab, Powdery mildew

viii. IPM Module for management of disease:-

Citrus canker: *Xanthomonas campestris* pv.*citri*

Name of the Fungicides	**(gm/ml)/ha**
Copper oxychloride 50% WG (per lit)	2.50
Streptocyclin (Spray)	50-100 ppm

Gummosis : *Phytophthora citrophthora, P. palmivora, P. parasitica*

Name of the Fungicides	**(gm/ml)/ha**	**Waiting periods (days)**
Aureofungin 46.15% SP (Drenching)	1%	30

Scab : *Elsinoe fawcetii*

Name of the Fungicides	**(gm/ml)/ha**	**Waiting periods (days)**
Captan 75% WP	0.12%	1667

Powdery mildew

Name of the Fungicides	**(gm/ml)/ha**	**Waiting periods (days)**
Sulphur 80% WP	2500	3130

ix. Major weeds associated with crop: *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Chemical, mechanical and biological control

Umbrella plant: *Cyperus rotundus* (annual, monocot, narrow leaves, sedge)

Name of the Herbicides	**(gm/ml)/ha**
Chlorimuron ethyl 25% WP	24
2,4-D Ethyl Ester 4.5% GR	25000
MCPA, Amine salt 40% WSC	2000-5000
Metsulfuron methyl 20 %WP	20
Orthosulfamuron 50% WG	150
Bensulfuron methyl 0.6% + Pretilachlor 6% G	10000

***Cynodon dactylon* (perennial, dicot, narrow leaves, grass)**

Name of the Herbicides	**(gm/ml)/ha**
2,4-D Ethyl Ester 4.5% GR	**25000**
Bensulfuron methyl 0.6 %+ Pretilachlor 6 %G	**10000**

Bathua/pigweed: *Chenopodium album* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	**(gm/ml)/ha**	**Waiting period (days)**
Carfentrazone ethyl 40% DF	50	80
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38% EC	1320-2200	
Methabenzthiazuron 70 %WP (POE: 30DAS)	2000-2500	100
Methabenzthiazuron 70 %WP (POE: 16-18 DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20%WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Heavy soil)	4200	
Sulfosulfuran 75% WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110

Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Proper Canopy Management (Training and Pruning)
2. Spraying schedule is required to avoid the diseases and pest in orchard.
3. INM modules to overcome the early senility of plants.
4. PHM & marketing to be enhanced.

xii. Production constraints in agro-ecological region:

1. In hilly terrain due to sloppy surface, nutrient loss is more as compared to plains.
2. In rainy season, water logging resulted the canker
3. Early degradation of plant (dieback& physiological disorder) health due to lack of proper nutrient management.

9A. Name of the Vegetable crop: Cabbage

i. Existing varieties being used: Golden acre or mix of varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole Green star, Pride of India

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Cultivars- In cabbage, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be head formation. Use of hybrid varieties only
8. Transplanting- Farmers practices improper planting distance.
9. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field. Use of organic manures
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
12. Harvesting- The harvesting should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Promotion of high yielding round shaped, 100% heading percentage, mature within 90 days.

1. Soil Testing- Farmers should test their soils before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to go for deep ploughing before sowing the crop particularly during the hot season or before the snowfall
3. Seed- Farmers should adopt improved varieties/ hybrids
4. Soil solarisation practice should follow in nursery beds.
5. Seed Treatment- To combat the different seed borne diseases to treat the seed by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing
6. Seed Rate- It is recommended to use the seed quantity for different as follows- (Early)-600-700g/ ha open pollinated

(Mid and Late)- 500-550g/ha open pollinated
(Hybrid)-350-400g/ha

7. Optimum sowing time :Mid Sept- Oct
8. Transplanting- Farmers should transplant seedlings properly as for early (40x45cm), medium (40x45cm),
9. Manures and fertilizers- Farmers should incorporate well rotten cow dung (20-25tonnes/ha) and NPK (120:60:60) in irrigated, half dose of NPK in unirrigated condition.
10. Irrigation- As per requirements. At critical stages such as head initiation and head development
11. Weed control- Farmers must know about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically.
12. Harvesting- The farmer must aware about the maturity stage of a particular crop variety so he can harvest the crop as per their object. In general the heads should be harvested when they attempt the size in between 500-750 gms.

v. Major insect pests associated with crop: Diamond black moth, cabbage butterfly, Aphid and Painted bug

vi. IPM Module for management of insect pests :

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Hand picking and destruction of cabbage butterfly eggs and larvae in nursery as well as main crop to reduce the pest multiplication.
3. Growing of African bold seeded mustard as trap crop at 22:2 ratio (Cabbage: Mustard) to attract DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

After Planting

1. Regular Monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Hook out the head borer and destroy mechanically. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT.

Dimond back moth: *Plutella Xyllostella*

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	50	3
Cyantraniliprole 10.26% OD	600	5
Indoxacarb 14.5% SC	200-266	7
Indoxacarb 15.8% EC	266	5
Spinosad 2.5% SC	600-700	3
Chhlorfenapyr 10% SC	750-1000	7
Emamectin benzoate 5% SG	150-200	3
Flubendamide 480% SC	45-60	7
Flubendamide 20% WG	90-120	7
Chlofluazuron 5.4% EC	1500	7
Diafenthiuron 50% WP	600	7
Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7

Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	600-1000	
Bacillus thuringiensis serovar kurstaki (3a,3b,3c) 5% WP	500-1000	
Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500	

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7

Painted bug

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Dimethoate 30% EC	200	660

vii. Major disease associated with crop: *Sclerotenia* stem rot, *Xanthomonas* Black rot and Downy mildew

viii. IPM Module for management of disease(except organic areas):

***Sclerotenia* stem rot:**

1. Summer deep ploughing,
2. Burn the infected crop debris,
3. Two spray at 10-12 days interval of carbendazim @ 1.0 gm / litre

***Xanthomonas* Black rot:**

Seed treatment with Streptocyclin @ 100 mg/kg seed and two spray of Streptocyclin 1.0 gm / 10 litre of water after 10-12 days interval.

Downy Mildew:

1. Burn the infected crop debris,
2. Spray of mancozeb @ 2.5 gm/litre at initial stage of disease appearance.

ix. Major weeds associated with crop: *Parthenium, Chenopodium album*, Krishnil, Teepatiya

x. IPM Module for management of weeds:

1. Use of weedicides, if required.
2. Weeding, hoeing
3. Deep ploughing

Bathua/pigweed: *Chenopodium album* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Carfentrazone ethyl 40% DF	50	80
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38% EC	1320-2200	
Methabenzthiazuron 70 %WP (POE: 30DAS)	2000-2500	100
Methabenzthiazuron 70 %WP (POE: 16-18 DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120

Metribuzin 70% WP (Heavy soil)	300	120
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20%WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Heavy soil)	4200	
Sulfosulfuran 75% WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Use of hybrid varieties suitable for year round production system for mid or high hills.

xii. Production constraints in agro-ecological region:

1. Less heading in open pollinated cabbage
2. Boron deficiency is becoming serious.
3. Less availability of high quality seeds
4. High prices of hybrid seeds
5. Post-harvest losses are more due to non availability of
6. storage facility
7. High prices of fertilizers
8. Low prices of farm produce
9. Lack of knowledge about the cultivation practices
10. Lack of processing facilities
11. So far no minimum support price is fixed for the crop.

9B. Name of the vegetable crop: Cauliflower

i. Existing varieties being used: Unknown varieties available in the mandi

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:

Mid- Snow crown

Late- Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil.
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Cultivars-In cauliflower, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be curd formation.
8. Transplanting- Farmers practices improper planting distance.
9. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
12. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological

region:

1. **Soil Testing-** Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. **Land Preparation-** The farmers are recommended to open the land before sowing the crop for sterilization.
3. **Seed Treatment-** For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or *Trichoderma viride* 4g/kg before sowing
4. **Seed Rate**- The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha
5. **Planting distance**- Farmers should be sown the seed Asiatic type line to line 45 cm and plant to plant 8cm and European type line to line 30 cm and plant to plant 8 cm
6. **6. Manures and fertilizers**- should be used as per soil testing , General recommendation are **FYM**-250q/ha **Nitrogen**: 60 kg/ **Phosphorus**: 100 kg/ha and **Potassium:** 50kg/ha **Micronutrient:** should be used as per soil testing,
7. **Irrigation**- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at 7-8 days interval and in summer 3-4 days interval
8. **Harvesting**- Depending upon the cultivars, the roots become ready for harvesting in about 25-35 days after sowing. Early and rapid maturing European cultivars reach harvest maturity in 25-30 days after sowing. They become bitter and pithy if the harvesting is delayed. In India, harvesting is done manually. A light irrigation may be given before harvesting to facilitate lifting of roots. In advanced f countries, commercial radish growers use a single row harvester that pulls the plants from the soil, cuts the roots from the tops, and then places them in bags for transportation to a picking shed.

Major insect pests associated with crop: Diamond back moth, Aphids are serious problem

i. IPM Module for management of insect pests :

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Growing of African bold seeded mustard as trap crop at 22:2 ratio to attract DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

After Planting

1. Regular monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT.
5. Spray Dipel 8 SP (Bt var. kurstaki) @ 0.2% at 15 days interval after 22-25 DAT to manage DBM.

Dimond back moth: *Plutella Xyllostella*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	50	3
Cyantraniliprole 10.26% OD	600	5
Indoxacarb 14.5% SC	200-266	7
Indoxacarb 15.8% EC	266	5
Spinosad 2.5% SC	600-700	3
Chhlorfenapyr 10% SC	750-1000	7
Emamectin benzoate 5% SG	150-200	3
Flubendamide 480% SC	45-60	7

Flubendamide 20% WG	90-120	7
Chlofluazuron 5.4% EC	1500	7
Diafenthiuron 50% WP	600	7
Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	600-1000
Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7

ii. Major disease associated with crop: Black rot

iii. IPM Module for management of disease(except organic areas):

***Xanthomonas* Black rot:**

Seed treatment with Streptocyclin @ 100 mg/kg seed and two spray of Streptocyclin 1.0 gm / 10 litre of water after 10-12 days interval.

iv. Major weeds associated with crop: *Parthenium, Chenopodium album*, Krishnil, Teepatiya

v. IPM Module for management of weeds:

1.Use of weedicide if required.
2.Weeding, hoeing
3.Deep ploughing.

vi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Advanced technical package and practises regarding crop.
2. Use of trap crop like radish to attract the white butterfly.
3. Inter Cropping with coriander and rye in hills.

vii.Production constraints in agro-ecological region:

1. Less availability of high quality seeds
2. High prices of hybrid seeds
3. Post-harvest losses are more due to non availability of
4. storage facility
5. High prices of fertilizers
6. Low prices of farm produce

7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities
9. So far no minimum support price is fixed for the crop.

9 C. Name of the vegetable crop: Radish

i. Existing varieties being used: Dunagiri, Chinese Pink and Pusa Himani

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant, Punjab Pasand

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
4. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
5. Sowing time: Sept- Dec
6. Planting distance- Farmers practices improper planting distance and sown through broadcast.
7. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
8. Fertilizers: Farmer use imbalance fertilizer
9. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method.
10. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
11. Harvesting- The root harvesting should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of long white tapering varieties
2. Line sowing and use of less or non-pithy varieties
3. Use of round shaped varieties for culinary purpose

v. Major insect pests associated with crop: Aphids are problem

vi. IPM Module for management of insect pests:

Aphid; *Aphis gossypii* Glover and *Myzus persicae* (Sulzer)

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the numbers considerably without any insecticidal spray.
2. Yellow sticky trap is effective for controlling aphid population.
3. Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha if needed.

vii. Major disease associated with crop: White rust

viii. IPM Module for management of disease(except organic areas):

Use of recommended pesticides in recommended dose

ix. Major weeds associated with crop: Local

x. IPM Module for management of weeds: Weeding manually

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

Use of short duration, non pithy, coloured varieties for year round production.

Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Cauliflower early- Radish- Bottlegourd

Brinjal-Radish –Chilli

Bottle bourd-radish-French bean

xii. Production constraints in agro-ecological region:

1. Pithyness problem in low hills
2. Less availability of high quality seeds

3. High prices of hybrid seeds
4. Post-harvest losses are more due to non availability of storage facility
5. High prices of fertilizers
6. Low prices of farm produce
7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities
9. So far no minimum support price is fixed for the crop.

9D. Name of the vegetable crop: Tomato

i. **Existing varieties being used:** Private company varieties like Himsona, Rakshhak etc.

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VL Tamatar 4; Available good yielding varieties like Naveen2000+, Himsona etc should be used from private sector and varieties like Pusa Sheetal, Pusa Gaurave, Pant T-3 should be used from Government sector for and B Zone

iii. **Existing package of practices being used:**

1. Without soil and seed tretament, Poorly managed nurseries, Subterreaen staking, Non- judicious use of fertilizers,
2. Generally crop grown in open field condition
3. Sowing time- Oct-Nov. And Jan-Feb
4. Sowing space-75x60 cm and 75x45 cm

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Use Inderminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition. Use Zn in deficient soil.
2. Use micronutrient including Ca, B and Mo
3. Crop rotation Tomato-cowpea-Early cauliflower.

v. **Major insect pests associated with crop:** Fruit borer and white flies in low or mid hills are serious pest

vi. **IPM Module for management of insect pests:** Fruit borer and White flies

Tomato fruit borer *Helicoverpa armigera* (Noctuidae: Lepidoptera)

1. Growing trap crop of African tall marigold as border row before 15 days of transplanting is beneficial in reducing egg laying in main crop.
2. Field sanitation and clean cultivation is effective tool to suppress the pest population.
3. Setting of sex pheromone traps @ 5 trap/acre for monitoring is effective.
4. Spray of Ha NPV @ 500 LE/ha mixed with 0.1 per cent UV retardant (Tinopol) and 0.5 per cent jiggery is effective.
5. Use of Bt @ 0.50kg/acre and NSKE 5 per cent to kill early stage larvae. Release of the egg parasitoid, *Trichogramma chilonis* or *T. brasiliensis* @ 1Lakh/ha coinciding with flower initiation at 15 days interval may reduce the pest population.
6. Development of pyridalyl nanocapsule suspension for efficient management of tomato fruit and shoot borer (*Helicoverpa armigera*) is an efficient approach for frequent delivery and effective management.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Indoxacarb 14.5% SC	400-500	5
Chlorantraniliprole 18.5% SC	150	3
Cyantraniliprole 10.26% OD	900	3
Flubendamide 480% SC	120	5
Flubendamide 20% WG	240	5
Novaluron 10% EC	750	1-3
Novaluron 5.25%+ Indoxacarb 4.5% SC	1700	5

Methomil 40% SP	750-1125	5-6
Lambda cyhalothrin 5% CS	300	5

Management strategies(white fly)

A. Crop Hygiene

Field hygiene should be a high priority and should be included as an integral part of the overall strategy for managing whitefly populations, Tomato yellow leaf curl virus(TYLCV) incidence, and insecticide resistance. These practices will help reduce the onset of the initial infestation of whitefly, regardless of biotype, and lower the initial infestation level during the cropping period.

B. Other Cultural Control Practices

Use proper pre-planting practices.

1. Vegetative propagated ornamental plants (i.e. *Hibiscus, Poinsettia*, etc.) should not be grown at the same location, especially if bringing in plant materials from other areas.
2. Avoid yellow clothing or utensils as these attract whitefly adults.
3. Delay planting new fall crops as long as possible.
4. Do not plant new crops near or adjacent to old, infested crops.

Use proper post-planting practices.

1. Apply an effective insecticide to kill whitefly adults prior to cultural manipulations such as pruning, tying, etc. Rogue tomato plants with symptoms of TYLCV.
2. Plants should be treated for whitefly adults prior to rouging and, if nymphs are present, should be removed from the field, preferably in plastic bags, and disposed of as far from production fields as possible.
3. Manage weeds within crops to minimize interference with spraying and to eliminate alternative whitefly and virus host plants.
4. Destroy old crops within 5 days after harvest, destroy whitefly infested abandoned crops.

C. Insecticidal Control Practices.

1. Restricted the use of neonicotinoids (imidacloprid or acetamiprid) in the field only during the first six weeks of the crop thus leaving a neonicotinoid-free period at the end of the crops.
2. Use selective rather than broad-spectrum control products where possible to conserve natural enemies and enhance biological control.
3. Do not apply insecticides on weeds on field perameters. These could kill whitefly natural enemies and, thus, interfere with biological control.
4. Crop rotation is effective tool to prevent pest population.
5. Avoiding of same group of crop in same field for a long time is beneficial.
6. Sticky trap is effective to control whitefly population.

White fly

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period(days)**
Cyantraniliprole 10.26% OD	900	3
Spiromesifen 240% SC	625	3
Thiamethoxam 25% WSG	200	5
Imidacloprid 17.8% SL	150-175	3

vii. Major disease associated with crop: Buckeye fruit rot is a major serious disease.

viii. IPM Module for management of disease(except organic areas):

Buck eye rot:

1. Burn the infected fruit, leaves etc. and staking of plants,
2. Remove the leaves upto 9 inches from ground.

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Mancozeb 75% WP	1500-2000	
Propeneb 70% WP	1500	10

ix. Major weeds associated with crop: *Trifolium alaxenderum , Cyperus rotundus, Cynodon*

dactylon.

x. IPM Module for management of weeds:

Cultural practices.

Through recommended chemicals.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of high yielding varieties grown under ventillated polyhouse using standardized technology with fertigation technology in tomato can enhance the productivity of tomato manifold. Polyhouse technology is a boon for small and marginal farmers with fragmented holdings.
2. Reduce number of spray of pesticides.
3. Raise nursery on treated soil.
4. Treat seed with fungicide before sowing.
5. Manage fog during fruiting period.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continuous cultivation.
2. Poor nursery management in the crop
3. Poor staking and pruning techniques.
4. Poor technical knowhow

9E. Name of the vegetable crop: Potato

i. Existing varieties being used: K. Bahar, K Badshah, and Kufri Jyoti

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: K Jyoti, K. Ashok , K. Himsona

iii.Existing package of practices being used:

1. Planting time:
2. Region B (1000-1500) : Feb-March
3. Spacing: 50-60 x 15-20 cm
4. Seed rate: 25-30 qtl/ha
5. Farmers are only using FYM along with urea at hills but the farmers in plains are using FYM + 160:100:120kg/ha NPK

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with application of organic manures.
2. Fertilizer should be used on soil test basis. Dehaulming practise should be adopted for long duration storage of tubers.
3. Suitable fungicides should be used for control of Late blight disease e.g. mancozeb, cardendazim alone and in combination.

v. Major insect pests associated with crop: Potato tuber moth, Hadda beetle, Potato aphid, White grub is a serious and wide spread problem

vi. IPM Module for management of insect pests:

Potato tuber moth: *Phthorimaea operculella*

1. Heaps of green grasses may be kept at suitable interval in infested field during evening and next day early in the morning along with caterpillars to destroy.
2. Clean cultivation and mechanical destruction of caterpillars also help in reducing pest infestation.
3. Irrigation also brings them on the surface and birds shall predate them.
4. Apply chlorpyriphos 20EC at the rate of 2.5ml/l in the soil before seed sowing.

Epilachna beetle: *Epilachna viginatioctopunctata*

1. Hand packing of grubs and collection of beetles by hand nets during early stages of attack, helps in reducing the intensity of infestation.

2. Conservation and augmentation of natural parasitoids viz. *Pediobius foveolatus, Pleunotrogrus faveolatus* and *Tetrastichus* sp.
3. Application of Neem, Mahua, ground nut cakes are efficient in suppressing the pest population.
4. Spray of Malathion 50 EC in 200 liters of water per acre provides effective control of this pest

Aphids: *Myzus persicae*

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the numbers considerably without any insecticidal spray.
2. Yellow sticky trap is effective for controlling aphid population. Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG (Spray)	100	77
Thiamethoxam 25% WSG (Drenching)	200	77
Dimethoate 30% EC	660	
Oxydemeton-methyl 25% EC	1000	
Carbofuran 3% CG	16600	
Phorate 10% CG	10000	

White grub - use of VL Kurmula trap 1,use of WGPSB2 Bio-Formulation @ 10 gm/kg vermicompost or FYM,drenching of Chlorpyriphos @ 2ml/L

vii. Major disease associated with crop: Late blight and common scab disease in the crop and tuber.

viii. IPM Module for management of disease:

Late blight of potato: *Phytophthora infestans*

1. Use resistant verities.
2. Burn the infected crop debris, avoid excess moisture,

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Cyazafamid 34.5% SC	200	27
Chlorothaonil 75% WP (per lit. water)	0.875-1.250	14
Azoxystrobin 23% SC	500	12
Mandipropamid 23.4% SC (per lit. water)	0.8	40
Propineb 70% WP	0.30%	15
Captan 50% WG	1500	21
Captan 75% WP	1667	8
Copperoxychloride 50% WP	1250	
Copperhydroxide 53.8% DF	1500	22
Dimethomorph 50% WP	1000	16
Hexaconazole 2% SC	3000	21
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Metalaxyl 8%+ Mancozeb 64%WP	2500	49
Metalaxyl 4%+ Mancozeb 64%WP	2500	24
Capatan70%+ Hexaconazole 5% WP	500-1000	21
Carbendazim 25%+ Mancozeb 50%WS	0.6-0.7/Kg	Seed Treatment
Cymoxanil 8%8% +Mancozeb 64%WP	1500	10
Famoxadone 16.6%+Cymoxamil 22.1% SC	500	40
Fenamidone 10%+ Mancozeb 50% WG	1250-1500	30

Metiram 55%+ Pyraclostrobin 5% WG	1500-1750	15
Metalaxyl 3.3%+ Chlorothanil 33.1% SC	0.02%	34

Potato scab: *Streptomyces scabiei*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Thiram 75% WS (Seed Treatment/ Kg)	2.5-3.0	7-10

ix. Major weeds associated with crop: *Ranunculus, Cyperus, Chenopodium album*

x. IPM Module for management of weeds:

Bathua, Pigweed*: Chenopodium album* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D Dimethyl amine salt 58% SL	2000	3440
Oxyflourfen 23.5% EC	100-200	425-850

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Selection of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja.
2. Seed treatment should be followed.
3. Planting of pre-sprouted tubers should be done.
4. Proper crop rotation to should be followed.
5. Winter/ summer ploughing of fields.
6. Use of organic mulching material in appropriate thickness especially under rain fed mid hills agro climatic conditions.
7. Dehaulming practise should be adopted by the farmers for long duration storage of tubers.
8. Medium size whole tuber should be used as planting material.

xii. Production constraints in agro-ecological region:

1. Early mature varieties.
2. Use of Kufri Girriraj and Kufri Jyoti varieties supplementation with use of optimal tuber size,
3. Selection of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja.
4. Seed treatment should be followed.
5. Planting of pre-sprouted tubers should be done.
6. Proper crop rotation to should be followed.
7. Winter/ summer ploughing of fields.
8. Use of organic mulching material in appropriate thickness especially under rain fed mid hills agro climatic conditions.
9. Dehaulming practise should be adopted by the farmers for long duration storage of tubers.
10. Medium size whole tuber should be used as planting material.

9 F. Name of the vegetable crop: Brinjal

i. **Existing varieties being used:** Non descriptive or non identified varieties, Pant Rituraj, Pant smrat. Locally available varieties

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Navkiran, Brinjal 704 (SunGro Seed), Navina, VNR212 (VNR Seed), IndameSupriya (Indo-American), Pant Rituraj, Pant Samrat (Pantnagar), Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Nursery- Nursery soil generally not sterilize by the farmers.
4. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
5. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
6. Sowing time: Dec-Jan, June-July
7. Transplanting- Farmers practices improper planting distance.

8. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
9. Fertilizers: Farmer use imbalance fertilizer
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method..
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
12. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Availability of purple and round varieties in cropping system.
2. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
3. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
4. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
5. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed orTrichoderma viride 4g/kg before sowing
6. Seed Rate- The recommended seed rate of brinjal: Hybrid-250g/ha, Open pollinated-500-600g/ha
7. Transplanting- Farmers should transplant seedlings properly as for non spreading type varieties- 60cm x 60cm, spreading type varieties - 75cm x 60cm.
8. Manures and fertilizers- should be used as per soil testing , General recommendation are FYM-250q/ha Nitrogen: (Hybrid-200kg/ha, Open pollinated-100-120kg/ha) Phosphorus: (Hybrid-100kg/ha, Open pollinated-80kg/ha Potassium: (Hybrid-80/ha, Open pollinated-60kg/h), Micronutrient: should be used as per soil testing,
9. Irrigation- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at7-8days interval and in summer3-4 days interval. Augmenation of assured irrigation for optimal production.
10. Weed control- Farmers must know the about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically. Farmer can control the weeds by hand weeding along with pre-planting surface application @ of 1.0-1.5 kg/ha Alachlor.
11. Growth substances: Use 2,4-D @ 2ppm at flowering stage
12. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

v. Major insect pests associated with crop: Shoot and fruit borers

vi. IPM Module for management of insect pests:

Brinjal fruit & shoot borer: *Leucinodes orbonalis*

1. The damaged portions of the plants and fruits should be removed and destroyed.
2. Early removal of drooping shoots will reduce the fruit infestation.
3. Proper collection of all the infested flower buds, fruits during harvest.
4. Continuous cultivation of brinjal also favors the pest infestation.
5. Varieties like Punjab Barsati, (moderate resistant cultivar) Pusa purple round, Punjab Neelam found to be resistant to brinjal fruit borer.
6. Biological method recommended by IIHR, Bengaluru involving release of *Trichogramma chilonis* @10 to 15 lakh parasites/ha/season along with 2 sprays of *Bt* formulation found to be economically effective.
7. Installation of BSFB (brinjal shoot and fruit borer) pheromone traps Lucinure @3/ha to monitor and mass trap the male moths is effective.

8. Neem Seed Kernal Extract(NSKE)5 % per cent at the time of flowering is effective.
9. Prevent continuous growing of same group of crop at same field.
10. Rotate brinjal with cabbage or other crops

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC -	200	22
Emamectin Benzoate 5% SG	200	3
Thiacloprid 21.7% SC	750	5
Thiodicarb 75% WP	625-1000	6
Lambda cyhalothrin 5% CS	300	5
Cypermethrin 25% EC	150-200	1
Betacyfluthrin 8.49%+ Imidacloprid 19.81% OD	200	7
Triazophos 35% + Deltamethrin 1% EC	1250	3
Pyriproxyfen 5%+ Fenpropathrin15% EC	750	7

vii. Major disease associated with crop: Phomopsis blight and rot (*Phomopsis vexan*) is a serious problem in the hills.

viii. IPM Module for management of disease:

1. Use healthy seed materials for sowing.
2. Seed should be extracted only from disease free fruits.
3. After extraction of seeds it should be dried for a week and then stored.
4. Avoid continuous cultivation of brinjal. A rotation of brinjal - paddy - gingelly will helps to check the disease development.
5. In the fields the affected plants and debris should be collected and burnt
6. During summer deep ploughing should be given.
7. Spray following insecticides

Blight

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Zineb 75% WP	1125-1500	1500-2000

ix. Major weeds associated with crop: *Oxalis latifolia, Phyllanthus niruri, Amaranthus viridis,Euphorbia hirata, Solanum* sp.

x. IPM Module for management of weeds:

1. Hand weeding.
2. The field should be kept weed-free, especially in the initial stage of plant growth, as weeds compete with the crop and reduce the yield drastically.
3. Frequent shallow cultivation should be done at regular interval so as to keep the field free from weeds and to facilitate soil aeration and proper root development.
4. Deep cultivation is injurious because of the damage of roots and exposure of moist soil to the surface.
5. Two-three hoeing and the earthing up are required to keep the crop free of weeds.
6. Preemergence application of Fluchloralin (1.5 kg a.i./ha) coupled with one hand weeding 30 days after transplanting is effective for control of weeds

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of hybrids can increase productivity 2 to 3 times higher.
2. Use of mulch in rainy season.
3. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Brinjal- Radish-Bottle gourd, Brinjal- spinach-cowpea, Brinjal- Turnip-Amaranthus, Brinjal- Spinach-Bitter gourd etc.

xii. Production constraints in agro-ecological region:

1. Wild animals problems
2. Marketing problem in rainy season
3. Non-availability of suitable hybrids and High prices of hybrid seeds
4. Post-harvest losses are more due to non availability of storage facility
5. High prices of fertilizers
6. Low prices of farm produce
7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities
9. So far no minimum support price is fixed for the crop.

9 G. Name of the vegetable crop: Chilli

i. **Existing varieties being used:** Local, Andhara Jyoti, LCA-206

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Kashi Anmol, Pant C-1, Tajwasni, Pusa Sadabhar, Punjab Lal, Panjab Surkh, CH-1 and CH-3

iii. **Existing package of practices being used:**

1. Growing local varieties.
2. No line transplanting.
3. Generally they plant two over aged seedling at one place.
4. No or very less use of fertilizer.
5. Sowing of untreated seed.

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Grow high yielding varieties.
2. Treat the seed with copper containing fungicides before sowing.
3. Adopt soil testing.
4. Transplant one seedling at one place.
5. Transplant the seedlings when they attain 5-6 leaf stage.
6. Transplant the seedlings at proper spacing-
   Dwarf varieties like Kashi Anmol at 45 x 30 cm
   Tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm.
7. Apply recommended dose of fertilizer (15-20 t FYM + 120: 60:60NPK/ha) after soil test in irrigated condition, whereas under unirrigated condition apply half dose of recommended NPK.
8. Use of seed treatment like Pant bioagent 3 for managing seed and soilborne diseases.
9. Earthening up of plants within 45 days after transplantation to get rid off waterlogging
10. Use of high dose of organic manure i.e. 200 q/Ha increases productivity and incidence of dieback and Anthracnose.

v. **Major insect pests associated with crop:** Thrips problem is major problem

vi. **IPM Module for management of insect pests :**

1. Thrips *Franklinothrips vespiformis* (Crawford) and *Erythrothrips asiaticus* R. &. M. are predaceous in nature and their population may be encouraged by avoiding chemical sprays.
2. Yellow or blue sticky trap is effective for controlling this pest.
3. If still the population persist spraying of imidacloprid 70% WG @ 0.25ml/l or acetamiprid 20%SP @ 0.2g/l or thiomethoxam 25%WG @ 0.2g/l or metasystox@1.5ml/l is effective.

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Thiamethoxam 30% FS (Seed Treatment)	7/Kg	
Imidacloprid 70% WS (Seed Treatment)	10-15/Kg	
Cyantraniliprole 10.26% OD	600	3
Emamectin benzoate 5% SG	200	3

Spinosad 480% SC	160	3
Acetamiprid 20% SP	50-100	3
Thiacloprid 21.7% SC	225-300	5
Indoxacarb 14.5%+ Acetamiprid 7.7% SC	400-500	5
Flubendamide 19.92%+ Thiacloprid 19.92%	200-250	5
Methomil 40% SP	750-1125	5&6
Lambda cyhalothrin 5% EC	300	5
Ethion 50% EC	1500-2000	5
Fipronil 5% SC	800-1000	7
Imidacloprid 17.8% SL	125-250	40

vii. Major disease associated with crop: Dieback and anthracnose is major disease of block.

viii. IPM Module for management of disease:

Dieback

1. Use of disease-free seeds is important in preventing the disease. Seed treatment with Thiram or Captan 4g/kg is found to be -effective in eliminating the seed-borne inoculum.
2. Good control of the disease has been reported by three sprayings with Ziram O. 25% Captan 0.2% or miltox 0.2%. Chemicals like wettable Zineb 0.15% not only reduced the disease incidence but also increased the yield of fruits.

Anthracnose

1. Seeds should be obtained from spotless fruits.
2. Debris of diseased crop should be collected and burnt.
3. Seed treatment with thiram or captan at the rate of 2.5 g/kg of seed.

ix. Major weeds associated with crop: *Euphobia hirta*, *Cynodon dactylon* , Cyprus and Oxalis

x. IPM Module for management of weeds:-

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of tall hybrids supplentation of organic packages of practices to be followed
2. Grow high yielding varieties.
3. Treat the seed with copper containing fungicides before sowing.
4. Adopt soil testing.
5. Transplant one seedling at one place.
6. Transplant the seedlings when they attain 5-6 leaf stage.
7. Transplant the seedlings at proper spacing.

xii. Production constraints in agro-ecological region:

1. High incidence of flower and fruit drop in chillies
2. Fruit losses due to high incidence of dieback and anthracnose.
3. Non availability of quality seed.
4. Less irrigation facilities.
5. High cost of hybrid seeds.
6. Unaware about the insect-pest management.

9H. Name of the vegetable crop: Cucumber

i. Existing varieties being used: Kalyanpur Green, Japanese Long Green, Poona Khira, Pant Khira-1, Poinsette, Japanese Long Green, Straight Eight, Swarna Sheetal, Swarna Poorna, Swarna Ageti etc.Local and traditional varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:

For open field condition: Pusa Udhay, Pusa Barkha,Shubhangi, Himangi, Punjab Naveen, Tasty, Ruchi, Mandakini, Kumud, Noori, Alamgir, Rani, Don etc,

For protected condition: Pant Parthenocarpic Cucumber-2 & 3, Hilton, Kian, Isatis, Malini etc.

iii. Existing package of practices being used:

1. Use of traditional seeds,
2. Planting in rainy season,
3. Traditional stacking method,
4. Long harvest duration season,
5. Sale at local market
6. Absence of crop rotation.
7. Random selection of variety (May or may not be suited to Agroeco-region).
8. Untimely sowing / planting of crop.
9. Use of untreated seed.
10. Unbalanced use of fertilizers.
11. Use of plant protection chemicals having long wetting period.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Glasshouse or polyhouse technology
2. Use of Hybrids or/and Pathenocarpic varieties
3. Management of crop geometry.
4. Use of organic manure or fertigation inside polyhouse.
5. Management of Dacus and other flies.
6. Use of protected cultivation.
7. Adoption of crop/ soil health related crop rotations.
8. Recommended/suitable variety for Agroeco-region.
9. Use recommended spacing eg. 60-200 × 50-100 cm
10. Treating seed before sowing.
11. Balanced use of fertilizers (125: 155: 125 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).
12. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
13. Selection of optimum planting period.Region B: (Protected cultivation): Feb to June
14. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
15. Adoption of micro irrigation technologies for efficient use of available water.
16. Adoption of fertigation system for efficient use of fertilizers

v. Major insect pests associated with crop: Leaf miner, white fly, thrips, leaf eating caterpillar, fruit fly, cut worm, red pumpkin beetle Fruit flies

vi. IPM Module for management of insect pests : Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

Red pumpkin beetle

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Dichlorovos 76% SC	500	627

vii.Major disease associated with crop: Powdery mildew and downy mildew

viii. IPM Module for management of disease(except organic areas):

Downy mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Zineb 75% WP	1500-2000	
Cymoxanil 8%+ Mancozeb 64% WP	1500	10
Azoxystrobin 23% SC	500	7
Amectoctradin+ Dimethomorph 20.27% SC	800-1000	3

ix.Major weeds associated with crop:

x. IPM Module for management of weeds: *Oxalis latifolia, Phyllanthus niruri ,Amaranthus viridis, Euphorbia hirata, Solanum* sp

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of well designed and recommended protected technology suited to area i. e poly houses, net house, insect proof net house, shed net house, poly tunnels with the use of mulches & micro irrigation structures.
2. To follow proper crop rotation.
3. Selection of varieties suited to Agroeco-region.
4. To use sufficient quantity of fully decomposed Farm Yard Manure (two year old)/ vermi compost.
5. Balanced use of fertilizers through fertigation.
6. To use technology such as soil solarisation/ chemical treatments for effective control of pests.
7. Timely sowing/ transplanting of crop.
8. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
9. Use bio pesticides/ plant protection chemicals recommended for protected cultivation.
10. Timely harvesting of crop.
11. To save the precious natural resource water, follow micro irrigation technologies (drip irrigation).
12. Use genetically pure & treated seed.

xii. Production constraints in agro-ecological region:

1. Good quality seed is inaccessible.
2. High cost of seed & poor purchasing power of farmers.
3. Water scarcity.
4. Protected cultivation is cost involving technologies.
5. Repair of the poly houses/ micro irrigation structures is a tedious task.
6. Damage of crop / poly houses /micro irrigation structure by wild animals.
7. Unawareness about scientific technologies.
8. Involvement of middle men in marketing.
9. Availability of agriculture inputs is not easy.
10. Use of unsafe agro chemicals.
11. Difficult labour availability.
12. Different biotic and abiotic stresses.

9I. Name of the vegetable crop: Pea

i. Existing varieties being used: Arkel or mixture of varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Sabji Matar 3, G 10 and VL 7, Arkel, Azad Pea 3, VL 10 & VL 11, Pusa Pragati

iii. Existing package of practices being used:

1. Sowing in Autumn month
2. No line sowing,
3. High seed rate,
4. Mature more than 120 days,
5. Stacking is done for tall varieties,
6. Dual purpose varieties
7. Sowing by broadcasting method, no seed treatment, using own saved seeds to grow crop

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of tall varieties sown in line with effective stacking methods. Mangement of powdery mildew, Aschochyta blight and other diseases and Fusarium wilt in autumn season
2. Sowing early maturing varieties at closer spacing (30 cm plant to plant and about 5-10 cm

between plants) and higher seed rate (120 kg/ha).

3. Sowing time:
   Reigion B: Nov- Dec
4. Seed rate: 100 Kg/ ha
5. Treating the seed with 2 g Thiram /kg of seed and rhizobium culture if being sown in field for first time.
6. If available, at least one ton of farmyard manure per ha should be incorporated in the soil at the time of land preparation. Add fertilizers containing NPK as 30: 70: 50 kg/ha all apply as basal dose.
7. Water the crop as per need especially during flowering and pod setting.

v. Major insect pests associated with crop: Leaf miner

vi. IPM Module for management of insect pests: Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

vii. Major disease associated with crop:

1. Powdery mildew in all agroecological situations
2. Fusarium wilt in autumn sown crop
3. Aschochya blight in rainy season in high hills.

viii. IPM Module for management of disease:

1. Use of oganic inputs only
2. Use of rust and powdery mldew resistant strains.
3. Use TH colonized compost.
4. Seed biopriming with TH / PsF/ TH + PsF (10g/kg seed) or Seed treatment with Thiram + Carbendazim (2:1) @ 3.0 g/kg seed.
5. Cultivation of powdery mildew resistant varieties
6. Two to three sprays of (TH + PsF) or mancozeb (2.5 kg/ha) at 7 to 10 days interval beginning with appearance of foliar diseases (need based).

i. Major weeds associated with crop: All seasonal weeds

ii. IPM Module for management of weeds: Use pendimethaline @ 1kg ai/ha as pre-emergence and one hoeing 25-30 days after sowing.

iii. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Increasing crop intensity, Line spacing
2. Use of tall cultivars in cropping system
3. Standardization of time for seed sowing in pea viz. Septemeber sowing in high hills, Mid Nov sowing time for Mid hills can enhance productivity.

iv. Production constraints in agro-ecological region:

1. Monkey Menace
2. Need to increase seed production program in distt.

9J. Name of the vegetable crop: Capsicum

i. Existing varieties being used: Locally produced seed, California wonder, Hathi soond

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: California wonder, Bull nose, Arka mohini, Arka Gaurav, Indira, Bharat, Pusa Dipti

iii. Existing package of practices being used:

1. Poorly managed nurseries infected with damping off.
2. Overaged or less vital seedling utilization

3. No control measure of wilt

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Seed sowing in line in nursery

2. Good nursery management
3. Control of damping off in nursery
4. Mangement of Fusarium and bacterial wilt

v. Major insect pests associated with crop: Fruit borer, aphid, cut worm

vi. IPM Module for management of insect pests: Cultural, mechanical and biological control

vii. Major disease associated with crop: Fusarium and bacterial wilt and anthracnose.

viii. IPM Module for management of disease:

In Nursery

1. Soil Solarization of nursery bed by covering with polythene sheet (25 – 50 □□) for 45 to 60 days during April-June.
2. Use TH/PsF colonized compost
3. Seed biopriming with TH / PsF or TH + PsF (10 g/kg seed).
4. Use resistant cultivars like Punjab Lal etc., if possible
5. Grow the nursery under tunnel of poly net of 50 mesh.

On Crop

1. Use TH/PsF colonized compost.
2. Use of healthy seedling.
3. Root dipping of seedlings in TH/PsF suspension (10 g/l water).
4. Roguing of virus infected plants and destruction of weeds followed by need based spraying of systemic insecticides for vector management
5. Need based spraying of mancozeb (2.5 kg/ha) at 15 days interval.
6. For the management of soil borne diseases follow crop rotation
7. Soil drench (near seedling) with TH/ TH + PsF (10 g/l) for the management of root rot and wilt.
8. Two to three spays of TH + PsF (1 kg/acre) to manage foliar diseases (need based).

ix. Major weeds associated with crop: *Trifolium alexenderum*

x. IPM Module for management of weeds: Manual weeding in hills.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Seed sowing in in line in nursery
2. Control of damping off in nursery
3. Control of fusarium and bacterial wilt
4. Proper fertilizer use
5. Use of mulch

xii. Production constraints in agro-ecological region: Non availability of quality seed, damping off and wilt disease

9K. Name of the vegetable crop: Onion

i. Existing varieties being used: Nasik red, locally grown seed

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Agri found light red, Agri found dark red, Pusa red, Pusa ratnar, VL onion 3

iii. Existing package of practices being used:

1. Poorly managed nurseries.
2. Overaged or less vital seedling utilization
3. No control measure of purple blotch

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Good quality seed, seed sowing in line in nursery, proper use of fertilizer, control of purple blotch

v. Major insect pests associated with crop: Thrips

vi. IPM Module for management of insect pests:

Onion thrips *Thrips tabaci* Hood (Thripidae: Thysanoptera)

1. Use of sticky trap
2. Overhead irrigation is quite effective to wash off thrips
3. Younger plots should be planted upwind of older plots, relative to prevailing winds, to make it harder for the thrips to find the new plantings
4. Mixed cropping of carrots and onions also may reduce thrips population
5. If thrips population exceed over 5 thrips/plant, following insecticides can be used-

Name of the Insecticides	**(gm/ml) /ha**
Imidacloprid 17.8 %SL	125
Acetamiprid 20%SP	1000
Thiamethoxam 25%WG (15-30 DAT)	100
Fipronil 5%SC	1000
Spinosaid 45%SC	160
Phorate 10% CG	10000

vii. Major disease associated with crop: Purple blotch

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: Non grassy weeds

x. IPM Module for management of weeds: Apply Oxyflurofen 23.5 % EC @ 0.1-0.2 kg a.i/ha within 3 days after planting to control grassy and non grassy weeds.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of good quality seed,
2. Control of thrips and purple blotch

xii. Production constraints in agro-ecological region: Thrips and purple blotch

10A.Name of the fodder crop: Berseem

i. **Existing varieties being used:** Mescavi, Vardan

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: BL-10, UPB-10

iii. Existing package of practices being used: Broadcasting of seed without culture and nutrient application, lack of proper water for irrigation.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Proper turning of soil and preparation of small fields and sowing of crop in puddle field after treatment of seed with Rhizobium culture. 1st cutting after 1 month of sowing than after every 15-20 days and fertilizer (Urea) application after each cutting
2. Field preparation: 3-4 Harrowing + Leveling the field.
3. HYVS. – Mescavi, Warden. BL-10, 22,42, 180, Pusa Gaint & Bundel Berseem 243
4. Seed rate: 25-30 kg/ha
5. Sowing method: Wet method-like rice in puddled field
6. Dry method: Without puddled.
7. Sowing time: First an week of October
8. Fertilizer: 30:60:70:: N:P_2O_5 K_2O kg/ha
9. Irrigation: Field should remain at field capacity throughout the crop period after germination.
10. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.
11. Cutting management: First cut -45-50 DAS
12. Other cutting at 25-30 days interval- total 5-6 cutting are taken
13. Yield: 800-1000g/ha. Green forage.

v. Major insect pests associated with crop: Aphids

vi. IPM Module for management of insect pests:

vii. Major disease associated with crop:

viii. IPM Module for management of disease:

ix. Major weeds associated with crop: Kasni

x. IPM Module for management of weeds: Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of rhizobium culture and fertilizer application after each cutting,
2. For seed production the crop should be left after April

xii. Production constraints in agro-ecological region:
Irrigation facilities, Culture , Fertilzer, HYV

10B.Name of the fodder crop: Sorghum

i. **Existing varieties being used**: Chari

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: SSG-988, PC-29, MP Chari, PCH-106

iii. Existing package of practices being used: Broadcasting

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Line to Line 30 cm. HYV, First cutting at 50% Flowering stage & subsequent 3 cutting after 45 days interval
2. Soil : Loam Soil
3. Field Preparation: 2-3 harrowing followed by leveling
4. High Yielding Varieties
   A.Single cut- Pusa Chari- 1, 6,423, Pant Chari- 3,4,7 &8
   B. Multi cut- SSG-59-3, PCH-106, Safed Moti, PC-5, COFS-29, CSH 20MF, CSH 24MF, Harasona
5. Seed rate: 10 kg/ha
6. Spacing : 30-45 cm line to line
7. Sowing time: June-July- Rainfed condition
   Feb-July- Irrigated condition
8. Fertilizer: 100-120: 60:40::N:P_2O_5 : K_2O kg/ha
9. Irrigation: Rainfed: Not required
   Irrigated: 20-25 days interval
10. Cutting management :
    Single cut: At 50% flowering stage
    Multi cut- 45 days after sowing first cut & subsequent cutting at 25-30 days interval. Total 2-3 cutting are taken

Note: After each cut, crop should be topdressed with 30 kg/N/ha after irrigation

v. Major insect pests associated with crop:

vi. IPM Module for management of insect pests:

vii. Major disease associated with crop:

viii. IPM Module for management of disease:

ix. Major weeds associated with crop: Seasonal weed

x. **IPM Module for management of weeds:** Hand weeding

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Multicut varieties

xii. Production constraints in agro-ecological region: Irrigation facilities, Fertilizer, HYV

10C.Name of the fodder crop: Lobia

i. **Existing varieties being used:** Local

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: UPC-5286, UPC-4200, BL-1

iii. Existing package of practices being used: Broadcasting of seed, Rainfed conditions, Self seeded seed is being used from long time

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** HYV, Mixed cultivation of fodder Maize+Lobia **,** Use of 75-80 kg nitrogen + 50-60kg phosphoros+15 kg Zinc

v. **Major insect pests associated with crop:** Borer

vi. **IPM Module for management of insect pests: -**

vii. **Major disease associated with crop:** YMV

viii. **IPM Module for management of disease: -**

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**
Mixed cropping with Maize+ Lobia
Sorghum+Lobia

xii. **Production constraints in agro-ecological region:**
Lack HYV

10D.Name of the fodder crop: Fodder Maize

i. **Existing varieties being used:** Local varieties, , Ganga safed, Naveen, African Tall

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Ganga-2, Ganga-5, QPM

iii. **Existing package of practices being used:** Broadcasting of seed, no fertilizer used

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. HYV, Line sowing at 25-30cm Line to line and 10cm plant to plant, 80-100 kg N, 40-60 kg P
2. Soil: Well drained alluvial soil with soil PH 5.5-7.5.
3. Field preparation: 4-5 harrowing + leveling
4. HYVS: African Tall, J-1006. Pratap Makka Chari-b.
5. Seed rate: 50kg/ha
6. Spacing : 30-45 cm(row to row distanced)10-15 cm (plant to plant)
7. Sowing time
   Rainfed: Onset of monsoon
   Irrigated : Feb to July
8. Sowing method : Line sowing is proposed over broadcasting
9. Fertilizer : 100-120 : 60:40: 20::
   : P_2O_5 : K_2O: ZnSo4 kg/ha
10. Irrigation: Fodder maize grown under irrigated condition should be irrigated at 20 days interval. Spring/summer crop requires 5-6 irrigations.
11. Weed control: Pendimethalin @ 0.75 kg ai/ha (PE) application.
12. Harvesting: The crop should be harvested at tasseling /silling stage or 50-55 days after sowing.
13. Yield: Green fodder: 350-450q/ha.

v. **Major insect pests associated with crop:** Borer

vi. **IPM Module for management of insect pests: -**

vii. **Major disease associated with crop:** YMV

viii. **IPM Module for management of disease: -**

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**
Mixed cropping with Maize+ Lobia
Sorghum+Lobia

xii. **Production constraints in agro-ecological region:**

Lack HYV, Fertilizer, Rainfed conditions

10E.Name of the fodder crop: Jai (Oat)

i. **Existing varieties being used:** Local varieties, Kent

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** JHO-851, UPO-94, OS-6

iii. **Existing package of practices being used:** Broadcasting of seed, no use of NPK, Rainfed conditions

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. HYV, Use of recommended NPK,
2. Soil : Loam soils
3. Field preparation : 2-3 Harrowing + leveling
4. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
5. Seed rate: 100 kg/ha
6. Spacing : 30cm line to line distance
7. Sowing time: first week of October to last October

v. **Major insect pests associated with crop:** Bore**r**

vi. **IPM Module for management of insect pests: -**

vii. **Major disease associated with crop:** YMV

viii. **IPM Module for management of disease: -**

ix. **Major weeds associated with crop:** Local weeds

x. IPM Module for management of weeds: Hand **weeding**

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** HYV, Use of recommended NPK

xii. **Production constraints in agro-ecological region:**
Lack HYV

10F.Name of the fodder crop: Hybrid Napier

i. **Existing varieties being used:** Pusa giant

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** IGFRI-3,6,10 NB-21

iii. **Existing package of practices being used:** Planting on bunds and wasteland near gadhera in rainy season

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. LxL-75-90cm; PxP -45cm
2. Rootslip -25000-30000 /ha
   200q FYM, N:P 50kg/ha BD
3. Soil : Loam soils to clay soil
4. Field preparation : 2-3 Harrowing + leveling
5. HYVS: Phule Jaywant, NB-37, CO-3, BAIF-10, PBN-83, PBN 233, Hybrid-3 Napier.
6. Seed rate: 40000 rooted slips or stem cutting (3 buds)/ha
7. Spacing : 75 cm x 50cm
8. Sowing time: Onset of monsoon or month of February
9. Fertilizers: 60kg/ha + 60 kg P_2O_5 + 40kg K_2O/ha at sowing time followed by 30kgN top dressing after each cut.
10. Irrigation: Irrigate crop after each 20-25 days interval during summer season. Normally irrigation is not required during rainy season.
11. Cutting management: First cut after 50-55 days of sowing and subsequent cuttings are taken after 30 days interval.
12. Yield: 1500-2000q/ha green forage

v. Major insect pests associated with crop:
vi. IPM Module for management of insect pests: -
vii. **Major disease associated with crop:**
viii. IPM Module for management of disease: -
ix. Major weeds associated with crop: Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:
1. LxL-75-90cm; PxP -45cm
2. rootslip -25000-30000 /ha
3. 200q FYM, N:P 50kg/ha BD should be grown on waste and community land

xii. Production constraints in agro-ecological region:
Lack HYV

10G.Name of the fodder crop: Gini grass
i. Existing varieties being used: Local
ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PGG-1,9 Bundel gini ghas 1,2
iii. **Existing package of practices being used:**
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** seed rate 4-5 kg/ha, transplanting of seedling 4-6 wk at a distance of 50 cm. FYM 200q /ha, urea 1Q/ha
v. **Major insect pests associated with crop:**
vi. IPM Module for management of insect pests:
vii. **Major disease associated with crop:**
viii. IPM Module for management of disease:
ix. **Major weeds associated with crop:** Local weeds
x. IPM Module for management of weeds: Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: seed rate 4-5 kg/ha, transplanting of seedling 4-6 wk at a distance of 50 cm. FYM 200q /ha, urea 1Q/ha
xii. Production constraints in agro-ecological region:
Non availability of HYV

10H.Name of the fodder crop: Khadik
i. **Existing varieties being used:** Local
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Leaves Suitable for livestock feeding, can be grown in cold climate in a temp range of 2-38 degree centigrade and at the rainfall of 1200-2500mm. leaves are used in Oct-Feb and May-June.
iii. **Existing package of practices being used:** 35-130kg green fodder/tree 18% CP
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** increase the no. of plants in community land, Forest
v. **Major insect pests associated with crop:**
vi. IPM Module for management of insect pests:
vii. **Major disease associated with crop:**
viii. IPM Module for management of disease:
ix. Major weeds associated with crop: Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Leaves Suitable for livestock feeding , can be grown in cold climate in a temp range of 2-38 degree centigrade and at the rainfall of 1200-2500mm.

leaves are used in Oct-Feb and May-June

xii. Production constraints in agro-ecological region:
Non availability of HYV

10J.Name of the fodder crop: Utis

i. **Existing varieties being used:** Local

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**Local

iii. **Existing package of practices being used:** available in forests, orchards, kitchen garden

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Leaves Suitable for livestock feeding , can be grown in cold climate in a temp range of 0-38 degree centigrade and at the rainfall of 1200-2500mm. leaves are used in Oct-Dec and April-July. No tannin so more digestible leaves, Resistant to frost and snowfall, 900-2800m. Can not be fed to pregnant animals.leaves 60-190 kg/tree

v. **Major insect pests associated with crop:**

vi. IPM Module for management of insect pests:

vii. **Major disease associated with crop:**

viii. IPM Module for management of disease:

ix. Major weeds associated with crop: Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Leaves Suitable for livestock feeding , can be grown in cold climate in a temp range of 0-38 degree centigrade and at the rainfall of 1200-2500mm. leaves are used in Oct-Feb and May-June. No tannin so more digestible leaves, Resistant to frost and snowfall, 900-2800m

xii. Production constraints in agro-ecological region:
needs more plantation in community land and forests

11 A.Name of the Medicinal crop: Aloevera

i. **Existing varieties being used:** Local

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Sim, Sheetal

iii. **Existing package of practices being used:** Grown on low productive lands without scientific cultural practices

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** sowing LxL -50cm and PxP- 40cm 50:25:25 kg NPK and 60000-65000 plants/ha

v. Major insect pests associated with crop:

vi. IPM Module for management of insect pests:

vii. Major disease associated with crop:

viii. IPM Module for management of disease:

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: LxL -50cm and PxP- 40cm

xii. Production constraints in agro-ecological region: Poor knowledge of package and practices

11B.Name of the Medicinal crop: Brahmi

i. **Existing varieties being used:** Local

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Praja shakti, Subodhak

iii. **Existing package of practices being used:** Grown on low productive lands without scientific cultural practices- No proper management after cutting

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological**

region: sowing LxL -50cm and PxP- 40cm 100:60:60 kg NPK and 35kg N/after harvesting 60000-65000 plants/ha

v. **Major insect pests associated with crop:**
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:**
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: S**owing LxL -50cm and PxP- 40cm 100:60:60 kg NPK and 35kg N/after harvesting; 60000-65000 plants/ha proper management is required.
xii. **Production constraints in agro-ecological region:** Poor knowledge of package and practices

11C. Name of the Medicinal crop: Kuth

i. **Existing varieties being used:** Local
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Wild / Local collection
iii. **Existing package of practices being used:** No proper management after cutting
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region**
Proper drying of heads is essential for obtaining viable seeds.
Harvesting of roots should be done before flowering to ensure quality of roots.
Preferably crop should be grown above 2200 m height
v. **Major insect pests associated with crop:**
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:**
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Natural reserves and wild nurseries to retain the medical efficacy of plants in their natural habitats
xii. **Production constraints in agro-ecological region:** Absence of local pharmaceutical production; poor knowledge of package and practices

12A. Name of the Floriculture crop: Marigold

i. **Existing varieties being used:** Local varieties
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**
1. African Genda,
2. Pusa Narangi, Pusa Basanti, Moonsoth, Merinar
3. French Genda
4. Tina, Singhnet, Golden boy
iii. **Existing package of practices being used:** only house hold ornamental plant
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Transplanting in mid July and other mid October, and mid February, 3kg seed per hectare , Large size genda line spacing is 45x60 sq cm & small size genda spacing is 25x30 sq cm. 100kg n, 100kg, P and 200 kg K per ha should be mixed in soil in last plough. soil shound be moist always.
v. **Major insect pests associated with crop:** Thrips, leaf and leaf and bud eating caterpillar
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:** Powdery mildew

viii. **IPM Module for management of disease:**

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Transplanting in mid July and other mid October, and mid February, 3kg seed per hectare , Large size genda line spacing is 45x60 sq cm & small size genda spacing is 25x30 sq cm. 100kg n, 100kg, P and 200 kg K per ha should be mixed in soil in last plough. soil shound be moist always; Proper management of insect pests and diseases

xii. **Production constraints in agro-ecological region:** availability of quality seeds and adequate marketing of flowers.

12B. Name of the Floriculture crop: Rose

i. **Existing varieties being used:** local ornamental and old varieties

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**
For Gulabjal and oil_ Noorjahan, Ranisahiba
For flowers_ First red, Sonia, Noveleze, etc

iii. **Existing package of practices being used:** Plantation of rose cutting

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
1. Spacing
2. Fertilizer:40:20:20 NPK , fertilization using drip irrigation
3. Proper flower storage
4. High yielding varieties.
5. Adequate technological interventions.
6. To be cultivated in polyhouses.

v. **Major insect pests associated with crop:** Aphid, leaf miner, white fly, thrips, stem borer, rat

vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.

vii. **Major disease associated with crop:** blight and comrot, collar rot, leaf spot, Damping off

viii. **IPM Module for management of disease:** As per requirement through recommended pesticides.

ix. **Major weeds associated with crop:** Parthenium, *Chenopodium album*, Krishnil, Teepatiya

x. **IPM Module for management of weeds:**Weeding and Hoeing

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**
1. Spacing
2. Fertilizer:40:20:20 NPK , fertilization using drip irrigation
3. Proper flower storage –

xii. **Production constraints in agro-ecological region:** availability of quality seeds and adequate marketing of flowers. Availability of quality plants and adequate marketing of flowers

12C. Name of the Floriculture crop: Gladiolus

i. **Existing varieties being used:** Local

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** American buty, Oscar friendship, Shobh Sapna Poonam

iii. **Existing package of practices being used:** Plantation of of bulb with ridge bed

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
1. Bulb treatment with Bavistin, 40:20:20 NPK/ ha
2. LxL- 30cm, PxP-15 cm

v. **Major insect pests associated with crop:** Aphid, leaf miner, white fly, thrips, stem borer, rat
vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.
vii. **Major disease associated with crop:** blight, collar rot, leaf spot, Damping off
viii. **IPM Module for management of disease:** As per requirement through recommended pesticides.
ix. **Major weeds associated with crop:** Parthenium, *Chenopodium album*, Krishnil, Teepatiya
x. **IPM Module for management of weeds:**Weeding and Hoeing
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**
1. HYV varieties
2. Bulb treatment with Bavistin,
3. 40:20:20 NPK/ ha
4. LxL- 30cm, PxP-15 cm
5. Flower care and marketing

xii. **Production constraints in agro-ecological region:** availability of quality seeds and adequate marketing of flowers.

12.D Name of the Floriculture crop: Rajnigandha

i. **Existing varieties being used:** Local
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Hybrid varieties Subhashin, and Shringar
iii. **Existing package of practices being used:** Plantation of of bulb with ridge bed
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
Tubers LxL – 25-30 cm
Plant to plant-15-20cm 200:50:70 NPK/ha
v. **Major insect pests associated with crop:** Aphid, leaf miner, white fly, thrips, stem borer, rat
vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.
vii. **Major disease associated with crop:** Clitonia, bud rot
viii. **IPM Module for management of disease:** As per requirement through recommended pesticides.
ix. **Major weeds associated with crop:** Parthenium, *Chenopodium album*, Krishnil, Teepatiya
x. **IPM Module for management of weeds:**Weeding and Hoeing
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**
Hybrid varieties; Tubers LXL-25-30cm; Plant to plant-15-20cm; Fertilizers-200:50:70 NPK/ha
xii. **Production constraints in agro-ecological region:** availability of quality tubers and adequate marketing of flowers.

C1. Livestock: Buffalo

1.A Existing breeds available: Mostly non-descript, Neeli-Ravi cross, Murraha cross

1.B Specific breeds to be introduced: Murraha, Neeli-ravi,

2.A Existing feeds being used: Wild grasses, paddy straw, wheat straw, wild dried grasses, Leaves of trees such as silver oak, bhemal, khadeek, mulberry

2.B Specific feeds to be introduced / advised:

1. UMBB, Feed blocks, Fodder maize, multi cut chari, multi Berseem, Hybrid napier, tall fascue, Italian rai, cox foot, orchard grass fodder trees etc
2. Fortification of local Fodder, use of Chaff cutter and mangers etc
3. Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

3.A Existing health services:

State animal husbandry department (Vet. Hospital, LEO Centers)
BAIF, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:

Village level workers for first aid, vaccination and AI

4.A Existing management practices:

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,
3. Shortage of feed and fodder,
4. Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:

1. Proper scientific housing,
2. Scientific feeding management,
3. Manger and chaff cutter introduction,
4. Proper and timely vaccination and deworming, timely health and breeding facilities

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Poor breeds, shortage of feed and fodder, improper feeding, poor housing and management of animals, Improper health services, mostly unproductive animals,

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Feed and fodder shortage, local breed, low cost of milk

C2. Livestock: Cattle

1.A Existing breeds available: Mostly non-descript, Badri, Cross bred of Jursey, HF, Sahiwal

1.B Specific breeds to be introduced: Jursey, HF, Sahiwal

2.A Existing feeds being used: Wild grasses, paddy straw, wheat straw, dry grasses, Leaves of trees as silver oak, bhemal, khadeek, mostly rearing on grazing

2.B Specific feeds to be introduced / advised:

Fodder maize, multi cut sorgam (chari), Barseem, Hybrid napier, fodder trees etc
Fodder treatment, Chaff cutter, mangers etc

3.A Existing health services:

State animal husbandry department,
BAIF, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination and AI

4.A Existing management practices:

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,
3. Shortage of feed and fodder,
4. Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:

1. Proper scientific housing,
2. Scientific feeding management,
3. Manger and chaff cutter introduction,
4. Proper and timely vaccination and deworming, timely health and breeding facilities

5.A Problems of Livestock system- Goatary, Poultry, Fisheries:

Poor breeds, shortage of feed and fodder, improper feeding, poor housing and management of animals, Improper health services, mostly unproductive animals

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Feed and fodder shortage, local breed, low cost of milk

C3. Livestock: Goat

1.A Existing breeds available: Mostly non-descript,Chobarkha, Udaipuri

1.B Specific breeds to be introduced: Barbari, Jamunapari

2.A Existing feeds being used: Grazing

2.B Specific feeds to be introduced / advised: Grazing

3.A Existing health services: State animal husbandry department

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination

4.A Existing management practices:

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,
3. Shortage of feed and fodder,
4. Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Development of pasture land, scientific management

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Lack of range land management

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of range land management, managemantal problems as proper vaccination, ecto and endo parasite control, breed improvement

C4. Livestock: Sheep

1.A Existing breeds available: Mostly non-descript, gaddi, black sheep

1.B Specific breeds to be introduced: Gaddi, selective breeding of local breed

2.A Existing feeds being used: Grazing

2.B Specific feeds to be introduced / advised: Grazing

3.A Existing health services: State animal husbandry department

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination

4.A Existing management practices:

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,
3. Shortage of feed and fodder,
4. Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Development of pasture land, scientific management

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Lack of range land management

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of range land management, managemantal problems as proper vaccination, ecto and endo parasite control, breed improvement

C5. Livestock: Poultry

1.A Existing breeds available: Poultry: Local, Croiler, RIR, uttara fowl

1.B Specific breeds to be introduced: Poultry: Croiler, Kadaknath, Cob, Cari-davendra, cari-nirbheek

2.A Existing feeds being used: kitchen waste

2.B Specific feeds to be introduced / advised: Starter, grower, finisher feed according to age

3.A Existing health services: State animal husbandry department, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Specific poultry management services

4.A Existing management practices: Mostly backyard

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: High yielding breeds, proper feeding and management practices

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Poor breed and management

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is

not increasing:

C6. Livestock: Fisheries

1.A Existing breeds available: Local, Silver carp, grass carp and common carp

1.B Specific breeds to be introduced: Silver carp, grass carp and common carp

2.A Existing feeds being used: House hold waste

2.B Specific feeds to be introduced / advised: Pelleted fish feed having 25-30% protein

3.A Existing health services: State fisheries deptt. (fisheries inspector at district level)

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:

4.A Existing management practices:

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:

5.A Problems of Livestock system- Goatary, Poultry, Fisheries:

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Non availability of quality fish seed is major problem

D. Integrating Farming system

1.A Existing farming system: Animal husbandry+crop/Vegetable

1.B Specific farming system for doubling income in specific agro-ecological region:

Agri-HortAnimal-processing based farming system

Activity	Area
A.Cropping system:	8 nali
Paddy/Ragi/Barnyard millet-lentil/mustard/chickpea	
Horsegram/soybean/pigeon pea-wheat	
Rice-cabbage/cauliflower-frenchbean/capsicum/potato/summer squash	
Hybrid napier/Rai grass on the boundry	
B . Horticulture	8 nali
Peach/Pear/citrus (Malta)/Walnut+ginger/turmeric/fodder grass (As intercrop)	
Polyhouses (for growing tomato/capsicum/cucumber)+ polytunnel(for raising vegetable seedling)	
Water harvesting structure	
Mushroom Production Unit	
C Livestock	2 nali
a. Cow/buffalo	2no.
b. Backyard poultry	25 Birds
c. Goat farming	5+1
d. Bee kepping	
e. Fisheris	
D. Vermicomposting/Processing-	2 nali
Washing and cleaning of season vegetables, biogas/vermicompost/biopesticides	

Total cost : Rs 90,000.0

Total income : Rs 2.0 lakhs

Net income : Rs 1.1 lakh (Approx.)

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: Not available in area

1.B Grading facilities to be advised/ setup for doubling income in the agro-ecological region of district:

Establishment of minimal processing plants in various location based on crop and area specific.

For grains:

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity

3. Dockage tester for particular commodity

For horticultural crops:

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

2.A Existing processing facilities: Food proccessing units of Deptt of Horticulture. Units of some NGOs

2.B Processing facilities to be advised/ setup for doubling income in the agro-ecological region of district:

Fruits –juice,squaes, candy, jam, finger millets,Soybean-flour, Soybean -tofu& soya chunk preparation , millets-biscuits

For grains:

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity

For horticultural crops:

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

3.A Existing packing facilities: Few farmers

3.B Packing facilities to be advised/ setup for doubling income in the agro-ecological region of district:

A factory based on plastic cartoon, *Kilta*, *Dalia* of various grade and size based on weight of the fruit is needed at least at distt level to meet the requirement of apple and seasonal vegetables.

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity
3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)
4. IRRI bags for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables
3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed

8. Litchi peeling and shredding unit

4.A Existing storage facilities: At present no storage facilities are available in the distt.

4.B Storage facilities to be advised/ setup for doubling income in the agro-ecological region of district: A Cold storage for hill potato is required.

For grain:

1. Multipurpose (small to medium size) warehouse with mechanical drying and fumigation facility
2. Drying cum storage silo
3. Modified atmosphere and Hermetic storage structure
4. Kothar, metal bins for small capacity

For Horticultural crop:

1. Air/water pre-cooling chambers on farm level for removal of field heat
2. Evaporative cool chamber for chilling sensitive crops
3. Modified or control atmospheric storage structures
4. Cold storage structures
5. Zero energy cool chamber for hilly areas
6. Solar power cooling chambers
7. Jaggery storage bin

F. Waste land development and waste water

1.A Existing practices of soil water conservation: Using indegeneous technology use for water conservation include formations of bund, growing of Napier and other parennial grasses, multiple forest species as per need are requirement.

1.B Package of practices to be advised/ developed for management of wasteland and wastewater in the agro-ecological region of district:

1. Storage of wastewater by using low cost water harvesting technology as *kuchha* and *Pucca* tank. Polytank cane be constructed as (5x3x2m) capacity to meet the lean season demand of seasonal vegetables and for non agricultural use also.

2. In wasteland, a wide scope of fodder plantation of *Morus, Chhanchru, Melilotus* sp can be utilized. In dry and unirrigated situation there is scope of bael, amla can be included. There is need to put fodder trees and grasses in wasteland.

2.A Existing plantation: Tun, shirish, Bheemal, Kachnar, Kharik, shisham in low and mid hills Utis, banj,chhanchru, leucinia, Mulberry.

2.B Plantation suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:

Morus, Shirish, Kharik, Utis,Oak, Bheemal,Kachnar, Vilyati khair etc are useful as dual purpose species to meet fodder, firewoodr and other requiremnt of the farmes. Sufficient plants are avaialble at forest nurseries for planations.

1. Stabilization of eroded land using biological/engineering measures;
2. Plantation of suitable trees/brushes in waterlogged and eroded areas;
3. All agricultural operations should be done on contours i.e. across the existing land slope.
4. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
5. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
6. Diversion of runoff through ditches from upper slopes to safer places.
7. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
8. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual

rainfall.

9. Contour trenching (staggered/continuous).
10. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
11. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
12. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
13. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

3.A Existing fodder production: Crop stobbers, wild grasses, Forest leaves etc.

3.B Fodder suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:

Tall fescue (*Festuca arundinacea)*
Rye grass (*Lolium perenne*)
White clover (*Trifolium repens*)
Red clover (*Trifoliun pretense*)

Tall fescue

1. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
2. Fertilizer management- 60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
3. Irrigation management- Crop must be irrigated after each cut provided water is available
4. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval

Rye grass

1. Seed rate(Kg/ha)- 18-20
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

White clover

1. Seed rate(Kg/ha)- 6-8 Kg
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal)
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

Red clover

1. Seed rate(Kg/ha)- 6-8 Kg
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal)
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

4.A Type of waste water:

1. Effluent from kitchen and bathroom
2. Effluent from industries;
3. Sewage water from cities being discharged into surface and groundwater resources

4.B Existing treatment facilities: NA

4.CTreatment facilities to be advised/ developed for waste water treatment and utilization in the agro-ecological region of district:

1. Multistage filteration unit should be established to recycle the waste water for multiple use.
2. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
3. Industrial wastewater should not be used for irrigation directly; and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.
4. Sewage water from cities should be treated by municipal corporations or other agencies.

G. Reduced cultivation cost

1.A Existing inputs being given:

Traditional and unprocessed inputs are used in agricultural practices. Drudgery prone implements/tools are in practice for various operations.

Rice-wheat/Groundnut-wheat-Potato/French bean

Annexure–II is enclosed for N,P and K.

In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn) /ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop

Foliar spray of 1% $FeSO_4$ in rice nursery and groundnut.

In Mn deficient soils, application of 30 kg $MnSO_4$/ha, if Mn deficiency exist in field or two foliar spray of 0.5% $MnSO_4$ + 0.25% lime before first irrigation and one month after .

Dip potato seeds in a solution of 30 g borax/l for a half hour and dry under shade.

Tomato/Green Pea/Radish/Capsicum/Cabbage/Okra

In Cu deficient soils, application of 4-5 kg $CuSO_4$/ha or foliar spray of 0.25% $CuSO_4$ + 0.125% lime in standing crop

In Zn deficient soils, application of 10 (sandy loam)- 20 (Clay loam) kg $ZnSO_4$ (21% Zn) /ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop

Foliar spray of 1% $FeSO_4$ in rice nursery and groundnut.

In Mn deficient soils, application of 20 kg $MnSO_4$/ha, if Mn deficiency exist in field or two foliar spray of 0.5% $MnSO_4$ + 0.25% lime before first irrigation and one month after .

Two foliar spray of 0.2% Borax at interval of 20-30 d.

In Cu deficient soils, application of 2-4 kg $CuSO_4$/ha or foliar spray of 0.25% $CuSO_4$ + 0.125% lime in standing crop

1.B Soil test based inputs to be suggested in the specific agro-ecological region of district:

Application of nutrients based on soil test basis as major and micro elements.

1. Encourage water harvest technology for irrigation.
2. Sprinkler and drip method for irrigation should be encouraged to improve water use efficiency.
3. Use of mulches and available composts/organic manures
4. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
5. Promote reduced tillage operations.

2.A Existing mechanization:

Limited use of power driven implements in land preparation. Small tools like sickle, handhoe etc are being adopted by progressive farmers.

2.B Mechanization required for reducing cost of cultivation in the specific agro-ecological region of district:

Power tiller, power weeder, shrub cutter, Multiple crops threshers are becoming popular and are available in pockets. Old wooden based impelents are being replaced with iron/alloy (Plough, danalla,) based tools are available.

3.A Existing collective inputs: Community pasture land, Service bulls, Irrigation channel and source, Irrigation tanks, Chemical Fertilizers, Insecticides, Pesticides, Farm Yard Manure, Seed,

Water and Tillage Implements

3.B Collective inputs suggested for reducing cost of cultivation in the specific agro-ecological region of district:

1. Custom hiring energy based implements viz. Small tractor, tiller, Power spryers, Mandua thresher, Hydrum irrigation can reduce the cost of cultivation along with reduction of farm labour.
2. Encourage use of well decomposed organic manures and biofertilizers; avoid excessive use of chemical fertilizers.
3. Reduce the dose of chemical fertilizers and avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
4. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
5. Need based application of insecticides and pesticides, preferably enhanced the use of bio-agents; avoid the use of costly chemicals.
6. Follow line sowing of seed instead of broadcasting.
7. Encourage water harvest technology for irrigation.
8. Sprinkler and drip method for irrigation should be encouraged to improve water use efficiency.
9. Use of mulches and available composts/organic manures
10. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
11. Promote reduced tillage operations.

Factors responsible for increasing cost of cultivation in the specific agro-ecological region of district:

Rainfed lower hills

Soils are gravelly and chirty, deep, sandy loam to silty clay loam. Soils are slightly to moderately acidic in nature.

Mid hills south aspects

Area better suited to human settlement due to forest free cultivated land and maximum exposure to sunlight and represent sub-temperate climate. About 75% of total precipitation is received during rainy season, 12% in winter and 13% in summer. The situation is dominated by chir (pine) forest vegetation. Most of the area is rainfed. The soils are eroded, chirty/gravelly sandy loam to silty loam. Soils are heterogenous and poor in fertility.

Mid hills north aspects

The irrigated area is 8% by gulls. It has good cover of oak and its association. Duration of exposure to sunlight is the major factor influencing the microclimate and type of vegetation. Relative humidity is high (60-70%). Temperature is moderately low due to vegetation and high shading effect. Rainfall is high with occasionally snowfall. About 75% precipitation is received during rainy season, 15% in winter and 10% in summer. The soils are moderately to highly acidic in nature especially at mid and high elevation areas

Factors responsible for increasing cost of cultivation

1. Heterogeneous soils, soils of each situation differ widely in their physical, physico-chemical characteristics as they are developed from a variety of rocks and minerals under joint influence of vegetation, physiography and climate.
2. Sloping lands with high rate of removal of soil and nutrients from surface through erosion resulting to depletion of soil fertility.
3. Scattered holding and marginal land size.
4. 90 % of areas of mid and high hills are rainfed.
5. High rates of migration from hills to plains of males and young boys in search of jobs.
6. Women based farming system without technical knowledge – how and inputs.
7. Low efficiency of conventional farm tools and implement.
8. Indigenous breed of livestock with low production and working efficiency.

9. Poor quality of FYM. The method of preparation and application of FYM are defective generally heaped in an open area resulting into loss of nutrients.
10. Mostly soils are slightly to strongly acidic in nature depending upon elevation, vegetation and development of soil from rocks and minerals causing nutrient imbalance in soil and impose hidden nutrient toxicity and deficiency symptoms in crops retard growth and yield.
11. Minimum use of fertilizers: farmers are mostly small and marginal economically backward, not able to apply recommended doses of fertilizers. The average consumption is < 10 kg N:P:K ha-1.
12. Non availability of quality seeds of varieties recommended for rainfed upland situations.
13. The inputs are costly and therefore, the small and marginal farmers are not able to adopt the improved technology.
14. Non availability of inputs at right time and right place.
15. Sowing of crops is at the mercy of rains which are erratic. Thus planting is delayed and not done on suitable time. Sowing are done more than once either because of insufficient moisture mostly in rabi crops or due to crust formation in kharif.
16. Farmers follow practice of dry sowing. In such situation the seeds are eaten by birds and grubs resulting in inadequate plant population.
17. Due to limited moisture and nutrient supply the growth of crops is not proper and vegetative phase of growth (flowering and fruiting) are advanced.
18. Improper seed bed preparation: in order to utilize moisture, the farmers do not wait for fine preparation of fields and rush for sowing. This results in improper germination and infestation of weeds.
19. Severe infestation of insect-pest: white grubs and cut worms are the serious polyphagous pests, kill plants and reduce plant population up to 70-80 %. Due to non availability of suitable plant protection chemicals as well as high cost they are beyond the means of farmers. Besides, non availability of water for solution also pose problems.
20. Weeds; common weeds of the upland rainfed areas are Tipatiya (Oxalis latifolia), Pardeshi(Galensojaparviflora), Gajar grass (Parthenium Sp.)Kuni(Lantena camera) Kala bansa (Eupatorium sp.).The loss in general in food crops is high from 50-75 %.
21. Improper terrace management: most of terraces developed by farmers are on steep slopes with outward gradient.
22. Lack of proper drainage system for safe disposal of excess rainwater. The heavy runoff of water washes away the top fertile soil lead to steady depletion of nutrients and organic matter.
23. Coarse textured soils (charty/gravely) with low moisture and nutrient retention capacity.
24. Lack of proper storage facilities for crops (cold storage).
25. Lack of awareness for protected cultivation techniques and facilities for commercial high value crops (poly houses, poly tunnels, poly for raising nursery and cash crops.
26. No good marketing facilities.
27. Lack of proper irrigation facilities for minor irrigation and drip irrigation with fertigation.
28. Poor connectivity of road transport system.
29. Lack of farmer's participatory approach models for crop production technologies under hill agricultural system for the state. No storage facilities for perishable product
30. No chilling plant for milk

H. off-farm income

2.A Existing SHGS operative in specific agro-ecological region of district:

HELPIA, HIMANI, ATMA, CHIRAG, AAJIVIKA, NABARD, Durga udpadan group ,Manmohan utpadan group, Mahila utpadan group

1.B SHGS to be created/ encouraged in the specific agro-ecological region of district for doubling agricultural income:

Vegetable collection and procurement group

Vegetable and fruits processing groups

Gola Nashpati group
Malta collection and procurement group
Cheura collection and extraction group
Milk collection and chilling group
Goat production group

1. There is need to have regular monitoring and follow up of SHG's by the forming agencies and time to time evaluation of the group.
2. Regular monitoring by the concerned agency must be ensured like ensuring regular meeting of the SHG, checking their register, regular collection of the money, help during conflicts, solving problems occurring during banking etc. and submitting the monitoring report to their concerned officials so that steps can be taken by the high officials to ensure regular continuity of the SHG.
3. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
4. A large number of groups discontinued as they were not having knowledge regarding income generating activities that can be started (what activities can be taken up, how to operate it, where to market the produce etc.) So there is need of encouragement, motivation along with imparting knowledge, skills and linking them to market.
5. Trainings should be provided to the rural women on income generating activities as per the need of rural women, marketing potential and availability of locally available resources.
6. Loan procedure should be made more flexible with less interest rate.
7. As there were problems like non-cooperation among members, confusion regarding money matter, lack of confidence on office bearers with respect to group money etc., there is need of organizing training on good governance, democratic election and how to solve financial and administrative issues.
8. SHG's formed should be grouped into clusters, federations and registered cooperatives so as to converge with govt. schemes, facilitate collective purchase of input and marketing of products.
9. To encourage people to form and sustain SHG's so that new enterprise developed, intensive work needs to be done with them in sustainable manner.
10. Enterprises need to be identified depending upon local resources- human and material.
11. Market linkages need to be developed so that people can sell their produce gainfully.

1.C Problems related with SHG:

1. Not interested in continuing the group
2. Non-cooperation among the members
3. Problem in getting loan
4. Lack of resources like money, space
5. Lack of knowledge regarding various income generating activities,
6. Lack of trainings
7. Lack of follow-up and monitoring from the forming agencies.
8. In hills farm holdings are very small and large part is rainfed depending upon rains with very low and uncertain productivity.
9. Young people do not stay in villages and move to other areas or take up other profession such as tourism, transport, hospitality etc.
10. People remaining in villages are not very enterprising.
11. It is seen in the survey that all individuals who took loan increase their livestock only that is their traditional work and did not start any other enterprises.

2.A Existing Micro-entrepreneur employment:

Five groups are working for collection of small fruits for juice preparation

2.B Micro-entrepreneur employment to be generated in the specific agro-ecological region of district for doubling agricultural income:

1. Improved hill agriculture implements

2. Kumaoni and local food products for tourism
3. Mushroom production and processing units
4. Honey and honey products unit
5. Milk and milk products shops

3.A Existing skill development facilities: Extension training institute

3.B Skill development facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Mushroom production and training facilities
2. Development of advanced horticultural handling units
3. Fish ponds
4. Dairy/Poultry/ gottary units
5. Value addition and food chain centre
6. Storage, grading and Packaging centre
7. Silk worm based skill development units
8. Bioagant and biofertilizers production lab
9. Tissue culture lab for massive production of elite planting material
10. Medicinal plant growing and processing units
11. Development of rosary and extraction units

4.A Existing women skilling facilities: NA

4.B Women skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Khadi and Kargha training for women skill
2. Drugery reduction practices for high efficiency
3. Herbal dye based skill training and skill for local textiles.
4. Value addition skill for women
5. Training centre, processing and packaging units as per the locally available resources

5.A Existing youth skilling facilities: Extension training institute

5.B Youth skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Mushrrom production and training facilities
2. Development of advanced horticultural handling units
3. Fish ponds
4. Dairy/Poultry/ gottry units
5. Value addition and food chain centre
6. Storage, grading and Packaging centre
7. Silk worm based skill development units
8. Bioagant and biofertilizers production lab
9. Tissue culture lab for massive production of elite planting material
10. Medicinal plant growing and processing units
11. Development of rosary and extraction units

Beekeeping

Beekeeping is an environment friendly and agro-forestry based occupation. It provides enormous potential for income generation, poverty alleviation and sustainable use of forest resources. Beekeeping is one of the oldest traditions in India for collecting the honey. Honey bee farming is becoming popular due its demand in national and international markets as well. *Apis cerana indica* is the indigenous bee, is known to be the ideal pollinator for organically grown mountain crops due to its capacity to significantly enhance agricultural productivity. India has a potential to keep about 120 million bee colonies that can provide self-employment to over 6 million rural and tribal families. In terms of production, these bee colonies can produce over 1.2 million tons of honey and about 15,000 tons of beeswax.

Less Investment: Bee Farming is not a manufacturing activity, as such costly machine and tools are not required. There is nothing like production capacity as well. Only small wooden frames with boxes are needed. Their sizes are also standardized. To begin with around 15 such sets/boxes can be purchased or assembled at rate of Rs.1500.00 per box that would cost Rs.22, 500/- for 15 Boxes. Honey extractors would cost to the tune of Rs.5, 000/- each with filtration facilities. For other miscellaneous expenditures including training and consultancy services a sum of Rs.5000.00 can be earmarked. That means total of Rs.32, 000.00 would be required to start Bee Farming with 15 Boxes which is equivalent or less than the cost of cultivation of one acre of paddy field.

More Returns: As per the established norms, each box comprises 7-8 hives which is able to harvest around 30-35 kg of honey in a year. The annual harvest of honey starting with 15 bee boxes could be 450-525 kg depending on the flowering season. Even after considering very conservative selling price of Rs. 150/- per kg; the annual realisation would be to the tune of Rs. 67,500/- to Rs.78,750/-. Therefore, Bee Farming can be considered as an excellent, profitable agro-based green enterprise for landless farmers and entrepreneurs.

Beekeeping in Uttarakhand: Beekeeping has been an integral part of human society since centuries in hill regions of Uttarakhand state. The state of Uttarakhand has a predominantly agrarian economy and large number of small and marginal farmers in the mountainous state call for augmenting agricultural production by organic means. The indigenous bee sub-species *Apis cerana indica* commonly is ideal pollinator for organically grown mountain crops, with the capacity to significantly enhance agricultural productivity with an indirect but vital role in combating soil degradation by pollinating wild plants thereby enabling improved regeneration of bio mass, to be returned to the soil. Beekeeping with *Apis cerana indica F*. is a common practice in hills of Garhwal and Kumoun Himalaya which is carried out mostly by using traditional methods since long past and is stationary in nature. In these regions, beekeeping is also carried out with *Apis mellifera,* but in winter season, due to temperature lower than 20ºC, colonies are being migrated to plains. According to report given by KVK Jeolikot(2017), in Uttarakhand, there are about 4,790 beekeepers with 45,247 number of *A. cerana indica* colonies yielding 546.70 mt of honey production. Whereas, in Almora region of Uttarakhand, there are about 400 beekeepers with 1,165 number of *A. cerana indica* colonies yielding 16.4 mt of honey production. The Uttarakhand state has extremely rich bee forage plants. In most of the remote areas where *Apis cerana indica* beekeeping is common, the use of pesticides and chemicals is negligible, the level of dangerous chemicals in the atmosphere is insignificant and the environmental pollution is at minimal level. Honey produced from such areas is purely natural, free of any residues and can be sold as an organic product. There is vast potential for beekeeping in the country. However, due to lack of knowledge, scientific beekeeping is not being practiced by, most of the beekeepers. It is necessary for beekeepers to participate in the trainings / other capacity building programmes on the subject to gain scientific knowledge on the subject. Selection of good apiary site, good quality bees and proper management are the main keys for success of beekeeping. Following are the important points to start beekeeping and further management practices.

1. Selection of good apiary site: Select apiary site by considering the following:

1. Apiary ground should be clean & free from dry leaves etc. to avoid fire during summer
2. Apiary site should be away from power station, brick kilns, highway and train tracks
3. Site should be open & at dry place having shade
4. Site should be easily accessible by road
5. Fresh running water should be easily available near the apiary
6. It should have natural / artificial wind breaks
7. Site should receive early morning and afternoon sunshine
8. There should not be other commercial apiary within 2-3 kilometers from the apiary site
9. There should not be any source of stagnant / dirty water, chemical industry/ sugar mill, etc., nearby the apiary
10. Area should be rich in bee flora

2. Selection of good quality bees: Beekeeping depends on floral resources, climatic conditions, management and also quality of bees, particularly queen. Therefore, the following should be kept in mind to select the bee colonies:

1. Buy disease free bee colonies from existing reputed beekeepers after getting training on the subject.
2. Select and multiply honey bee colonies only from disease resistant, high honey yielding, young, healthy and high egg laying capacity queen, less swarming tendency etc.
3. Keep colonies with good prolific queens
4. Capture few bee colonies from their natural abodes in forests which may be used for further breeding/ multiplication to prevent inbreeding.

3. Management of apiary:

A. Placement of colonies in apiary

1. Hives should be as per specification of BIS/ISI and should be of locally available seasoned light weight wood. Unseasoned and heavy wood should be avoided
2. Avoid nailing the bottom board with the brood chamber
3. Restrict number of bee colonies in a apiary from 50-100
4. Keep row to row and box to box distance as10 and 3 feet, respectively

Hives used for traditional beekeeping in hilly areas are

Wall hives: Wall hives locally known as 'Khadra', 'Jaala' or 'Jalota' are rectangular structures made in the walls of houses and 'Chhaan' or 'Sunni' (cattle sheds) at the time of construction. Each hive has a small round or rectangular opening on the outer side as an entrance for bees. The size of 'Jalotas' varies in different locations; usually they are 45-60 cm in length, 25-30 cm in width and 20-30 cm in height . Generally one hive is made in each wall, but numbers may vary from 2-4. The interiors of hives are smoothed with cow dung and clay. In winters due to lack of floral resources and extreme cold in the hills, the population of *Apis cerana* colonies decreases to a great extent. Thick wall hives provide considerable insulation in such conditions.

Log hives: Two types of log hives are found, Type I: These are made up of cylindrical hollowed pieces of tree trunk 60-100cm long and 20-40 cm in diameter; however size depends upon the circumference of available trunks. This type of log hives is usually made from the trunk of *Quercus leucotrichophora, Q. floribunda, Rhododendron arboreum and Pinus roxburbhii.* The entrance is made at the mid front side. Both sides are plastered with a mixture of cow dung and clay. Type II: Old cooperages locally known as 'Pariya' or 'Dokha' when rendered useless for milk products, are used as hives. These are about 70-90 cm long with the diameter at top from 25-35 cm and thickness of log 3-5cm. An entrance is made towards the outside and the hive is placed horizontally on a raised platform of stones or the wall of a courtyard. It is mainly made up of the wood of *Ougeinia oogeinesis, Rhododendron arboreum, Toona* spp. A stripe of old comb is fixed to the upper part, inside the hive, and is plugged with a wooden or metal cover, then sealed with a mixture of clay and cow dung. The wooden lid is fixed at the top with an entrance on it.

Miscellaneous Types: These are rectangular box hives made up of separate wooden boards with movable top cover . Their size varies in different localities. Usually these are 80-110 cm long, 25-30 cm wide and 40-50 cm high. During extraction, the top cover is removed along with attached combs and bees, and taken away from the hive, then each comb is smoked and shaken gently. Bees return to the hive and beekeepers cut combs easily.

All hives are made from locally available materials, thus are economically cheaper and environmentally friendly. These hives have thicker walls as compared to modern hives thus provide protection to bees from extremely low and high temperatures. In higher hills traditional hives are more suitable than modern hives but for the drawback in colony management.

B. Inspection of colonies

1. Adopt general colony and personal hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board, top cover, etc. frequently

2. Check the colonies periodically for any abnormalities or changes in behaviour of bees
3. Inspect colonies on clear sunny days preferably at temperatures between 20 and 30°C
4. Do not inspect colonies in cold, windy and cloudy days
5. Use smoker when needed to subdue the bees
6. Use protective dress and veil while inspecting colonies
7. Handle colonies gently, avoid jerks
8. Avoid crushing bees as it could lead to stinging
9. Isolate the diseased colonies from healthy ones.
10. Handle diseased and healthy colonies separately

C. Provision of fresh water in the apiary

Ensure availability of fresh water preferably in shallow containers near the apiary to maintain a healthy apiary. Water is needed for the following

1. Maintenance of adequate humidity in a colony to ensure proper incubation of eggs
2. For feeding bee bread by nurse bees, the mixture of honey and pollen of certain consistency is required for which water is needed
3. When temperature in the apiary increases beyond 37°C, water is used by bees to evaporate and cool the colony

D. Dearth period management

1. Provide 50% sugar syrup to the colonies during dearth periods when honey stores in the colonies is not adequate and nectar is not available in the area. The syrup should be prepared by boiling clean water in the vessel and sugar added with slow stirring for few minutes. Cover the vessel with lid and let it cool. Feed cooled syrup.
2. Sugar syrup should be kept in such a way that the bees should not drown in it. This should be ensured by using shallow vessels with straw to facilitate easy feeding
3. Do not prepare the feed in open in the apiary and avoid dripping on the ground to prevent robbing by bees and ants
4. Feed the colonies in the evening preferably after sunset
5. Feeding should be given to all colonies in the apiary at one time
6. Pollen substitute comprising of fat free soyabean flour (3 parts) + Brewer's yeast (1 part) + skimmed milk powder (1 part) + sugar (22 parts) +honey (50 parts) made in the form of patties should be provided when pollen stores in the colonies is not adequate and pollen is not available in the area
7. Provide fresh water near the colony in shallow vessels
8. Extra frames should be stored in air tight chambers and fumigated with sulphur powder regularly
9. Old and dark combs should be discarded

E. Care during honey extraction

1. Use honey extractor, containers and other bee hive tools /equipments made of stainless steel / food grade plastic. Don't use tins & containers made of other degraded material
2. Wash all the equipments / containers etc. thoroughly with warm water before honey extraction
3. Extract honey from super chambers only
4. Select frames only with 75% sealed cells with ripened honey for extraction
5. Cover the entrance gate of the colony with small branches or twigs to avoid robbing
6. Extract honey in a closed room and not in the open to avoid robbing
7. Do not leave super and brood frames, after extraction of honey open in the apiary;
8. Do not spill honey in the apiary

F. Care during migration

1. Migrate colonies during non-availability of flora to areas with abundant flora.
2. Before migration survey the area to assess the availability of the flora to locate the colonies
3. Ensure honey extraction before migration
4. Close the entrance gates of the colonies in the evening after all worker bees are inside the

colony
5. Pack the colonies internally and externally before migration to avoid jerking
6. Colonies in the vehicle should be packed in such a way that the entrance side should face the front side of the vehicle
7. Start migration late in the evening and ensure the colonies reach the destination within 10-12 hrs. the next day morning and entrance gates are opened after landing in the new location
8. Avoid jerking in the way while transporting bee colonies

G. Seasonal management of apiary

a**) Summer Management**

1. Keep the colonies in thick shade
2. Regulate the microclimate of the apiary by using wet gunny bags over top cover and sprinkling water around the colonies in the apiary during noon hours.
3. Provide fresh water in/near the apiary

b) Monsoon management

1. Clean and bury deep the debris lying on the bottom board
2. Keep the surroundings of the colony clean by cutting the unwanted vegetation which may hamper free circulation of the air
3. Provide artificial feeding (sugar syrup and/or pollen substitute) as per requirement of the colony
4. Check the robbing within the apiary
5. Unite weak/laying worker colonies
6. Control predatory wasps, ants, frogs, lizards in the apiary

c) Post monsoon season management

1. Provide sufficient space in the colony
2. Strengthen the colonies to stimulate drone brood rearing
3. Control ectoparasitic mites, wax moth and predatory wasps

(d) Winter management

1. Examine the colonies and provide winter packings in weak colonies specially in hilly areas
2. Feed sugar/pollen substitute to weak colonies as stimulative feeding to provide energy and initiate brood rearing
3. Shift the colonies to sunny places
4. Protect the colonies from chilly winds by using wind breaks
5. Unite the weak colonies with stronger ones

e) Spring management

1. Unpack the colonies, clean the bottom board, replace the worn out hive parts and provide sufficient space
2. Provide stimulative sugar/pollen substitute to increase brood rearing
3. Equalise the colonies
4. Extra frames should be raised by providing comb foundation sheets
5. Replace the old queens with new ones through mass queen rearing or divide the colonies
6. Manage the colonies in such a way to prevent swarming
7. Monitor regularly for ectoparasitic mites and adopt control measures

H. Protecting colonies from pesticides

1. Persuade the farmers not to use pesticides or use selective pesticides that are less harmful to bees at recommended concentrations
2. Avoid the use of dust formulations as they are more harmful to bees than spray formulations
3. Prior information about spraying would help in reducing poisoning of bees
4. Avoiding spraying of pesticides during flowering of the crop and peak foraging time of the bees would help in reduction in the mortality of foraging bees
5. Spraying may be done in the evening after sun set when bees do not forage
6. Colonies may be temporarily shifted if heavy spraying schedule is fixed

7. If shifting of the colonies is not possible, feed with 200 ml sugar syrup and close the gate by using wire screen for the day of spraying.

I.Methods of attracting and catching swarms

1. Swarming is a natural process for propagation of honey bees. Swarms are the lone source of bees in traditional beekeeping of *Apis cerana* while only a few empty hives are inhabited by absconded or feral colonies.
2. Empty hives are cleaned and smeared with clay, cow dung or both. Honey or jaggery are put inside hive to be used as bait to attract the swarm.
3. Flowering shoots of *Brassica campestris, or Raphanus sativus* can also be used just above the hive entrance, hoping that scout bees will find their home in the empty hive.
4. When swarms is found in the vicinity, water can be sprinkled and soil or ash can be thrown to settle them. 'Tofri' or 'Garori' (special baskets) made up of 'Ringal' (bamboos); 'Jhola' (bag) can be used to catch and carry swarms. 'Kutrine' (burning cotton cloth) is used as a traditional smoker and 'Talikh' (a cloth) to save faces while catching the swarm.
5. To catch a swarm layer of jaggery or honey is applied at the inner base of the basket and hang it inverted near the settled cluster. The cluster is gently displaced from the other side with smoke to direct the bees towards the basket. As the swarm makes a cluster on the basket, it is transferred to the hive. When the bees are settled the basket is removed. Finally the hive is closed with its wooden cover and be smeared with a mixture of cow dung and clay.

J. Management of Honey Bee Diseases and pest

Honey bees could be affected by diseases and the real cause of abnormality or any disease present in the honey bee broods need to be ascertained before taking up any control measures. It is best to contact the researchers/scientists/beekeeping experts at the nearest centre or university or Government department working on honey bees. After the exact diagnosis of the causal agent of the particular disease, the guidelines/ recommendations given by the expert should be followed in true letter and spirit. However, general advisory for the management of common diseases of honey bees is given below:

1. Select good site to locate the apiary preferably in an open, dry place with shade.
2. Adopt general colony hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board frequently.
3. Select and multiply honey bee colonies only from disease resistant stocks.
4. Keep colonies with good prolific queens.
5. Create broodlessness in colony for at least 15 days by enclosing the queen in a queen cage.
6. Check the colonies periodically for any abnormalities or changes in behaviour of bees.
7. If you observe any colonies with disease, isolate them from healthy ones. Handle diseased and healthy colonies separately.
8. Keep the colonies strong by adding sealed brood comb or worker population only from healthy colonies and also by providing adequate food during dearth periods.
9. Prevent robbing, drifting, absconding and avoid migration of bee colonies when you notice disease symptoms.
10. Follow 'Shook Swarm' or shaking method to remove contaminated combs completely by transferring entirely new combs in one operation to the colonies with disease symptoms. Destroy the removed combs by burning.
11. Sterilise the combs and equipments by any one of the following methods:

c. Disinfect the empty combs and equipments with 80 per cent acetic acid @ 150 ml per hive body in piles for few days at a protected place. Air the treated materials before use.

d. Dip the contaminated equipments and combs in soap solution containing 7 per cent formalin for 24 hours. Then wash the treated material with water, dry and use.

12. Use of antibiotics to control honey bee diseases is likely to result in contamination of honey causing problems in export of honey.

13. The traditional method to check the entry of ants is spreading ash or turmeric powder in their way.

K. Honey Extraction

The main honey seasons in hilly areas are '*Chait*' (April), '*Baisakh*' (May) and '*Ashaad*' (July-August). In some localities, an additional extraction during '*Kartik*' (October) is also done. Colonies yield most honey in '*Chait*'-'*Baisakh*' and the least in '*Kartik*'. Traditional tools used are '*Dathule*'. (sickle) to open the cover or wooden plug and '*Buwan*' (traditional brush) made up of '*Babul*' (*Eriophorum comosum*) to brush off bees. Besides these traditional smokers, large pans for keeping combs, a pot with water and '*Parunla*' or knife for cutting '*Faur*' or '*Fwar*' (bee combs) are required at the time of harvest. Honey is mostly extracted at night but a few beekeepers do it in day time also. Combs are cut down, leaving the innermost comb for feeding and to attract swarms the next year. Honey combs are squeezed after removing the brood area from the cut combs. The harvested honey has many impurities like insect body parts, wax cells, etc. Usually, squeezed combs are thrown away after extraction, which can be fed to cattle especially bulls. Honey is stored in plastic or metal containers and in bottles.

The beekeepers doing beekeeping with modern hives should use honey extractors to harvest honey. The quality of honey extracted using honey extracting machine is much better than squeezing method.

Mushroom cultivation

The shrinking land, demand for functional foods, priorities for recycling agricultural residues and changing trades in view of globalization are going to play an important role in the agricultural scenario, and secondary agriculture is likely to play a pivotal role. Our country can emerge as a major player in mushroom production in wake of availability of plenty of agricultural residues and labour. To remain competitive it will be important to harness science and modern technologies for solving the problems of production and bio-risk management. Mushroom being an indoor crop, utilizing vertical space offers solution to shrinking land and better water utility. Packages and practices of mushroom cultivation in Almora is as follow:

1. **White Button Mushroom (*Agaricus bisporus*)**

Button mushroom scientifically known as *Agaricus bisporus* and has he widest acceptability. Cultivation of this mushroom is a complex process and requires two different temperature i.e. 22-26^{0}C for spawn run and 14-24^{0}C for fruit body formation. Besides specific temperature, it require proper humidity (80-90%) and enough ventilation during fruit body formation.

Steps of cultivation process

Compost preparation: Compost is an artificially prepared growth medium from which mushroom is able to derive important nutrients required for growth and fructification. Cemented floors and shade over the floor are required for making good quality compost. There are two main methods for compost preparation:

Long method of composting: This is an outdoor process and takes around 28 days in its completion with a total of seven turnings. The following materials are required for long method of compost:

Wheat straw	1000 Kg	Urea	10 kg
Wheat bran	50 kg	Gypsum	100 kg
Ammonium sulphate or calcium ammonium nitrate	30 kg	Furadan	500 g
Super phosphate	10 kg	B.H.C.	500 g
Muriate of Potash	10 kg		

Before making compost, wheat straw is spread on cemented floor and is turned many times with water being sprayed at regular intervals.

Day 0: At the stage, there should be around 75% humidity content in the wheat straw, to which wheat bran, calcium ammonium nitrate, urea, murate of potash, and super phosphate are mixed thoroughly and evenly. The material is then piled 1.5m thick x1.25m high with the help of wooden rectangular block. The blocks are removed. Once the entire material has been stacked up or piled up. Water is

sprayed twice or thrice to keep the substrate moist. Temperature should be in the range of 70-750C.

1st turning Day 6: On the sixth day first turning is given to the stack. The purpose of turning is that every portion of the pile should get equal amount of aeration and water. If the turnings are not given, then anaerobic condition may prevail which may lead to the formation of non-selective compost. In the stack, the central zone is fermenting at its peak and has maximum temperature rest of the portion is either not at all fermented or ferments improperly. The correct method of turning is as: Removing about 15cm of compost from the top and spread it on one side of the floor, the rest part of compost on the other side of the floor. Now turning is done by shaking the outer (top most) part and the inner part of the compost, first separately and then missing them altogether thoroughly with the help of wooden buckets.

2nd turning (Day 10): On the tenth day, again the top most part and the inner part of the compost is separated, water is sprayed on the top part. Again the two parts are piled up together in such a way that now the top part is inside and the inner part is on the top of the stack.

***3rd turning (day 13)*:** it is also done in the same way as described earlier and required quantity Gypsum mixed at this stage.

***4th turning (day 16)*:** The same process of turning is followed. The required quantity of furadan & lindane are added during this turning.

***5th turning (day 19)*:** The compost is turned in the same manner.

***6th turning (day 22)*:** The same process of turning is followed. The required quantity of furadan and lindane are added during this turning.

***7th turning (day 25)*:** The compost is turned in the same manner

8*th turning (day 28)*: if no ammonia persists in the compost, spawning is done.

Short method of composting: Compost prepared by short method of composting is superior in production quality and the chances of infection and disease is quite low. Composting by this method requires special infrastructures; equipments etc. that initial cost is to high, therefore, the farmers can purchase the readymade compost from the authentic composting units. The compost when ready for spawning should have the following characteristics:

Moisture	About 68%	**Ammonia**	Below 0.006%
pH	7.2-7.5	**Nitrogen**	Around 2.5%
Fire fangs (Actinomycetes)	Excellent growth		

Proper timing for cultivation: Sept. – Nov.& Feb.-April (02 crop)

Cultivated strain: Delta, U-3, S-11, MC-465, A-15

Spawning :The process of mixing of the spawn in the compost is known as spawning. Spawn is thoroughly mixed in the compost at the rate of 600-750 gm per 100 kg of compost (0.6-0.75%). The spawned compost is filled in tray or polypropylene bags covered with formalin treated news papers. In case of bags, they should be folded at the top and covered up. After spawning, temperature and humidity of crop room should be maintained at 22-26^{o}C and 85-90%, respectively for spawn run. Water should be sprayed over the covered news papers, walls and floors of the crop room. After 12-14 days of spawning white mycelial growth is seen running the entire length of the tray/bag. This is then covered with casing soil on the surface.

Casing soil : The significance of casing soil is to maintain the moisture content and exchange of gases within the surface of the compost which helps in the proper growth of the mycelium. The pH of the casing soil should be 7.5-7.8 and must be free from any infection or disease. In our country casing soil is prepared from the following ingredients.

Two years old manure + garden soil	3:1
Two year old manure + garden soil	2:1

Two year old manure + spent compost	1:1
Two year old manure + spent compost	2:1

Pasteurization of casing soil: The casing soil is piled on cemented floor and is treated with 4% formalin solution. Thorough turning of the soil is done and it is covered with polythene sheet for the next 2-3 days. After that remove the polythene cover and turn the casing soil so that it is free from the smell of formalin.

Using the casing soil: A layer of casing soil (3-4cm thick) is being spread uniformly on the compost when the surface has been covered by white mycelium of the fungus. Formalin solution (0.5%) is then being sprayed. Temperature and humidity of the crop room should be maintained at 14-18^{o}C and 80-85%, respectively. Proper ventilation should be arranged with water being sprayed once or twice a day.

Harvesting of crop: Pin head initiation takes place after 12-18 days of casing and the fruiting bodies of the mushroom can be harvested for around 50-60 days. The crops should be harvested before the gills open as this may decrease its quality and market value.

Productivity: From 100 kg compost prepared by long method of composting 14-18 kg of mushroom can be obtained. Similarly, 18-22 kg mushroom can be obtained from pasteurized compost (Short Method Compost).

2. Oyster mushroom

The species of the genus *Pleurotus* are commonly known as oyster mushroom or dhingri mushroom. This mushroom can be cultivated at a temperature range between 20-28^{o}C and relative humidity between 75-90 per cent.

Steps of cultivation process

Substrate and its preparation

The tropical wastes like rice straw, wheat straw, corncobs, dried water hyacinth, sugarcane bagasse, banana leaves, cotton waste or sawdust are used as substrate for cultivation. The straw should be cut into small pieces (3-5cm long) to facilitate proper wetting as well as to increase surface area. Although this mushroom can be cultivated on simple water soaked straw but there are chances of crop failure due to presence of contaminants. In order to avoid contaminations the straw should be treated by hot water and chemical.

Hot water treatment-The substrate should be is treated with hot water at 65^{o}C for 1 hour. The excess water is then drained off and substrate cool down to room temperature for spawning.

Chemical treatment- The materials are usually soaked in water chemically sterilized with carbendazim (7-10g) and formalin (120-150 ml)/ 100 litre of water for 16-18 hours. After that straw is taken out from solution and spread on clean cemented floor or on polythene sheet to evaporate the excess water. The ready substrate should contains 65-68 per cent moisture.

Proper timing for cultivation March.- May & July.-Sept (02 crop)

Cultivated spices: *P. sajor-caju, P. florida, P. sapidus, P. eryngii, P. cornucopiae, P. flabellatus, P. djmore, P. eous, P. ostreatus*

Spawning and crop management : Oyster mushroom spawn should be about 15-20 days old when mycelium has formed complete coating around the grain. The normal rate of spawning in a pasteurized substrate is 2-3% of the wet substrate. The spawning is usually done by mixing the spawn throughout substrate. Before filling the substrate in polythene bags, holes of about 1 cm diameter are made at 10-15 cm distance all over the surface for free diffusion of gases and heat generated inside. The optimum temperature for growth of mycelium is 23 ±2^{o}C. Relative humidity in growing room should be range between 85-90% during spawn-run. Spawn run usually takes about 15-20 days. After complete spawn run, polythene removed completely with help of sharp knife carefully. Usually 3-4 days after opening the bags, mushroom primordial (pin heads) begin to form. After opening the bags water should be sprayed 2-3 time per day regularly.

Harvesting and yield: Mature mushrooms become ready for harvesting in another 2-3 days. An average biological efficiency (fresh weight of mushrooms harvested divided by dry substrate weight x

100) can range between 70-80% and sometimes even more. To harvest the mushrooms, they are grasped by the stalk and gently twisted and pulled. A knife should not be used.

3. Milky Mushroom

Calocybe indica is commonly known as milky mushroom or dudhiya mushroom due to its milky white appearance of the fruit body. It can be easily cultivated at the temperature range between 25-35^{o}C and relative humidity 70-90 per cent.

Substrate and its preparation

The tropical wastes like chopped paddy straw and wheat straw are used as substrate for cultivation. To avoid contaminations the straw should be treated by hot water and chemical as like oyster mushroom.

Proper timing for cultivation: May - Aug (01 crop)

Cultivated species: Calocybe indica and Macrocybe gigentium

Spawning and crop management: About 18-20 days old spawn is used for spawning. Spawning should be done @ 4 per cent of ready substrate. The spawning is usually done by mixing the spawn throughout substrate. The spawned substrate should be filled in polythene bags 4-5kg per bag. The bags should be folded at the top and covered up. The optimum temperature for growth of mycelium, ranges between is 20-37^{o}C. Relative humidity in growing room should be range between 80-85% during spawn-run. Spawn run usually takes about 15-20 days.

Casing: This mushroom needs casing for fruit body initiation. After complete spawn run casing is done and its thickness should be kept 2-3 cm is being spread uniformly on the surface of the spawn run substrate. Temperature and humidity of the crop room should be maintained at 25-35^{o}C and 80-85%, respectively. Proper ventilation and adequate light should be maintained and water being sprayed once or twice a day. After 10-12 day of casing fruit primordia (pin head) are formed and within 5-6 days the mature and ready for harvesting.

Harvesting: The fruit bodies should be harvested before spore release by twisting so that stubs are not left on substrate. After harvesting lower portion of stalk with adhering casing soil should be cut with sharp knife. About 70 kg fresh mushroom can be harvested per quintal of dry substrate.

II. Enabling Policies

1.A Existing policies related with agriculture and animal husbandry:

Subsidies and incentives are given on all agricultural inputs. 50 to 90% subsidies are granted on all inputs and implements.

1.B Policies to be suggested for doubling income in the specific agro-ecological region:

1. Section of crop and area specific crop production program
2. Timely and assured supply of agricutural inputs to farmers at door.
3. Popularization of polyhouse technogy for vegetables and flower production
4. Inclusion of hybrid seed programe for crop production.
5. Establishment of seed production units for temperate crops.
6. Need to establish more food processing unts.
7. Availabilities of credit at minimum rate.
8. Assured buyback policy for agricultural produce.

2.A Existing Institutions: ICAR Institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK, NGOs

2.B Institutions to be suggested for doubling income in the specific agro-ecological region of district:

1. Establishment of food proceesing units at distt level to procure and marketing of surplus.
2. Need to develop or establish animal breeding/Grading up program
3. Testing of new crops in nontraditional areas for doubling the crop production.

3.A Existing Incentives:

3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district:

1. An assured bonus to farmers to grow new crop or higher production potental

2. Selection of farmers at village for trendsetter for dessimination of technical knowlwdege and technolgy may be awarded
3. Free access to libraray and one institute at least once in a year.

4.A Existing risk coverage facilities: Crop and Animal Insurance Schemes

4.B Risk coverage facilities to be suggested for doubling income in the specific agro-ecological region:

1. Risk coverage may be applicable for all agricultural products and animals
2. Declaration and minimum support price be fixed well in time

J. Marketing and value addition in specific agro-ecological region

1.A Existing marketing facilities: No organized procurement agency/mandi

1.B Marketing facilities to be suggested for doubling income in the specific agro-ecological region:

1. Contractual farming,
2. Linkages with MNCs and NCs,
3. Mahila hat, local hat, weekly bazaar and local mandi,
4. AC van,
5. Online portal for sale

2.A Existing grading facilities: Nil

2.B Grading facilities to be suggested for doubling income in the specific agro-ecological region:

Mechanical grading facilities should be made available on cluster basis for cereals and vegetables & fruits

For grains:

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

For horticultural crops:

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

2.C Processing facilities to be created for better marketing and value addition in the district:

Modern and cost effective Grading and packaging facilities, small scale fruit and vegetable processing units

For grains:

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity
10. Sugarcane crusher, open pan evaporator, moulds for jaggery, packaging unit at village level

For horticultural crops:

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity

2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

2.D Packing facilities to be created for better marketing and value addition in the district :
Packing facilities for packing of processed food item like tetra pack. can packing. Ecofriendly packing material for small and big quantities etc are required.

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity
3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)
4. IRRI bags for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables
3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed
8. Litchi peeling and shredding unit

3. Existing marketing and value addition problems in the specific agro-ecological region: No marketing facility, No value addition facility, High transportation cost

K. Online Management and Evaluation

1.A: Existing online management structure available: Internet etc.

1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district: Each village should be connected by Internet facility with proper device, awareness about internet user.

2.A: Existing evaluation procedure: Manual

2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district: Internet , GPS, Email, Whatup, ITC tools

3.A: Existing monitoring system: Physical and through regular visits at village level

3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district: Regular visits and online report submission, farmer's feed back ,pre and post evaluation system should be there

4.A: Existing feedback system: Manually

4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district: Internet portal and proper software for evaluating ongoing activities

5.A: Existing reading system: Literature, Booklets, Hindi Extension Journals etc

5.B: Reading system required for online management and evaluation in specific agro-climatic region of district: Farm advisery portal, online helpdesk services, mobile advisory

Specific action plan for doubling agricultural income in agro-ecological region

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties for increasing productivity

1. Promotion of high yielding varieties of wheat (UP-2572, VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS 507 and HPW 349), paddy (Irrigated condition - VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85*; Rainfed- Chatki Dhan- VL Dhan 208, VL Dhan 209; Jethi dhan – Vivek Dhan 154, VL Dhan 157, VL Dhan 156 and VL Dhan 158 in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.

2. Promotion of high yielding varieties of corn (Vivek QPM 9, Vivek Maize Hybrid 45, Vivek Maize Hybrid 53,CMVL Sweet Corn 1, CMVL Baby Corn 2)
3. Promotion of high yielding varieties of finger millets (, VL Mandua 324, and VL Mandua 352) and Barnyard millet (PRJ-1, VL Madira 172 and VL Madira 207) in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.
4. Promotion of high yielding variety of lentil (PL-4, PL-7, PL-8, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL Masoor 514), horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19) and soybean (PS 1042, VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65 PS 1092) in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.
5. Promotion of high yielding varieties of vegetable pea (Pant Sabji Matar 3, G 10 and Arkel, Azad Pea 3, Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12, Pusa Pragati), Capsicum (VL Shimla Mirch 3 California wonder, Bull nose, Arka mohini, Arka Gaurav, Indira, Bharat, Pusa Dipti), Cabbage (T-621, Pragati, Indica,, Pusa Mukta , Sri Ganesh Gole), tomato (Himsona, Naveen 2000, Avinash 2, NP 7730, VL Tamatar 4), Onion (Agri found light red, Agri found dark red, Pusa red, Pusa ratnar, VL Piaz 3), Garlic (VL Garlic 1 and VL Lahsun 2) in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.
6. Promotion of high yielding varieties of Citrus (Malta : Blood red, Valencia; Kinnow; Lemon & lime: Pant lemon 1, Kagzi lime, Orange), Apricot (DK 5, Harcot, New castle, Shakarpara, Charmagz), Peach (Alxander, Red Globe, Crest heaven, Glo Heaven etc Nectarine- Snow Queen), Pear (Max Bartlette, Red Bartlette, Willium, Starkrimson, Hokoi, Plum (Italian plum, Prunes *viz* Frontier) in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Berinag and Gangolihaat* blocks.
7. Promotion of high yielding variety of fodder crop berseem (BL-10, UPB-10), Sorghum (SSG-988, PC-29, MP Chari, PCH-106), Fodder maize (Ganga-2, Ganga-5, QPM), Hybrid Napier (IGFRI-3,6,10 NB-21), Gini grass (PGG-1,9 Bundel gini ghas 1,2) in *Bin, Munakot, Kanalicheena, Dharchula, Didihat, Barinag and Gangolihaat* blocks.

Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Development of water harvesting and roof harvesting techniques for water storage in all blocks.
2. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
3. Creation of rain water harvesting structure in private as well as government buildings in all blocks.
4. Creation of trenches for high percolation of water in most of the area of *Kanalichhinna, Berinag, Gangolihat, Didihat, Munakot and Dharchula* blocks.
5. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in low or valley areas of all the blocks of this region.

Adoption of cluster approach for holistic development

1. Rejuvenation of existing orchards of Citrus, Pear, Peach, Plum and stone fruits (Almonds, Apricot, walnut) in *Munsyari, Gangolihat, Berinag, Didihat, Kannalichinna, Bin, Munakot and Dharchula.*
2. Promotion of onion, potato and garlic cultivation in all *blocks of the region*.
3. Promotion of off season vegetables (tomato, capsicum, cole crops etc.,) cultivation in *all blocks*.
4. Promotion of production of vegetable pea, Ginger, Turmeric in *Bin, Munakot*, *Didihat, Gangolihat, Berinag* and *Kannalichhina* block.
5. Promotion of production of hybrid rice in *Kannalichhinna, Dharchula, Bin and Munakot* block.
6. Promotion of production of Urd, Mung and lentil in *Kannalichhinna, Berinag, Gangolihat, Dharchula, Bin and Munakot* block.

Management of wild animal problem

1. Promotion of live fencing of wild Apricot, Jatropha, Cheura, lime/ lemon at larger scale in fruit crops, ginger or turmeric in shady areas, Lemon grass to ward off wildlife in cultivated field.
2. Enacting legislative measures for protection of crop from wild animals.
3. Promotion of protected cultivation of vegetables (Tomato, Capsicum, Cabbage, Cauliflower and Cucumber) in *all blocks.*
4. Promotion of cultivation of Kilmaru, Ber, wild Aonla, Kafal, Hishalu and other wild fruits in different pockets in forest areas for wild animals.

Adoption of Farm mechanisation (Power tiller, thresher etc)

1. Popularization of multi crop thresher and Power Weeder at Nyay Panchayat level in *all the blocks*.
2. Promotion of serrated sickle, wheel hoe, handle fork, handle kutla, power tiller, small wheat thresher, winnowing fan, small reaper, Vivek Millet thresher cum pearler, VL Paddy thresher and Vivek small tool kit for reduction in drudgery of hill farmers.

Adoption of efficient irrigation techniques

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available.
2. Drip Irrigation in integration with water harvesting structure where irrigation water is not available.
3. Green House Cultivation for vegetables.

Management of soil health in low or valley areas

1. Popularization of soil testing in intensive mode and distribution of soil health card to farmers for judicious use of fertilisers.
2. Promotion of Forti fication of composting unit, adoption of legume based cropping system and green manuring techniques in concern areas of all blocks.
3. Organic cultivation of rice, millets, spices and local grains in all blocks.

Others

1. Cluster approach for holistic development.
2. Promotion of timely and local availability of high yielding varieties of all the cereal, pulse, High Value Crops like vegetable, fruits, spices, etc.
3. Cultivation of fodder grasses like Gini grass, Hybrid Napier, Khadik , Bheemal, oats, fodder maize and berseem) & medicinal (Gadryani, Jambu, Kuth, Uteesh) plants.
4. Adoption of only well decomposed FYM/ value added compost.
5. Promotion of efficient and timely use of INM, IPM and IDM modules.
6. Compulsion of seed treatment through bio agent/ chemical in the cluster.
7. Adoption of moisture conservation practices like mulching with local straw or black mulch in all blocks.
9. Promotion to focus on integrated weed management..

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of high milk breeds of cows (Jursey, HF, Sahiwal), buffaloes (Murrah, Neeli-ravi) and goats (Barbari, Jamunapari), sheep (Gaddi, selective breeding of local breed) fish (Silver carp, grass carp and common carp) in *Bin, Munakot, Kannalichhinna, Didihat, Dharchula, Berinag, Munsyari and Gangolihat* block.
2. Establishment of Fodder Bank in *Bin, Dharchula, Munsyari, Gangolihat, Didihat, Kanalichhinna and Berinag* particularly during lean period.
3. Establishment of milk chilling plant at *Munakot , Gangolihat, Berinag, kannalichinna* and *Bin* block.
4. Promotion of Urea, Molasses, and Mineral mixer blocks at *all blocks.*
5. Establishment of hatcheries for need of broilor or croilor in *Berinag, Gangolihat*, *Didihat, Dharchula and Munsyari blocks.*
6. Availability of feed material with low prices & Timely health check-ups of animals.
7. Introduction and promotion of Cross breed milch breed of animal for increasing income of marginal farmer

Strategy 3 : Integrating Farming system

Following Integrated farming system model may be developed in all blocks:

Agri-HortAnimal-processing based farming system

Activity	Area
A. Cropping system:	8 nali
Paddy/Ragi/Barnyard millet-lentil/mustard/chickpea	
Horsegram/soybean/pigeon pea-wheat	
Rice-cabbage/cauliflower-frenchbean/capsicum/potato/summer squash	
Hybrid napier/Rai grass on the boundry	
B . Horticulture	8 nali
Peach/Pear/citrus (Malta)/Walnut+ginger/turmeric/fodder grass (As intercrop)	
Polyhouses (for growing tomato/capsicum/cucumber)+ polytunnel(for raising vegetable seedling)	
Water harvesting structure	
Mushroom Production Unit	
C Livestock	2 nali
a. Cow/buffalo	2no.
b. Backyard poultry	25 Birds
c. Goat farming	5+1
d. Bee kepping	
e. Fisheris	
D. Vermicomposting/Processing-	2 nali
Washing and cleaning of season vegetables, biogas/vermicompost/biopesticides	

Total cost : Rs 90,000.0

Total income : Rs 2.0 lakhs

Net income : Rs 1.1 lakh (Approx.)

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of mini fruit grading plant for plum, peach, pear and stone fruits in all blocks.
2. Establishment of Food Processing Units for Malta and citrus at *Bin, Munakot, kannalichinna, Berinag and Dharchula* blocks.
3. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all the blocks.
4. Promotion of common resources on custom hire basis viz. Power weeder/tiller, Mini thresher and other equipments at Nyay Panchayat level in *all blocks*.
5. Establishment of Food and Processing Units at *Bin, Munakot, Kannalichinna, Berinag, Gangolihat and Dharchula* for pickle making using wild *Aonla, chilli, mango & lemon*.
6. Establishment of Food and Processing Units at *Bin, Munakot, Kannalichinna, Didihat, Gangolihat and Dharchula* for Ketch up of Tomato and jam- jellies of local fruits
7. Promotion of common resources on custom hire basis viz. Power tiller in *all blocks.*

Strategy 5 : Waste land development and waste water

1. Contour making for arable purpose in waste land in *Bin, Munakot, Kannalichinna, Gangolihat, Berinag, Gangolihat and Dharchula* and other and other high hills areas.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in all blocks.
3. Plantation of Mulberry plants, Wild fruit plants, Fodder trees (Bheemal, Utees, Oak etc.) may be promoted in *all blocks*
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland of all blocks.
5. Popularization of trenches or silages for percolation of water to avoid surface run off in *Bin, Munakot, Kannalichinna, Didihat, Gangolihat and Dharchula* blocks.
6. Construction of check dam and artificial structure to maximize water percolation rate all blocks.
7. Construction of tank for storage of water for lean season in all blocks.
8. Establishment of storage system for rain water in monsoon season.
9. Establishment of waste water treatment plants based on phycoremediation technique at sewer

drainage points.

Strategy 6 : Reduced cultivation cost

1. Adaption of integrated nutrient management techniques and promotion of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc.
2. Provision of mechanization (Use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers etc.)
3. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in all blocks.
4. Promotion of line sowing and balanced fertilizers application in crops.
5. Sowing of crops with recommended seed rate, spacing and depth.
6. Promotion of need based application of pesticides and other agricultural inputs. `
7. Promotion of hand tools in agricultural and horticultural operations.
8. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
9. Promotion of pressurized irrigation techniques in horticultural crops.

Strategy 7 : Off-farm income

1. Promotion of apiculture/ mushroom/poultry for small and landless farmers in all blocks.
2. Promotion of cultivation and collection of medicinal plants in *Kannalichinna, Didihat, Berinag, Gangolihat, Dharchula, Munsyari* blocks.
3. Promotion of skill development in women and youth in all blocks.
4. Creation of new SHGs in other villages of all blocks.
5. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Pickle making, Jam & Jelly making, Spice cultivation, Ghee making & packing, etc. may be provided for better performance in all blocks.

Strategy 8 : Enabling Policies

1. Ensure Buy back of farmer's produce through common agencies.
2. Announcement of Minimum Support Price of crop in each block by the government before sowing.
3. Land consolidation is essentially required.
4. Implementation of policies for control of wild animal menace in agricultural areas.
5. Implementation of Soil Health Card Scheme in each block.
6. Increasing institutional support by providing subsidises and incentives to small and marginal farmers in all blocks.
7. Labelling of organic inputs and certification mechanism for various crops in all three blocks.
8. Popularization of Udhyan and KCC for widespread use of government incentives/ subsidies to farmers.
9. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
10. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.

Strategy 9 :Marketing and value addition in specific agro-ecological region

1. Development of local hats at Block level on weekly basis.
2. Establishment of linkages of farmers with the different private companies to ensure proper marketing.
3. Farmer's produce collection center should be developed at road head of the villages.
4. Creation of better transportation facilities with cool chain van at Block level.
5. Creation of direct linkages with food processing industries for better prices.
6. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.

7. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
8. Installation of mini grading machines at village level.
9. Establishment of godowns with latest technology in all blocks.
10. Development of proper marketing network to check the interference of middle men in marketing of agricultural produce of the farmers.

Strategy 10 : Online Management and Evaluation

1. Development of Mobile apps/ software for online management and evaluation at district level.
2. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
3. Organization of monthly review meeting at district to solve the problems related with farmers.
4. Promotion of use of community radio, TV talks and Whatsapp etc. for effective implementation of programme.

Agro-Ecological Region: Region C (1500 m-2400m)

A.General information about Agroeco-region
District: Pithoragarh
Agro-ecological region: Region C (1500 to 2400 m)
Main Blocks in Region: Didihat, Munakot, Bin, Dharchula, Munsiyari, Kanalichina, Berinag
Main village cluster in blocks:
Didihat: Lakhtigaon, Chaubati, Bhaludiyar
Munakot
Bin
Dharchula: Galati, Khumti, Rafijuma, Khet
Munsiyari: Kotalgaon, Chauna, Dola
Kanalichina: Satgarh, Ascoda, Ratoli, Kanalichina
Berinag: Humkarki, Kandakiroli
Gangolihat: Jajulinag, Surkhal
Irrigated Clusters: NIL
Rainfed Clusters: All are rainfed
Existing rain water management facilities:

1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj)
3. Village pond (Taal and Chaal)
4. Collection from hill slope (Khaal)
5. Hydrum as lift device
6. Roof water harvesting but limited

B. Productivity Enhancement
1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region

1. Low cost lining material to check seepage
2. Efficient water application systems (sprinkler and drip)
3. Rejuvenation and popularisation of traditional water harvesting systems
4. Cost effective lifting devices
5. Roof top water harvesting system
6. Poly tank for water storage for scattered fields

2. Existing practices for soil health improvement

1. Mixing of Bicchu Ghas ,Timura and Walnut leaves in soil
2. Use of undecomposed farmyard mannure/compost
3. Meagre/ no use of biofertilizers
4. Imbalanced/ insufficient nutrient use
5. Use of raw/partially decomposed FYM
6. Meagre/ no compost making/recycling of crop residue
7. Mixed cropping of cereal and legume in few pockets
8. Soil health card scheme launched in 2015

3. Specific Action / Interventions recommended to improve soil health in specific agro-ecological region
iii)Cereals and oilseeds

1. Integrated fertilizer application
2. Bio-fertiliser/soluble fertiliser based farming
3. Soil test based fertilizer application
4. Promotion of pulse based crop rotation
5. Maximum use of value added compost/FYM

Cereals and oilseeds

1. Seed/ soil inoculation with Azotobacter and Phosphorus solubilising microbial culture (250-300g each/ acre for seed inoculation;/ and 1-1.5 kg each mixed in well decomposed 25 kg FYM/ acre for soil inoculation).
2. Soil test based balanced use of fertilizers in irrigated areas as per recommendation; INM shall be preferred
3. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

Pulses and soybean

1. Seed with specific *Rhizobium* inoculant and Phosphorus solubilising microbial culture.
2. Use of recommended dose of phosphatic fertilizer
3. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

Vegetables and spices

1. Seed/ nursery soil inoculation with *Azotobacter*/ *Azospirillum* inoculant and Phosphorus solubilising microbial culture (each of 200 g/m2 for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with *Azotobacte*r/ *Azospirillum* inoculant and Phosphorus solubilising microbial culture at transplanting.
3. Soil test based balanced use of fertilizers; INM shall be preferred
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost.
5. Low availability of Phosphorus in soil can be mitigated by use of Di ammonium phosphate (DAP) or Zinc phosphate application.
6. Recommended doses of FYM/Vermi-compost can be used for better soil health.

4.Existing crop cultivation strategy being adopted under changing climatic condition

1. Regular Occurrence: Frost, Drought, Cold wave
2. Southern part of district receives high amount of rainfall.
3. Approximately 16% cultivable area is irrigated.
4. Rice, wheat, ragi, maize are prominent crops of the district.
5. Local French bean varieties are being grown in summer season.
6. Growing of vegetables and horticultural crops over small area.

5.Specific strategy to be adopted for doubling productivity under changing climatic conditions in the agro-ecological region

1. The climatic projection suggests increasing air temperature and erratic distribution of rainfall. Therefore following strategy should be followed to increased income under changing climatic scenario.
2. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
3. Plenty of rain water (Approximately 1300mm rainfall) is available in rainy season the rain water should be properly stored (polythene tank, farm pond, by forming bunds) and harvested for Kharif season crops.
4. The area of off season vegetable should be increased at least by double by the year 2022.
5. Soil erosion triggered by higher slope gradient is the major issue of Pithoragarh. Therefore water and soil conservation techniques like terrace farming, bunding etc should be encouraged
6. The frost susceptible vegetable crops should only be grown on southern aspect of topography so that availability of radiation increases and the effect of frost could be minimized.
7. Crop residues should be burnt in the previous night if there is forecast of frost.
8. In frost prone regions organic mulch should be used in a vegetable field for enhancing energy level in field.
9. The summer temperature is falling in the optimum temperature range, while soils are slightly

acidic which favours cultivation of French bean as a summer crop in Munsyari and Dharchula blocks of Pithoragarh District. Plantation of litchi/mango orchards

10. Timely sowing of high yielding varieties of cereals, pulses, vegetables and oilseeds
11. Promotion of protected cultivation
12. Adoption of intercropping techniques
13. Use of fertilizer on soil test basis
14. Increase in water and fertilizer use efficiency through drip
15. IPM & INM modules for specific crop and plants
16. Proper storage and marketing

6 A. Name of Field Crop: Wheat

i. Existing varieties being used: Mundaria, Lal Mishri, VL-738, VL-616,dal bakhani

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: UP-2572, VL-804, VL-904,VL -829,VL 832 , VL-907

iii. Existing package of practices being used:

1. Preparation of land- 1 or 2 ploughing with local plough no definite depth
2. Seed rate and seed sowing -150-175 kg/ha, Broad casting
3. Manure and fertilizer-
4. use of undecomposed FYM (rainfed) and undecomposed FYM with small doses of chemical fertiliser by some progressive farmers (in irrigated conditions)as per availability
5. Irrigation-usually maximum area is rain fed and in valley condition 1 or 2 irrigation

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2 ploughing + 1 harrowing with mould bold plough upto 10-15 cm
2. Seed rate and seed sowing -100-125kg/ha, line sowing 18-21 cm apart
3. Manure and fertilizer- 10-15 tonne FYM , NPK 100-120:60:40, 50-60:30:20with micronutrients
4. Irrigation-As per irrigation facility 1 irrigation at CRI, jointing stage and 1 at flowering stage.

v. Major insect pests associated with crop: Cutworm ,Termites, Aphids, Jassids

vi. IPM Module for management of insect pests(except organic areas):

Aphids (*Macrosiphum (Sitobion) avenae* or *Macrosiphum miscanthi*)

1. Avoid late sowing of crop to save crop from aphid.
2. Conservation and enhancement of biocontrol agents like coccinellid beetles, Chrysopa, syrphid, Apanteles etc. protects the crop against aphid attack.
3. Spray any of the following insecticides after diluting in 500 litre water/ha when more than 5 aphids are recorded per ear head:

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG	50	21
Quinalphos 25 %EC	1000	

Termites: *Microtermes obesi* and *Odontotermes obesus*)

1. Dismantle termataria (monde) around fields & kill the termite queen.
2. Summer deep ploughing and burning of stubbles/residue of previous crop.
3. Use well rotten cowdung manure/compost to avoid termites.

Name of the Insecticides	(gm/ml) /ha
Thiamethoxam 30% FS (Seed Treatment/Kg)	3.3 per Kg

Cutworm: *Agrotis ipsilon* and *A. segetum*)

Avoid late sowing of crop to save crop from armyworm.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Methyl parathion 50% EC	300	600
Trichlorfon 50% EC	500	1000

vii. Major disease associated with crop: False smut, Rust, Loose smut

viii. IPM Module for management of disease:

Loose smut: *Ustilago nuda* f.sp. *tritici*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carbendazim 50% WP (Seed Treatment/Kg)	1.0	2.0
Carboxin 75% WP (Seed Treatment/Kg)	1.5-1.9	2-2.5
Tebuconazole 2% DAS	0.02	1.00
Difenoconazole 3% WS	0.06	2.0

Yellow rust=stripe rust: *Puccinia striiformis=Puccinia glumarum*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Propiconazole 25% EC	500	30

ix. Major weeds associated with crop: *Anagalis arvensis, Argemone mexicana, Asphodelus tenuifolius, Avena fatua, Chenopodium album , Rananculus , Phalaris minor*

x. IPM Module for management of weeds(except organic areas):

Red chickweed: *Anagalis arvensis* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Carfentrazone ethyl 40 %DF	50	80
2,4-D Sodium salt Technical (80WP)	625-1000	90
Methabenzthiazuron 70 %WP (POE-30DS)	2000-2500	100
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20% WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Medium soil)	4200	
Clodinafop-propargyl 15%+ Metsulfuron methyl 1 %WP	400	100
Mesoulfuron methyl 3+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

Onion weed: *Asphodelus tenuifolius* (annual, monocot, narrow leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38 %EC	1320-2200	
MCPA Amine salt 40 %WSC	2500	

Field bindweed: *Convulvulus arvensis* (perennial, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D Dimethyl amine salt 58% SL	860-1290	
Metsulfuron methyl 20%WG	20	76
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100

Common wild oat: *Avena fatua* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Diclofop methyl 28%EC	2500-3500	90
Isoproturon 50% WP	2000	
Isoproturon 75% WPs	1330	60
Methabenzthiazuron 70 %WP (PE: 2DAS)	1500-2000	100
Methabenzthiazuron 70% WP (POE: 16-18 DAS)	1000-1250	100
Triallate 50% EC	2500	150
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100

Dwarf canary grass: *Phalaris minor* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Clodinafop Propargyl 15% WP	400	110

Diclofop methyl 28% EC	2500-3500	90
Fenoxaprop-p-ethyl 10% EC	1000-1200	110
Isoproturon 50% WP	2000	
Isoproturon 75% WPs	1330	60
Methabenzthiazuron 70 %WP (PE: 2DAS)	1500-2000	100
Methabenzthiazuron 70 %WP (POE: 16-18DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Pendimethalin 30% EC(Light soil)	3300	
Pendimethalin 30% EC (Medium soil)	4200	
Pendimethalin 30% EC (Heavy soil)	5000	
Pinoxaden 5.1 %EC (POE: 30-35DAS)	800+900	90
Sulfosulfuran 75%WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

Bathua/pigweed: *Chenopodium album* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Carfentrazone ethyl 40% DF	50	80
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38% EC	1320-2200	
Methabenzthiazuron 70 %WP (POE: 30DAS)	2000-2500	100
Methabenzthiazuron 70 %WP (POE: 16-18 DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20%WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Heavy soil)	4200	
Sulfosulfuran 75% WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Wheat-Horse gram/Soybean(rainfed),Wheat-Rice(irrigated),
4. Timely Sowing, Seed treatment, Use of HYV
5. FIRB
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM
8. INM and soluble fertiliser
9. Integrated weed management
10. IPM

11. Good storages conditions
12. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. climate changing,
4. Wild animal damages, Migration,
5. Poor Irrigation facilities,
6. SAAR practices (Shifting area practice)

6B. Name of Field Crop: Rice

i. Existing varieties being used: China-4, lal dhan, lal –safed rikhua, Saket 4

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:

Irrigated condition(>1500 msm)-VL 85,81, 86,62
Rainfed- Chatki Dhan-VL 206,207,208
Jethi dhan –VL 154

iii. Existing package of practices being used:

1. Preperation of land- 1 or 2 ploughing with local plough no definit depth, Manual puddling
2. Seed rate and seed sowing -150 kg/ha in dirct seeding rice , and in transplanting 60-70 kg/ha
3. More than 45 days seeding used
4. Manure and fertilizer- use of un decomposed FYM (undecomposed FYM 1.5-2.0qt./nail) with small doses of chemical fertiliser by some progreesive farmers (in irrigated conditions)as per availability
5. Irrigation-usually maximum area is rain fed and in valley condition as avalability of irrigation roaster
6. No IPM practices

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 1 or 2 ploughing with local plough , puddling
2. Seed rate and seed sowing -100-125/ha in direct seeding rice , and in transplanting 40-50 kg/ha, basmati20kg/ha,hy 20kg/ha
3. 25-30days seeding used
4. Manure and fertilizer- -15 tonne FYM , NPK 100-120:60:40, rainfed 50-60:30:20with micronutrients(Zn, Fe)
5. Irrigation-usually maximum area is rain fed and in valley condition as avalability of irrigation roaster
6. Use of pre and post emergence tp herbicide, rainfed- pre emergence, Use of IPM practices

v. Major insect pests associated with crop: Stem borer, Rice leaf folder, rice bug, thrips

vi. IPM Module for management of insect pests:

Stem borer:

1. In the stem borer endemic area raise the nursery away from light source.
2. Raise nursery in narrow strip and mechanically destroy egg masses and moths
3. Remove seedling with Stem borer eggs before transplanting.
4. Use nitrogenous fertilizer moderately and split the application of it over three growth stages to reduce the damage.
5. For the monitoring install the pheromone traps in the field at the rate of 3 trap per acre at a distance of 60 m in a triangular pattern and record the males trapped daily to access the peak population.
6. For the management of yellow stem borer through pheromone mediated mass trapping of male install the pheromone trap in field at the rate of 20 traps/ha in rows maintaining a distance of 20

and 25 meters between traps and rows, respectively. The traps in the first rows are installed 10 m inside from the boundary of the field. The traps are tied on 1.25-1.5m long straight bamboo sticks or poles with the help of jute or plastic strings.The lures containing 3 and 5 mg pheromone are changed after 3 and 4 week, respectively, whereas 10 mg lure work for whole season. Adjust the trap height at 0.5 m and 1.0 m in the early vegetative and reproductive stage of crop, respectively, or 30 cm above crop canopy in all the stages of the crop.To check the escape of trapped males put a tea spoonful insecticidal dust in the polythene sleeve of dry sleeve trap. Dust is not required in funnel type trap. To Ascertain the quality use lures supplied by 2-3 manufacturers in alternate traps initially and after recording their performance replace the ineffective lures by highly effective lure. Relocate the traps displaced in bad weather and replace the polythene sleeve damaged by weather or animals.

7. Mass rearing and release of some parasitoids such as different species of *Trichogramma* have not been found useful in the rice ecosystems in so many countries including India which are inhabited by *Telenomus* and *Tetrastichus* species. Use of trichocard, therefore, increases the cost of cultivation without any gain. The conservation of *Telenomus* and *Tetrastichus* species is self sufficient to naturally reduce the stem borer population.
8. To increase the effectiveness of parasitoides and predators in the rice field
9. Conserve and enhance the natural enemies which are already present in the field.
10. Create favourable condition for natural enemies.
11. Always leave a pest residue in the field at non-economic level, for natural enemy.
12. Reduce the harmful effect of pesticides on natural enemy by:
    A. Apply insecticide only when necessary, not regularly.
    B. Apply insecticide only when the pest population reaches Economic Threshold Level.
    C. Applying a selective insecticide which is less toxic to natural enemy.
    D. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.
    E. Use selective formulation and application method.
    F. Application of granular formulation is less harmful to natural enemy
13. Following insecticides may be used to control stem borers of rice when the population or damage of pest is recorded to 1 moth or 1 egg mass/ m^2 or 5% dead heart :

50 Days within transplating (2 inch water in field)

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 0.4 %GR	10000	53
Fipronil 0.3% GR	16670-25000	32
Cartap 4% Gr	18750	
Carbofuron 3% CG	33300	
Carbosulfon 6% G	16700	37

50 Days after tranplanting

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5 %SC	150	47
Fipronil 5% SC	1000-1500	32
Fipronil 80 %WG	50-62.5	19
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75 %SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20% WG	125	30
Thiacloprid 21.7 %SC	500	30
Acephate 75% SP	666-1000	15

Acephate 95 %SG	592	30
Chromafenozide 80% WP	94-125	32
Monocrotophos 36% SL	1400	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Carbosulfon 25 %EC	800-1000	14
Chlorpyriphos 20% + Acetamiprid 0.4% EC	2500	10
Phosphamidon 40% + Imidachlorpid 2 %SP	600-700	22
Flubendamide 4%+ Buprofezin 20% SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

Name of the Bio-Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5
Azadirachtin 0.03% EC (Neem oil based)	2500-5000	5
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	1500	

Leaf folder:

Following insecticides may be used to control leaf folders of rice

50 Days within transplating (2 inch water in field)

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 0.4% GR	10000	53
Cartap 4% Gr	18750	
Carbosulfon 6% G	16700	37

50 Days after transplating

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	150	47
Indoxacarb 15.8 %EC	200	14
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75% SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20 %WG	125	30
Chromafenozide 80% WP	94-125	32
Fipronil 80%WG	50-62.5	30
Acephate 75 %SP	666-1000	15
Acephate 95 %SG	592	30
Monocrotophos 36 %SL	1400	
Dichlorovos 76% EC	627	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Quinalphos 25 %EC	1000	40
Flubendamide 4%+ Buprofezin 20 %SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

Name of the Bio-Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.15% EC (Neem seed kernel	2500-5000	5

based)		
Azadirachtin 0.03% EC (Neem oil based)	2500-5000	5
Azadirachtin 5% (Neem extract concentrate containing)	375	5
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	1500	
Beauveria bassiana 1.15%WP Strain BB-ICAR-RJP	2500	
Beauveria bassiana 1.15%WP Strain ICAR	2500	

Rice bug: *Leptocorysa acuta*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Methyl parathion 2% DP	500	25000

Biological control

Parasitoids:

Gryon flavipes, attacking: eggs

Predators:

Micraspis discolor, attacking: nymphs, adults

Neoscona theisi, attacking: nymphs, adults

Neurothemis fluctuans and *N. terminata* attacking: nymphs, adults

Orthetrum sabina, attacking: nymphs, adults

Pathogens:

Beauveria bassiana, attacking: nymphs, adults

Thrips

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Lambda-cyhalothrin 5% EC	250	15

Bio-insecticides

Name of the Bio-Insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5

vii. Major disease associated with crop: Khaira, rice blast ,Brown spot ,leaf blight, False smut

viii. IPM Module for management of disease:

During Nursery Sowing

Deep summer ploughing or soil solarisation

Seed bio priming with bio-control agent (PS @10g/kg seed) or fungicide (Carbendazime 1g/kg seed)

Fertilizers

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

Khaira disease: Due to Zinc deficiency)

Name of the Fungicides	(gm/ml) /ha
Zinc sulphate (Apply in soil at the time of plot preparation)	25000
Zinc sulphate spray (2.5 Kg Quick lime & 20 Kg Urea in 1000 lit. water	5000

Rice blast: *Magnaporthe grisea*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Picoxystobin 22.52% SC	600	12

Isoprothiolan 40 %EC	750	60
Tricyclazole 75% WP	300-400	30
Tebuconazole 25% WG	750	10
Idifenphos 50% EC	500-600	21
Carpropamid 27.8 %SC	500	
Cresoczim-methyl 44.3 SC	500	30
Hexaconazole 5% EC	1000	40
Casugamycin 3 %SL	1000-1500	30
Carbendazim 50 %WP	250-500	
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Tebuconazole 50% +Trifloxystrobin 25% WG	200	31
Carbendazim 12%+Mancozeb 63% WP	750	57
Azoxystrobin 18.2% + Difenoconazole 11.4%SC	0.1%	5

Bacterial leaf blight: *Xanthomonas oryzae*

1. Do not planting under full or partial shade to avoide bacterial blight (BLB) infection.
2. After bacterial blight infection of drain the water from field and stop the application nitrogenous fertilizer.
3. Drain of water to check spread of bacterial blight

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Streptocyclin (Seed Treatment)	40ppm	
Streptocyclin (Nursary Treatment)	40-100ppm	
Streptocyclin (Spray)	15	Local recommendation
Copper hydroxide 53.8% DF	1500	10
Copper hydroxide 50 %WP	500	Local recommendation

Biofungicides

Name of the Bio-Fungicides	**(gm/Kg) /ha**	**Treatment**
Pseudomonas fluorescens 1.5% WP (BIL-331 Accession No. MTCC 5866)	5 gm/Kg seed	Seed Treatment: Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP with minimum volume of water and coat the seed uniformly, shades dry the seeds just before showing.

Brown leaf spot: *Cochiobolus miyabianus*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Propineb 70 %WP	1500-2000	
Idifenphos 50% EC	500-600	21
Captan 75% WP	1000	

Biofungicides

Name of the Bio-fungicides	**Kg/ha**	**Treatment**

Pseudomonas fluorescens 1.5% WP (BIL-331 Accession No. MTCC 5866)	2.5 Kg/ha	**Seed Treatment:** Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP with minimum volume of water and coat the seed uniformly, shade dry the seeds just before sowing.

ix. **Major weeds associated with crop:** *Oxalis, Cyperus* spp*, Echinocloa* sp*, Chenopodium album, Commalina bengalensis, Cynodon* spp*, Digitaria sanguinales, Eclipta* spp*, Eleusine* spp

x. **IPM Module for management of weeds(except organic areas):**

Creeping Wood Sorrel: *Oxalis* sp. (annual,perennial, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Metsulfuron methyl 20% WG (Transplanted rice)	20	71

Umbrella plant: *Cyperus* sp. (annual, monocot, narrow leaves, sedge)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
MCPA, Amine salt 40% WSC (Transplanted rice)	2000-5000	
Metsulfuron methyl 20 %WP (Transplanted rice)	20	60
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Bensulfuron methyl 0.6% + Pretilachlor 6% G	10000	88 (Transplanted rice)

Bermuda Grass: *Cynodon dactylon* (perennial, dicot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Bensulfuron methyl 0.6 %+ Pretilachlor 6 %G	10000	88(Transplanted rice)

Bamboo grass: *Digitaria sanguinalis* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90

Jungle rice: *Echinochloa colonum, E. crusgali* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Anilofos 18% EC (Transplanted rice)	1660-2500	
Anilofos 2% G (Transplanted rice)	20000-25000	30
Bispyribac Sodium 10% SC (Nursary)	200	
Butachlor 50% EC (Transplanted rice)	2500-4000	90&120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90&120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Cyhalofop butyl 10% EC	750-800	90
2,4-D Ethyl Ester 38% EC	2500	
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Fenoxaprop-p-ehtyl 9% EC (Transplanted rice)	625	70 Post
Fenoxaprop-p-ehtyl 6.9% EC	812-875	61

Flufenacet 60% DF (Transplanted rice)	200	90-110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiargyl 6% EC (Transplanted rice)	1066	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90
Anilofos 24%+ 2,4-D ethyl ester 32% EC	1000&1500	90 (Transplanted rice)
Bensulfuron methyl 0.6% + Pretilachlor 6 G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Cinmethylin 10% EC (Transplanted rice)	750-1000	60
Paraquat dichloride 24% SL (Before sowing)	1250-3500	

False Daisy: *Eclipta alba* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Azimsulfuron 50% DF (Transplanted & Direct sown)	70	59
Bensulfuron methyl 60%DF (Preemergence)	100	88
Bensulfuron methyl 60%DF (Postemergence)	100	71
Bispyribac Sodium 10% SC (Direct seeded)	200	78
Butachlor 50% EC (Transplanted rice)	2500-4000	90-120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90-120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 WDG (Transplanted rice)	83.3-100	110
Metsulfuron methyl 20 %WG (Transplanted rice)	20	71
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90
Bensulfuron methyl 0.6% + Pretilachlor 6 %G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110(Transplanted rice)

Metsulfuron methyl 10%+ chlorimuron ethyl 10 %WP	20	90(Transplanted rice)

Indian goosegrass: *Eleusine indica* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Butachlor 50% EC (Transplanted rice)	2500-4000	90-120
Butachlor 5% G	25000-40000	90-120

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Jethirice- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Rice- Wheat /onion/berseem(irrigated),
5. Timely Sowing/Trans planting, Seed treatment,
6. Use of HYV,Hybrid (120-125days), Basmati(120-125days)
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products
14. Avoid early Nursery raisingpractice and use of 21-30 days old seedling

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, Wild animal damages, Migration,
4. Poor Irrigation facilities

6C. Name of Field Crop: Finger millet

i. Existing varieties being used: Band mutthi(Garhwali mandua), Khuli muthi(Kumaon mandua)

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VLM-324, VLM-315, VLM-149, VLM-146

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. undecomposed FYM 1.0-2.0qt./nali,
3. 1-2 weeding

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2 or 3ploughing ,
2. Seed rate and seed sowing -14-16kg/ha, Gapfilling/Transplating
3. Manure and fertilizer- -10 tonne FYM , NPK 20:40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v. Major insect pests associated with crop

vi. IPM Module for management of insect pests(except organic areas):

vii. Major disease associated with crop: Blast

viii. IPM Module for management of disease:

1. Grow resistant variety such as VL 149
2. Seed treatment with carbendazim @ 1g/kg seed followed by 2 sprays of carbendazim @ 0.1% (first when 50 per cent ear heads are formed and second 10 days later)

3. For organic farming seed treatment with Bioagents like T. harzianum @ 10g/kg seed followed by 2 sprays of same @ 10g/litre of water (first when 50 per cent ear heads are formed and second 10 days later).

ix. Major weeds associated with crop: *Oxalis latifolia, Phyllanthus niruri ,Amaranthus viridis,Euphorbia hirata, Solanum* sp., *Tribulus sp,Cyperus* sp

x. IPM Module for management of weeds(except organic areas):

For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. INM(Maximum use of value added compost/FYM
9. and soluble fertiliser)
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, wild animal damages, migration,
4. Poor Irrigation facilities

6D. Name of the Field crop: Barnyard Millet

i. Existing varieties being used: Non described

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PRJ-1,VL Madira -172

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nali,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 2or 3 ploughing,
2. Seed rate and seed sowing -14-16kg/ha, Gapfilling
3. Manure and fertilizer- -10 tonne FYM , NPK 20:40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: Stem borer

vi. IPM Module for management of insect pests(except organic areas): -

vii. Major disease associated with crop: Blight and Smut

viii.IPM Module for management of disease:

1. Grow resistant variety like PRJ 1.
2. Seed treatment with carbendazim @ 2g/kg seed or carboxin @ 2.5g/kg seed

ix. Major weeds associated with crop: *Oxalis latifolia, Phylanthus niruri , Amaranthus viridis,*

Euphorbia hirata, Solanum sp*,Tribulus* sp*,Cyperus* sp

x. IPM Module for management of weeds: Manual weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Barnyardmillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Gapfilling
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs, use of imbalance and un decomposed FYM, climate changing,
2. Wild animal damages
3. Migration specially from border area,
4. Poor Irrigation facilities

6E. Name of Field crop: Maize

i. Existing varieties being used: Lal makka

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Surya ,Kanchan ,Naveen,Vivek 31

50 kg seed of maize single cross hybrid DH 296 is available with Maize Breeder of the University. Maize hybrid DH 296 is a potential high yielding hybrid and is final stage of testing in SVT.

iii. Existing package of practices being used:

1. Sown as mixed cropping
2. Traditional seed variety , un decomposed FYM 1.5-2.0qt./nail, 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – composit-18-20 kg/ha, hy 20-25kg/ha, , Gapfilling,spacing 60*20cm
3. Manure and fertilizer- -10 tonne FYM , NPK 100:120:60 :40,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v. Major insect pests associated with crop: Stem borer,cut worm

vi. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: -

Maize stem borer: *Chilo partellus*

Name of the Insecticides	(gm/ml)/ha	Waiting Period (days)
Thiamethoxam 30 FS (Seed Treatment/Kg)	2.4	8
Carbofuran 3 %CG	1000	33000
Carbaryl 85% WP	1500	1764
Carbaryl 4 %G	250	6250

Dimethoate 30% EC	200	660
Phorate 10% CG	1000	10000

For management of white grub, chlorpyriphos 2 ml per liter of water can be applied in the root zone of the plant on need basis

vii. Major disease associated with crop: Downy mildew ,White rust

viii. IPM Module for management of disease(except organic areas):

1. Disease management strategies
2. Use of disease free certified seeds
3. Deep ploughing during summer
4. Crop rotation
5. Application of bio-agents i.e. Psedumonas fluorescens as seed treatment (10g /kg seed) plus soil application (2.5 kg/ha) and spray @ 0.1% and seed treatment with Trichoderma viride (10g /kg seed) and their stimulation by the addition of amendments can be done.
6. A fertilizer dose of 80 Kg N, 60 Kg P2O5, 40 Kg K2O is generally required. Entire PK and 10% of N is applied as basal. Remaining nitrogen is applied in 4 splits i.e. 20% at 4 leaf stage, 30% at 8 leaf stage, 30% at flowering stage and 10% at grain filling stage.
7. Row spacing should be done at 60-75 cm & plant to plant spacing, 20-25 cm.
8. Cultural practices which include sufficient availability of plant nutrients, optimum soil pH (6.2-7.0), adequate water in fields, weed control, optimum plant population and use of disease free and high quality seeds are very helpful in reducing the damage caused by various diseases by reducing the plant stress.

Downy mildew: *Peronosclerospora maydis*

Name of the Fungicides	**(gm/ml)/ha**	**Waiting Period (days)**
Metalaxyl-M 31.8% ES (Seed Treatment/Kg)	2.4	
Metalaxyl 35% WS (Seed Treatment/Kg)	7.0	
Mancozeb 75% WP	1500-2000	
Metalaxyl 8%+ Mancozeb 64% WP	2000	49
Azoxystrobin18.2%+Difenoconazole 11.4 %SC	0.1%	26

ix. Major weeds associated with crop: *Eleusine indica, Echinocloa* sp

x. IPM Module for management of weeds:

Indian goosegrass: *Eleusine indica* (annual, monocot, narrow leaves, grass)

Name of the Herbicides	**(gm/ml)/ha**	**Waiting Period (days)**
Alachlor 50 %EC	5000	90
Atrazin 50 %WP	1000-2000	
Diuron 80% WP	1000	

Jungle rice: *Echinochloa* sp. (annual, monocot, narrow leaves, grass)

Name of the Herbicides	**(gm/ml)/ha**	**Waiting Period (days)**
Alachlor 50% EC	5000	90
Alachlor 10 %GR	15000-25000	
Atrazin 50 %WP	1000-2000	
Diuron 80 %WP	1000	
Paraquat dichloride 24% SL (Before sowing)	800-2000	90-120

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of Baby corn and Sweet corn Shot duration hybrid Varieties ,Seed treatment , HYV, Inter cropping, Gap filling ,Weed Management
2. Organic cultivation,
3. Adoption of low-cost based cultivation practices,

4. Maize- Wheat/Lentil/Barley/oat (fodder) (rainfed),
   Maize+Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs
2. Use of imbalance and un decomposed FYM
3. Climate changing, wild animal damages, migration
4. Poor Irrigation facilities

6F. Name of Field crop: Ramdana

i. Existing varieties being used: Local

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Annapurna, PRA 1, VL Chua 44.

iii. Existing package of practices being used:
Traditional seed variety , un decomposed FYM 1.5-2.0qt./nail, 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – composit-1.5 kg/ha, spacing 50*15cm
3. Manure and fertilizer- -10 tonne FYM , NPK 40:20:0,
4. Irrigation-usually maximum area is rain fed

v. Major insect pests associated with crop: Leaf webber

vi. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: -Use of IPM technolgy

vii. Major disease associated with crop: Downy mildew ,White rust

viii. IPM Module for management of disease(except organic areas):

1. Disease management strategies
2. Use of disease free certified seeds

ix. Major weeds associated with crop: Local weeds

x. IPM Module for management of weeds: Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Quality seed, Control of leaf webber, INM
2. Contour cultivation and care soil & water conservation measures,Maximum use of value added compost/FYM
3. Integrated weed management
4. IPM, Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs
2. Climate changing, wild animal damages
3. Poor Irrigation facilities

6G. Name of Field crop: Buckwheat

i. Existing varieties being used: Local

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VL ugal 7, PRB 1.

iii. Existing package of practices being used:
Traditional seed variety , un decomposed FYM 1.5-2.0qt./nail, 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – composit-1.5 kg/ha, spacing 50*15cm
3. Manure and fertilizer- -10 tonne FYM , NPK 40:20:0,
4. Irrigation-usually maximum area is rain fed

v. Major insect pests associated with crop:

vi. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: -Use of IPM technolgy

vii. Major disease associated with crop:

viii. IPM Module for management of disease(except organic areas):

ix. Major weeds associated with crop: Local weeds

x. IPM Module for management of weeds: Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Quality seed, INM
2. Contour cultivation and care soil & water conservation measures,Maximum use of value added compost/FYM

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs
2. Climate changing, wild animal damage

7 A. Name of the Pulse crop: Horsegram

i. Existing varieties being used: Non described-Paharigahat

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VLG-8,10,15

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nail,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – 20-25kg/ha,spacing 30*10cm
3. Manure and fertilizer- -10 tonne FYM , NPK20:40 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v. Major insect pests associated with crop: -

vi. IPM Module for management of insect pests : -

vii. Major disease associated with crop: Rot,syam warn

viii. IPM Module for management of disease: -

ix. Major weeds associated with crop: *Oxalis latifolia,Phylanthus niruri ,Amaranthus viridis,Euphorbia hirata,Solanum* sp*,Tribulus* sp*,Cyperus* sp

x. IPM Module for management of weeds:

1. Apply Fenoxaprop-p-ethyl 9.3% EC @ 56.25-67.5 g a.i/ha at 20-25 days after sowing to control grassy weeds.

2. Apply Quizalafop-ethyl 5% EC @ 37.5-50 g a.i/ha at 15-20 days after sowing to control grasses and some broad leaf weeds.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Horsegram- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Horsegram +Maize+Fingermillet - Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM and soluble fertiliser
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM, climate changing, Wild animal damages
3. Migration, Poor Irrigation facilities

7B. Name of the Pulse crop: Lentil

i. Existing varieties being used: Chota masur ,lal masur

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PL-4, PL-7, PL-8,VLmasoor103,VLmasoor-125 VLmasoor-126

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Un decomposed FYM 1.5-2.0qt./nail,
3. 1-2 inter culture

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing – 20-25kg/ha,spacing 30*10cm
3. Manure and fertilizer- -10 tonne FYM , NPK20:40 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v. Major insect pests associated with crop: Pod borer

vi. IPM Module for management of insect pests : -

vii. Major disease associated with crop: Wilt

viii. IPM Module for management of disease: -

1. Deep ploughing during summer.
2. Select disease resistant/tolerant varieties like PL 5 , PL 6 and PL 7
3. Seed treatment with Carbendazim (1 g) + Thiram (2 g) per kg seed.
4. Foliar spray of Propiconazole (0.1 %) at the appearance of disease and repeated 2-3 times at 15 days interval.

ix. Major weeds associated with crop: *Oxalis latifolia,Phylanthus niruri ,Amaranthus viridis*

x. IPM Module for management of weeds:Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income

in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Timely Sowing, Seed treatment,
4. Use of HYV
5. Contour cultivation and care soil & water conservation measures
6. Maximum use of value added compost/FYM
7. INM and soluble fertiliser
8. Integrated weed management
9. IPM
10. Good storage condition
11. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM, climate changing,
3. Wild animal damages

7 C. Name of Pulse Crop: Arhar (Red gram)

i. Existing varieties being used: UPAS, ICPL-151, AL15

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Arhar-291, VL Arhar 1, Pant Arhar-3

iii. Existing package of practices being used:

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. They also do not follow balance use of chemical fertilizers. It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Timely sowing of crop in from mid of May to June.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: White fly, Pod borer, Thrips

vi. IPM Module for management of insect pests:

Pod borer: *Helicoverpa armigera*)

Name of the Insecticides	(gm/ml)/ha	Waiting Period (days)
Chlorantraniliprole 18.5% SC	150	29
Chlorantraniliprole 9.3%+ Lambda cyhalothrin 4.6%ZC	200	18
Indoxacarb 14.5% SC	353-400	15
Indoxacarb 15.8% EC	333	12
Thiodicarb 75% WP	625-1000	30
Emamectin benzoate 5% SG	220	14
Flubendamide 480 %SC	100	10

Spinosad 480% SC	125-162	47
Lufenuron 5.5% EC	600	65
Methomil 40% SP	750-1125	7
Lambda cyhalothrin 5% EC	400-500	15
Monocrotophos 36% SL	1250	
Quinalphos 25% EC	1400	

Redgram thrips: *Scirtothrips dorsalis*

Name of the Insecticides	**(gm/ml)/ha**	**Waiting Period (days)**
Dimethoate 30%EC	200	660

vii. Major disease associated with crop: Yellow Mosaic, Blast

viii. IPM Module for management of disease:

1. For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.
2. For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid 200 ml/ha

ix. Major weeds associated with crop: Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds:

1. For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.
2. Application of alachlore @ 2 kg ai before one day of sowing of crop.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management,
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop,
4. Cluster based farming, Inter cropping.
5. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Farmers don't follow proper package of practices,
2. Proper market linkage is not available,
3. Improper use of irrigation facilities,
4. Lack of quality input.

7 D. Name of Pulse Crop: Chickpea

i .Existing varieties being used: Avrodhi, Pant G-114, PG-186, Uday

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Kabli chana-1, GNG-1969, Aman, GNG-1958

iii.Existing package of practices being used:

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. They also do not follow balance use of chemical fertilizers. It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Timely sowing of crop in Ist fortnight of October to IInd fortnight of October.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.

6. Arrangement of irrigation facilities in case of drought should be available.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: White fly, Pod borer, Thrips

vi. IPM Module for management of insect pests:

Pod borer: *Helicoverpa armigera*)

Name of the Insecticides	(gm/ml)/ha	Waiting Period (days)
Chlorantraniliprole 18.5% SC	150	29
Chlorantraniliprole 9.3%+ Lambda cyhalothrin 4.6%ZC	200	18
Indoxacarb 14.5% SC	353-400	15
Indoxacarb 15.8% EC	333	12
Thiodicarb 75% WP	625-1000	30
Emamectin benzoate 5% SG	220	14
Flubendamide 480 %SC	100	10
Spinosad 480% SC	125-162	47
Lufenuron 5.5% EC	600	65
Methomil 40% SP	750-1125	7
Lambda cyhalothrin 5% EC	400-500	15
Monocrotophos 36% SL	1250	
Quinalphos 25% EC	1400	

Redgram thrips: *Scirtothrips dorsalis*

Name of the Insecticides	(gm/ml)/ha	Waiting Period (days)
Dimethoate 30%EC	200	660

vii. Major disease associated with crop: Yellow Mosaic, Blast

viii. IPM Module for management of disease:

1. For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.
2. For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid 200 ml/ha

ix. Major weeds associated with crop: Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds:

For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management, Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop,
3. Cluster based farming, Inter cropping.
4. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Farmers don't follow proper package of practices, Proper market linkage is not available,
2. Improper use of irrigation facilities,
3. Lack of quality input.

7E. Name of Pulse crop: Rajma

i.Existing varieties being used: Different local varities with different colour like Red rajma, White , Brown, Black, Spoted white etc are being grown in Munsyari and Dharchula.

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VL-63, VL-125,genetic improvement of local varieties

iii.Existing package of practices being used:

1. Broadcasting of seed
2. No seed treatment
3. Use of un-decomposed FYM

iv.Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preparation of land- 1 or 2 ploughing
2. Seed rate and seed sowing – 12-15kg/ha, spacing 30*45cm
3. Manure and fertilizer- -10 tonne FYM , NPK50:20 :20,
4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,
6. Use of IPM practices

v.Major insect pests associated with crop: Stem flies, Pod borer, Sucking pests, white grub

vi.IPM Module for management of insect pests :

Pod borer

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole18.5% SC	100	20
Flubendamide 480% SC	100	11
Monocrotophos 36 %SL	625	

vii.Major disease associated with crop: Angular leave spot, anthrochnose, powdery mildew, root rot

viii.IPM Module for management of disease:

ix.Major weeds associated with crop: - Local

x.IPM Module for management of weeds:- Hand weeding

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Genetic improvement of local varieties
2. Preparation of land- 1 or 2 ploughing ,
3. Seed rate and seed sowing – 75-80 kg/ha, spacing 30*10cm
4. Manure and fertilizer- -10 tonne FYM , NPK100:80 :40,,
5. Irrigation-usually maximum area is rain fed
6. Use of pre emergence herbicide (As per moisture availability), rainfed- pre emergence,
7. Use of IPM practices

xii.Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, Wild animal damages
4. Migration specially from border area,
5. Poor Irrigation facilities

7F. Name of Pulse/oilseed Crop: Soyabean

i. Existing varieties being used: Kala bhatt(Oval)

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PS 1042, VLS 21, VLS 47, VLS 59, PS 1092

iii. Existing package of practices being used:

1. Traditional seed variety ,
2. Undecomposed FYM 1.5-2.0qt./nail,
3. 1-2 weeding

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Preperation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing -100-125/ha,
3. Manure and fertilizer- -10 tonne FYM , NPK 20-80:40,

4. Irrigation-usually maximum area is rain fed
5. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

v. Major insect pests associated with crop: Semilooper, Leafy caterpiller, Whitefly, Girdle beetle, stem fly, pod borer, jassid etc.

vi. IPM Module for management of insect pests(except organic areas):

Cultural practices: The cultural practices make the environment less favorable for the pests and more favorable for its natural enemies. The following are cultural practices recommended for the management of soybean insect pests.

1. Removal and destruction of infected stubbles followed by deep summer ploughing destroys the pupae of stem fly, girdle beetle, pod borer and tobacco caterpillar present in the soil.
2. Optimal fertilizer dose of NPK and S @ 20:60-80: 30-40:20 kg/ ha should be applied.
3. Application of excessive dose of nitrogen fertilizer causes the infestation of all insect pests on soybean.
4. Crop rotation with non-leguminous plants is recommended for the management of leaf miner.
5. Intercropping of soybean with either asafetida (*Ferula assafoetida* L.) or maize or sorghum in the sequence of 4 rows of soybean with 2 rows of intercrop should be practiced. These intercrops help in conservation of biocontrol agents, like coccinellid beetles, Chrysoperla etc. In girdle beetle and semilooper endemic areas, intercropping with maize or sorghum should be avoided.
6. Planting of trap crops like castor for tobacco caterpillar, groundnut for leaf miner, marigold for pod borer and Dhaincha (*Sesbania sesban*) for girdle beetle.
7. Selection of insect resistant or tolerant varieties for cultivation.

Table1: Resistant or tolerant varieties for insect pests of soybean.

Insect pest	Resistant or tolerant variety
Stem fly	Dsb 25, Himso 1685, JS 20-89, MACS 1370, MACS 1410, NRC 97, JS 20-53,PS 1543, SL 983, Dsb 23-2
Girdle beetle	MACS 1410, Dsb 23-2, Himso 1685, JS 20-89, KDS 726
Defoliators	Dsb 23-2, KDS 726, PS 1543, PS 1569
Pod borer	Dsb 25, SL 683, NRC 97, MACS 1370, JS 20-89
Leaf miner	MACS 1370, Himso 1685, MACS 1370, MACS 1410
Pest complex	DS 2708, Dsb 23-2, Dsb 25, Himso 1685, JS 20-53, JS 20-79, JS 20-89, KDS 726, MACS 1370, MACS 1410, NRC 97, SL 983, PS 1543

Mechanical Control: Reduction of insect pest population by means of manual devices or labour is called mechanical control. The following measures are recommended for mechanical practices for soybean insect pests.

1. Collection and destruction of girdle beetle infested plant parts, egg masses and gregariously feeding larvae of Bihar hairy caterpillar and tobacco caterpillar.
2. Hand picking and mechanical destruction of matured pod borer larvae.
3. Erection of bird perches @ 10-12/ha to attract predatory birds for preying on defoliator larvae.

Physical control: Reduction of pest population by using device which affect them physically or alter their physical environment. Manipulation of temperature, humidity, light is used for this purpose. This includes the following:

1. Light traps should be placed at ground level early in the season for collection and destruction of the leafminer moths.
2. Installation of light traps in the field for monitoring and collection of adult moths.

Biological Control: The successful management of a pest by means of another living organism (parasitoids, predators and pathogens) is called biological control. The following biological control agents are used in IPM of soybean.

1. Release of *Tricogramma chilonis* @ 50,000/ ha four times at weekly interval against *S. litura*.
2. Spraying of *Bacillus thuringiensis* var. kurstaki @ 0.75 to 1.0 kg/ha for the management of

defoliators.

3. Foliar application of HaNPV (*Helicoverpa armigera* Nuclear Polyhedrosis Virus) for *H. armigera* @ 250 LE/ha.
4. The major predators of soybean insect pests are given in the table 2.

Table 2: Major predators of insect pests of soybean

Insect pests attacked	Predator
Whiteflies	Lady bird beetles: *Coccinella septumpunctata* *Coccinella transversalis*
Lepidopterous caterpillars	Pentatomid bug *Eocanthecona furcellata*
Lepidopterous caterpillars and Whiteflies	Spiders: *Lynx* spider and Orb weaver spider

Chemical Control: The control of insects with pesticides/insecticides is known is chemical control. The insecticides are applied only when the population of insect pests crossed the Economic Threshold Level (ETL) (Table 3). The list of insecticides recommended for soybean insect pests are given in table 4.

Table 3: Economic Threshold Level (ETL) of soybean insect pests

Insect Pest	Crop stage	Population/ meter
Green semilooper	Flowering	2 larvae
Tobacco caterpillar	Flowering	4 larvae
Girdle beetle	Flowering	10 % infestation
Pod borer	Podding	3 larvae

Table 4: List of insecticides recommended for soybean insect pests

Insect pests	Insecticides	Dosage
Sucking pests, stem fly	Thiamethoxam 30 FS (Seed treatment)	10ml/kg seed
Sucking pests	Acetamiprid 20 SP	100 ml/ha
Sucking pests	Spiromesifen 22.9 SC	600ml/ha
Sucking pests	Imidacloprid 17.8 SL	500 ml//ha
Sucking pests and girdle beetle	Triazophos 40 EC	800ml/ha
Defoliators	Dichlorovos 76EC	500 ml/ha
Defoliators and pod borer	Quinalphos 25 EC	1500 ml/ha
Sucking pests and defoliators	Monocrotophos 36 SL	800 ml/ha
Pod borer	Indoxacarb 15.8EC	333 ml/ha
Defoliators, stem fly and girdle beetle	Chlorantraniliprole 18.5 SC	150 ml/ha
Leaf miner	Carbaryl 50WP	2.0 kg/ha
Leaf miner and sucking pests	Oxydemeton methyl 25EC	350 ml/ha
Girdle beetle	Phorate 10 G	10 kg/ha
Stemfly and girdle beetle	Carbofuran 3 G	30 kg/ha

Bio-insecticides

Tobacco caterpillar (*Spodoptera litura*)

Name of the Bio-insecticides	(gm/ml) /ha
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

***Hairy caterpillar* (*Spilosoma obliqua*)**

Name of the Bio-insecticides	(gm/ml) /ha
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

Semilooper (*Chrysodeixis acuta*)

Name of the Bio-insecticides	(gm/ml) /ha
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

Soyabean leaf miner (*Odontota horni*)

Name of the Bio-insecticides	(gm/ml) /ha
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

vii. Major disease associated with crop: YMV, leaf spot, blight, Collar rot, rust

viii. IPM Module for management of disease:

Rust: *Phakopsora pachyrhizi*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Hexaconazole 5% SC	500	30
Propiconazole 25% EC	500	26

Collar rot: *Sclerotium rolfsii*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carboxin 37.5%+ Thiram 37.5% DAS	3.0/Kg	Seed Treatment

ix. Major weeds associated with crop : *Oxalis latifolia, Phylanthus niruri , Amaranthus viridis,Euphorbia hirata, Solanum* sp*,Tribulus* sp*,Cyperus* sp

x. Production constraints in agro-ecological region:

1. Apply Trifluralin 48%EC @ 1.0 kg a.i/ha as pre plant incorporation.
2. Apply Alachlor 50%EC @ 2-2.5 kg a.i/ha or Pendimethalin 30%EC @ 0.75-1.0 kg a.i/ha or Pendimethalin 30% EC + Imazethapyr 2% EC @ 0.75+0.05 kg a.i/ha or Metribuzin 70%WP @ 0.35-0.525 kg a.i/ha or Diclosulam 84% WDG @ 22-26 g a.i/ha within 3 days after sowing.
3. Apply Quizalofop- ethyl 5%EC @ 0.0375-0.05 kg a.i/ha or Fenoxaprop-p-ethy l 9.3% EC 0.1 kg a.i/ha or Haloxyfop 10.5% EC 108-135 g a.i/ha at 20-25 days after sowing to control grassy weeds.
4. Apply Imazethapyr 10%SL @ 0.1 kg a.i/ha or Imazamox 35%+ Imazethapyr 35% @ 0.07 kg a.i/ha at 20-25 days after sowing to control grassy and non grassy weeds.
5. Apply any pre emergence herbicide followed by one hand weeding at 30-35 days after sowing.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Timely Sowing, Seed treatment,
5. Use of HYV,
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM
8. INM and soluble fertilizer
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing, wild animal damages, migration,
4. Poor Irrigation facilities

8A. Name of the Fruit crop: Apple

i. Existing varieties being used: Royal Delicious, Red Delicious, Red Chief, Walspur, Oregoen spur, Red spur, Rymer, Sweet Banana, Kings Orange Pippins etc

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Need to introduce low chill or colour mutants and spur varieties suitable for different agroecological situations viz. Early Red one, Washington spur Pink Lady, Oregeon spur, Super chief and other new stains.

iii. Existing package of practices being used:

1. Use of old and traditional varieties
2. Less use of pollinizer cultivars
3. Use of high density plantation system without irrigation
4. Less or no use of mulch for water conservation
5. High incidence of wooly aphis
6. Use of organic manures
7. High stem and barky cankers
8. No use of IPM
9. No Grading or packing system or facilities
10. No facilities for under sized or cull fruits

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

Use of low chill cultivars like Red Velox, Washimgton spur, Pink Lady, Super chief, Red spur, walspur with suitable pollizers arrangement for apple

v. Major insect pests associated with crop: San jose scale, Tent caterpillar, coddling moth, wooly aphis

vi. IPM Module for management of insect pests:

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. Traps Parasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant*,Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Name of the Insecticdes	(gm/ml) /ha	Waiting period (days)
Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.

9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

vii. Major disease associated with crop: -

viii. IPM Module for management of disease: -

ix. Major weeds associated with crop: Local weeds

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

Use of high yielding cultivars with and suitable placement of pollinizer in high density planations with sufficent irrigation facility as drip for establishment of model and commercial orchards.

xii. Production constraints in agro-ecological region:

1. Availability of elite planting material
2. Lack of technical knowhow in apple cultivation

8B. Name of the Fruit crop: Peach

i. Existing varieties being used: Paradelux, July Elberta, Red June etc

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Alxander, Red Globe, Crest heaven, Glo Heaven etc

Nectarine- Snow Queen.

iii. Existing package of practices being used:

1. Use of old and traditional Varieties
2. Poor knowledge of canopy management practices
3. Organic inputs for crop production
4. No knowledge of high density orcharding
5. Irrigation facilities are rarely used
6. Lack of grading and packing facilities
7. No canning or processing unit
8. No availability of waste management of crop residue

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

Need to introduce non-clingstone varities with maturity indices on or before June. Use of High denisty plantation with mulch and supplemetation of drip irrigation.

v. Major insect pests associated with crop: San jose scale, Tent caterpillar, coddling moth, Peach leaf curl aphid, Peach fruit fly

vi. IPM Module for management of insect pests:

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. Traps Parasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Name of the Insecticdes	(gm/ml) /ha	Waiting period (days)
Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00

pm).

3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Name of Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Carbosulfan 3% CG	1000	33300
Oxydemetonmethyl 25% EC	0.025%	1500-2000

Peach Fruit Fly:

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap.
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

vii. Major disease associated with crop: Gummosis is major problem

viii. IPM Module for management of disease:

1. Use of proper cultural or field operation with minimum damage to the crop
2. Use of borax as spray of soil application
3. Use of antibiotic as prophylatic spray.

ix. **Major weeds associated with crop:** Nothing special

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

High density plantation with (3x3mts) supplemented with drip irrgation system.

xii. Production constraints in agro-ecological region:

1. Availability of elite planting material
2. Lack of technical knowhow in apple cultivation

8C.Name of the Fruit crop: Pear

i. **Existing varieties being used:** Gola, Victoria, China, Baggugosha, Kashmiri, Thumb pear etc

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Max Bartlette, Red Bartlette, Willium, Starkrimson, Hokoi, Sukoi (Low hills)

iii. **Existing package of practices being used:**

1. Use of old and traditional varieties
2. Less or no use of mulch for water conservation
3. Canopy management is poor
4. Recommended Cultural practices are rarely applied
5. Maturity indices are rarely use
6. Surplus management of fruit are not done
7. Processing industries are not established for Gola nashpati

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Use of new strains or occidental pears are needed for high hills
2. Introduction of new strains with less gritcells in fruits
3. Need to develop Postharvest management system with minimum losses.
4. Processing facilities needs to be strengthened.

v. **Major insect pests associated with crop:** San jose scale, codlling moth, peach curl aphid

vi. **IPM Module for management of insect pests:**

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant*,Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Name of Insecticides	(gm/ml)/ha	Waiting period (days)
Malathion 50% EC	0.05%	1500-2000
Oxydemetonmethyl 25% EC	0.07%	4200-5600

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host

5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Name of Insecticides	(gm/ml)/ha	Waiting period (days)
Carbosulfan 3% CG	1000	33300
Oxydemetonmethyl 25% EC	0.025%	1500-2000

vii. **Major disease associated with crop:** Fruit rot

viii. IPM Module for management of disease: Applications of contact and systematic fungicides

ix. Major weeds associated with crop: *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

Introduction of New Strain *viz*. Anjou, Starkrimson in high hills.

xii. Production constraints in agro-ecological region:

1. Availability of quality planting material
2. Adverse weather during season hits the spraying schedule of apple.
3. Negligence of drainage cause the root zone decrease.
4. Lesser emphasis on sanitation of orchard which leads the infection of diseases.
5. Lack of adaptation of proper technical knowhow during training and pruning in high /ultra high density orchard.
6. No proper facilities of cold chain.
7. Disaster during monsoon hit the specific workable and sustainable intensification yields.
8. No easily access to marketing facilities.

8D. Name of the Fruit crop: Plum

i. Existing varieties being used: Santa rosa, Beauty, Burbank

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Italian plum, Prunes viz Frontier

iii. Existing package of practices being used:

1. Use of old and traditional varieties
2. Less or no use of pollinizer varieties in plum especially in japnese type varieties
3. Less or no use of mulch for water conservation
4. Canopy management is poor
5. Recommended cultural practices are rarely applied
6. Maturity indices are rarely use
7. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: High density plantation with drip irrigation system.

v. Major insect pests associated with crop: Coddling moth, Tent caterpillar, San Jose, Leaf Curl Aphid, Peach Fruit Fly.

vi. IPM Module for management of insect pests:

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators, *Chilocorus bijugus* Mulsant, *Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

Name of the insecticides	(gm/ml)/ha	Waiting period (days)
Malathion 50% EC	0.05%	1500-2000

Oxydemetonmethyl 25% EC	0.07%	4200-5600

Tent Caterpillar:

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.
5. Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

Name of the insecticides	**(gm/ml)/ha**	**Waiting periods (days)**
Carbosulfan 3% CG	1000	33300
Oxydemetonmethyl 25% EC	0.025%	1500-2000

Peach Fruit Fly:

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

vii. Major disease associated with crop: -

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: *Chenopodium album, Cyperus rotundus, Cynodum dactylon, Parthenium, etc.*

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. High density plantation (3x3 mts) with drip irrigation
2. Intercropping of soybean or gahat or lentil in rabi season

3. Mulch technology
4. Post harvest management of perishable with refrigeration system and development of fruit wines factories in the state.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable and elite planting material
2. Poor technical knowledge

8E.Name of the Fruit crop: Kiwi

i. Existing varieties being used: Allison, Bruno, Hayward, Tomari, Abbott, Monty

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Allison, Bruno, Hayward, Tomari, Abbott, Monty

iii. Existing package of practices being used:

1. Canopy management is poor
2. Recommended Cultural practices are rarely applied
3. Maturity indices are rarely use
4. Processing industries are not established

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Proper planting distance,
2. Proper training and pruning
3. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
4. Need to develop Postharvest management system with minimum losses.

v. Major insect pests associated with crop: -

vi. IPM Module for management of insect pests: -

vii. Major disease associated with crop:

viii. IPM Module for management of disease:

ix. **Major weeds associated with crop:** Local

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Proper orchard establishment
2. Proper training and pruning
3. Proper orchard management practices like fertilizer, irrigation, insect and disease control measures

xii. Production constraints in agro-ecological region:

1. Proper orchard establishment
2. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
3. Use of micronutrients
4. Control of decline
5. Availability of quality planting material, Poor orchard management
   Need to develop Postharvest management system with minimum losses. Availability of quality planting material

8F.Name of the Fruit crop: Apricot

i. Existing varieties being used: Nugget, local variety

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: DK 5, Harcot, New castle, Shakarpara, Charmagz

iii. Existing package of practices being used:

1. Use of old and traditional Varieties
2. Poor knowledge of canopy management practices

3. No knowledge of high density orcharding
4. Irrigation facilities are rarely used
5. Lack of grading and packing facilities
6. No processing unit

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

Need to introduce high yielding varities with maturity indices. Use of High denisty plantation with mulch and supplemetation of drip irrigation.

v. **Major insect pests associated with crop:** Aphid

vi. IPM Module for management of insect pests: -

vii. Major disease associated with crop: root rot, gummosis is major problem

viii. IPM Module for management of disease:

ix. **Major weeds associated with crop:** Local

x. IPM Module for management of weeds: Through mechanical, chemical control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. High density plantation supplemented with drip irrgation system.
2. Proper fertilizer application

xii. Production constraints in agro-ecological region: Availability of Quality planting material

9 A. Name of the vegetable crop: Cabbage

i. Existing varieties being used: Golden acre or mix of varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole Green star, Pride of India

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Cultivars-In cabbage, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be head formation.
8. Transplanting- Farmers practices improper planting distance.
9. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
12. Harvesting- The harvesting should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Soil Testing- Farmers should test their soils before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to go for deep ploughing before sowing the crop particularly during the hot season or before the snowfall
3. Seed- Farmers should adopt improved varieties/ hybrids
4. Soil solarisation practice should follow in nursery beds .
5. Seed Treatment- To combat the different seed borne diseases to treat the seed by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing

6. Seed Rate- It is recommended to use the seed quantity for different as follows-
7. (Early)-600-700g/ ha open pollinated
8. (Mid and Late)- 500-550g/ha open pollinated
9. (Hybrid)-350-400g/ha
10. Optimum sowing time :Mid Sept- Oct
11. Transplanting- Farmers should transplant seedlings properly as for early (40x45cm), medium (40x45cm),
12. Manures and fertilizers- Farmers should incorporate well rotten cow dung (20-25tonnes/ha) and NPK (120:60:60) in irrigated, half dose of NPK in unirrigated condition.
13. Irrigation- As per requirements. At critical stages such as head initiation and head development
14. Weed control- Farmers must know about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically.
15. Harvesting- The farmer must aware about the maturity stage of a particular crop variety so he can harvest the crop as per their object. In general the heads should be harvested when they attempt the size in between 500-750 gms.

v. Major insect pests associated with crop: Diamond back moth, cabbage butterfly, Aphid and Painted bug

vi. IPM Module for management of insect pests :

1. Diamond black moth- plantation of mustard crop as trap crop at margins of cabbage field to attract the adults for egg laying,spray of *Bacillus thurengnsis* @ 1.0 kg /ha or
2. Cabbage butterfly - mechanically destroy the cluster of eggs,*Helicoverpa* - release of *Tricogramma* spp insect eggs @ 50000 / ha at the time of initation of flowering to 7- 10 days,

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Hand picking and destruction of cabbage butterfly eggs and larvae in nursery as well as main crop to reduce the pest multiplication .
3. Growing of African bold seeded mustard as trap crop at 22:2 ratio (Cabbage: Mustard) to attract DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

After Planting

1. Regular Monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Hook out the head borer and destroy mechanically. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT.

Dimond back moth: *Plutella Xyllostella*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	50	3
Cyantraniliprole 10.26% OD	600	5
Indoxacarb 14.5% SC	200-266	7
Indoxacarb 15.8% EC	266	5
Spinosad 2.5% SC	600-700	3
Chhlorfenapyr 10% SC	750-1000	7
Emamectin benzoate 5% SG	150-200	3
Flubendamide 480% SC	45-60	7
Flubendamide 20% WG	90-120	7
Chlofluazuron 5.4% EC	1500	7
Diafenthiuron 50% WP	600	7

Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	600-1000	
Bacillus thuringiensis serovar kurstaki (3a,3b,3c) 5% WP	500-1000	
Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500	

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7

Painted bug

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Dimethoate 30% EC	200	660

vii.Major disease associated with crop: Stem rot

viii.IPM Module for management of disease(except organic areas):

***Sclerotenia* stem rot:**

1. Summer deep ploughing,
2. Burn the infected crop debris,
3. Two spray at 10-12 days interval of carbendazim @ 1.0 gm / litre

ix.Major weeds associated with crop: *Oxalis latifolia, Phyllanthus niruri ,Amaranthus viridis*

x. IPM Module for management of weeds:

1. Use of weedicides, if required.
2. Weeding, hoeing
3. Deep ploughing

xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

Use of hybrid varieties suitable for year round production system for mid or high hills.

xii.Production constraints in agro-ecological region:

1. Less availability of high quality seeds
2. High prices of hybrid seeds
3. Post-harvest losses are more due to non availability of
4. storage facility
5. High prices of fertilizers

6. Low prices of farm produce
7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities
9. So far no minimum support price is fixed for the crop.

9B. Name of the vegetable crop: Cauliflower

i. Existing varieties being used: Unknown varieties available in the mandi

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:

Mid- Snow crown

Late- Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil.
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Cultivars-In cauliflower, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be curd formation.
8. Transplanting- Farmers practices improper planting distance.
9. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
12. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. **Soil Testing-** Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. **Land Preparation-** The farmers are recommended to open the land before sowing the crop for sterilization.
3. **Seed Treatment-** For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or *Trichoderma viride* 4g/kg before sowing
4. **Seed Rate**- The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha
5. **Planting distance**- Farmers should be sown the seed Asiatic type line to line 45 cm and plant to plant 8cm and European type line to line 30 cm and plant to plant 8 cm
6. **6. Manures and fertilizers**- should be used as per soil testing , General recommendation are **FYM**-250q/ha **Nitrogen**: 60 kg/ **Phosphorus**: 100 kg/ha and **Potassium:** 50kg/ha **Micronutrient:** should be used as per soil testing,
7. **Irrigation**- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at 7-8 days interval and in summer 3-4 days interval
8. **Harvesting**- Depending upon the cultivars, the roots become ready for harvesting in about 25-35 days after sowing. Early and rapid maturing European cultivars reach harvest maturity in 25-30 days after sowing. They become bitter and pithy if the harvesting is delayed. In India, harvesting is done manually. A light irrigation may be given before harvesting to facilitate lifting of roots. In advanced f countries, commercial radish growers use a single row harvester that pulls the plants from the soil, cuts the roots from the tops, and then places them in bags for transportation to a

picking shed.

v. Major insect pests associated with crop: Diamond back moth, Aphids are serious problem

vi. IPM Module for management of insect pests :

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Growing of African bold seeded mustard as trap crop at 22:2 ratio to attract DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

After Planting

1. Regular monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT.
5. Spray Dipel 8 SP (Bt var. kurstaki) @ 0.2% at 15 days interval after 22-25 DAT to manage DBM.

Dimond back moth: *Plutella Xyllostella*

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	50	3
Cyantraniliprole 10.26% OD	600	5
Indoxacarb 14.5% SC	200-266	7
Indoxacarb 15.8% EC	266	5
Spinosad 2.5% SC	600-700	3
Chhlorfenapyr 10% SC	750-1000	7
Emamectin benzoate 5% SG	150-200	3
Flubendamide 480% SC	45-60	7
Flubendamide 20% WG	90-120	7
Chlofluazuron 5.4% EC	1500	7
Diafenthiuron 50% WP	600	7
Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	600-1000
Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7

Fenvalerate 20% EC	300-375	7

Bioinsecticides

Name of the Bio-insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7

vii. Major disease associated with crop: Black rot

viii. IPM Module for management of disease(except organic areas):

***Xanthomonas* Black rot:**

Seed treatment with Streptocyclin @ 100 mg/kg seed and two spray of Streptocyclin 1.0 gm / 10 litre of water after 10-12 days interval.

ix. Major weeds associated with crop: *Parthenium, Chenopodium album*, Krishnil, Teepatiya

x. IPM Module for management of weeds:

1. Use of weedicide if required.
2. Weeding, hoeing
3. Deep ploughing.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Advanced technical package and practises regarding crop.
2. Use of trap crop like radish to attract the white butterfly.
3. Inter Cropping with coriander and rye in hills.

xii.Production constraints in agro-ecological region:

1. Less availability of high quality seeds
2. High prices of hybrid seeds
3. Post-harvest losses are more due to non availability of
4. storage facility
5. High prices of fertilizers
6. Low prices of farm produce
7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities
9. So far no minimum support price is fixed for the crop.

9 C. Name of the vegetable crop: Radish

i. Existing varieties being used: Dunagiri, Chinese Pink and Pusa Himani

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant, Punjab Pasand

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
4. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
5. Sowing time: June-Aug
6. Planting distance- Farmers practices improper planting distance and sown through broadcast.
7. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
8. Fertilizers: Farmer use imbalance fertilizer
9. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method.
10. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
11. Harvesting- The root harvesting should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological

region:

1. Use of long white tapering varieties
2. Line sowing and use of less or non-pithy varieties
3. Use of round shaped varieties for culinary purpose

v. Major insect pests associated with crop: Aphids are problem

vi. IPM Module for management of insect pests:

Aphid; *Aphis gossypii* Glover and *Myzus persicae* (Sulzer)

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the numbers considerably without any insecticidal spray.
2. Yellow sticky trap is effective for controlling aphid population.
3. Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha if needed.

vii. Major disease associated with crop: White rust

viii. IPM Module for management of disease(except organic areas):

Use of recommended pesticides in recommended dose

ix. Major weeds associated with crop: Local

x. IPM Module for management of weeds: Weeding manually

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of short duration, non pithy, coloured varieties for year round production.
2. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Cauliflower early- Radish- Bottlegourd
3. Brinjal-Radish –Chilli
4. Bottle bourd-radish-French bean

xii. Production constraints in agro-ecological region:

1. Lack of knowledge about the cultivation practices
2. Lack of processing facilities
3. So far no minimum support price is fixed for the crop.

9D. Name of the vegetable crop: Tomato

i. Existing varieties being used: Pant T3, Non descriptive varieties as open pollinated, Naveen 2000, Manisha, etc.

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Indeterminate hybrid varieties, Avinash (A-2), Himsona and various types of hybrids avalable in the market

iii. Existing package of practices being used:

1. Without soil and seed tretament, Poorly managed nurseries, Subterreaen staking, Non-judicious use of fertilizers,
2. Generally crop grown in open field condition

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use Inderminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition. Use Zn in deficient soil.
2. Use micronutrient including Ca, B and Mo
3. Crop rotation Tomato-cowpea-Early cauliflower.

v. Major insect pests associated with crop: Fruit borer and white flies **IPM Module for management of insect pests:** Fruit borer and White flies

Tomato fruit borer *Helicoverpa armigera* (Noctuidae: Lepidoptera)

1. Growing trap crop of African tall marigold as border row before 15 days of transplanting is beneficial in reducing egg laying in main crop.

2. Field sanitation and clean cultivation is effective tool to suppress the pest population.
3. Setting of sex pheromone traps @ 5 trap/acre for monitoring is effective.
4. Spray of Ha NPV @ 500 LE/ha mixed with 0.1 per cent UV retardant (Tinopol) and 0.5 per cent jiggery is effective.
5. Use of Bt @ 0.50kg/acre and NSKE 5 per cent to kill early stage larvae. Release of the egg parasitoid, *Trichogramma chilonis* or *T. brasiliensis* @ 1Lakh/ha coinciding with flower initiation at 15 days interval may reduce the pest population.
6. Development of pyridalyl nanocapsule suspension for efficient management of tomato fruit and shoot borer (*Helicoverpa armigera*) is an efficient approach for frequent delivery and effective management.

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Indoxacarb 14.5% SC	400-500	5
Chlorantraniliprole 18.5% SC	150	3
Cyantraniliprole 10.26% OD	900	3
Flubendamide 480% SC	120	5
Flubendamide 20% WG	240	5
Novaluron 10% EC	750	1-3
Novaluron 5.25%+ Indoxacarb 4.5% SC	1700	5
Methomil 40% SP	750-1125	5-6
Lambda cyhalothrin 5% CS	300	5

Management strategies(white fly)

A. Crop Hygiene

Field hygiene should be a high priority and should be included as an integral part of the overall strategy for managing whitefly populations, Tomato yellow leaf curl virus(TYLCV) incidence, and insecticide resistance. These practices will help reduce the onset of the initial infestation of whitefly, regardless of biotype, and lower the initial infestation level during the cropping period.

C. Other Cultural Control Practices

Pre-planting practices

1. Vegetative propagated ornamental plants (i.e. *Hibiscus, Poinsettia*, etc.) should not be grown at the same location, especially if bringing in plant materials from other areas.
2. Avoid yellow clothing or utensils as these attract whitefly adults.
3. Delay planting new fall crops as long as possible.
4. Do not plant new crops near or adjacent to old, infested crops.

Post-planting practices.

1. Apply an effective insecticide to kill whitefly adults prior to cultural manipulations such as pruning, tying, etc. Rogue tomato plants with symptoms of TYLCV.
2. Plants should be treated for whitefly adults prior to rouging and, if nymphs are present, should be removed from the field, preferably in plastic bags, and disposed of as far from production fields as possible.
3. Manage weeds within crops to minimize interference with spraying and to eliminate alternative whitefly and virus host plants.
4. Destroy old crops within 5 days after harvest, destroy whitefly infested abandoned crops.

C. Insecticidal Control Practices.

1. Restricted the use of neonicotinoids (imidacloprid or acetamiprid) in the field only during the first six weeks of the crop thus leaving a neonicotinoid-free period at the end of the crops.
2. Use selective rather than broad-spectrum control products where possible to conserve natural enemies and enhance biological control.
3. Do not apply insecticides on weeds on field perameters. These could kill whitefly natural enemies and, thus, interfere with biological control.
4. Crop rotation is effective tool to prevent pest population.

5. Avoiding of same group of crop in same field for a long time is beneficial.
6. Sticky trap is effective to control whitefly population.

White fly

Name of the Herbicides	(gm/ml) /ha	Waiting period(days)
Cyantraniliprole 10.26% OD	900	3
Spiromesifen 240% SC	625	3
Thiamethoxam 25% WSG	200	5
Imidacloprid 17.8% SL	150-175	3

vi. Major disease associated with crop: Buckeye fruit rot is a major serious disease.

vii. IPM Module for management of disease(except organic areas):

Buck eye rot:

1. Burn the infected fruit, leaves etc. and staking of plants,
2. Remove the leaves upto 9 inches from ground.

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Mancozeb 75% WP	1500-2000	
Propeneb 70% WP	1500	10

viii. Major weeds associated with crop: Local weeds

ix. IPM Module for management of weeds:

Cultural practices.

Through recommended chemicals.

x. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of high yielding varieties grown under ventillated polyhouse using standardized technology with fertigation technology in tomato can enhance the productivity of tomato manifold. Polyhouse technology is a boon for small and marginal farmers with fragmented holdings.
2. Reduce number of spray of pesticides.
3. Raise nursery on treated soil.

xi. Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continuous cultivation.
2. Poor nursery management in the crop
3. Poor staking and pruning techniques.
4. Poor technical knowhow

9E. Name of the vegetable crop: Potato

i. Existing varieties being used: Kufri Jyoti

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: K Girdhari, K Himalini and K Shailja

iii.Existing package of practices being used:

1. Planting time:
   Region B (1000-1500) : March- April
2. Spacing: 50-60 x 15-20 cm
3. Seed rate: 25-30 qtl/ha
4. Farmers are only using FYM along with urea at hills but the farmers in plains are using FYM + 160:100:120kg/ha NPK

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with application of organic manures.
2. Fertilizer should be used on soil test basis. Dehaulming practise should be adopted for long

duration storage of tubers.

3. Suitable fungicides should be used for control of Late blight disease e.g. mancozeb, cardendazim alone and in combination.

v. Major insect pests associated with crop: Potato tuber moth, Hadda beetle, Potato aphid, White grub is a serious and wide spread problem

vi. IPM Module for management of insect pests:

Potato tuber moth: *Phthorimaea operculella*

1. Heaps of green grasses may be kept at suitable interval in infested field during evening and next day early in the morning along with caterpillars to destroy.
2. Clean cultivation and mechanical destruction of caterpillars also help in reducing pest infestation.
3. Irrigation also brings them on the surface and birds shall predate them.
4. Apply chlorpyriphos 20EC at the rate of 2.5ml/l in the soil before seed sowing.

Epilachna beetle: *Epilachna viginatioctopunctata*

1. Hand packing of grubs and collection of beetles by hand nets during early stages of attack, helps in reducing the intensity of infestation.
2. Conservation and augmentation of natural parasitoids viz. *Pediobius foveolatus, Pleunotrogrus faveolatus* and *Tetrastichus* sp.
3. Application of Neem, Mahua, ground nut cakes are efficient in suppressing the pest population.
4. Spray of Malathion 50 EC in 200 liters of water per acre provides effective control of this pest

Aphids: *Myzus persicae*

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the numbers considerably without any insecticidal spray.
2. Yellow sticky trap is effective for controlling aphid population. Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG (Spray)	100	77
Thiamethoxam 25% WSG (Drenching)	200	77
Dimethoate 30% EC	660	
Oxydemeton-methyl 25% EC	1000	
Carbofuran 3% CG	16600	
Phorate 10% CG	10000	

White grub - use of VL Kurmula trap 1,use of WGPSB2 Bio-Formulation @ 10 gm/kg vermicompost or FYM,drenching of Chlorpyriphos @ 2ml/L

vii. Major disease associated with crop: Late blight and common scab disease in the crop and tuber.

viii. IPM Module for management of disease:

Late blight of potato: *Phytophthora infestans*

1. Use resistant verities.
2. Burn the infected crop debris, avoid excess moisture,

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Cyazafamid 34.5% SC	200	27
Chlorothaonil 75% WP (per lit. water)	0.875-1.250	14
Azoxystrobin 23% SC	500	12
Mandipropamid 23.4% SC (per lit. water)	0.8	40
Propineb 70% WP	0.30%	15
Captan 50% WG	1500	21
Captan 75% WP	1667	8

Copperoxychloride 50% WP	1250	
Copperhydroxide 53.8% DF	1500	22
Dimethomorph 50% WP	1000	16
Hexaconazole 2% SC	3000	21
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Metalaxyl 8%+ Mancozeb 64%WP	2500	49
Metalaxyl 4%+ Mancozeb 64%WP	2500	24
Capatan70%+ Hexaconazole 5% WP	500-1000	21
Carbendazim 25%+ Mancozeb 50%WS	0.6-0.7/Kg	Seed Treatment
Cymoxanil 8%8% +Mancozeb 64%WP	1500	10
Famoxadone 16.6%+Cymoxamil 22.1% SC	500	40
Fenamidone 10%+ Mancozeb 50% WG	1250-1500	30
Metiram 55%+ Pyraclostrobin 5% WG	1500-1750	15
Metalaxyl 3.3%+ Chlorothanil 33.1% SC	0.02%	34

Potato scab: *Streptomyces scabiei*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Thiram 75% WS (Seed Treatment/ Kg)	2.5-3.0	7-10

ix. Major weeds associated with crop: *Ranunculus, Cyperus, Chenopodium album*

x. IPM Module for management of weeds:

Bathua, Pigweed*: Chenopodium album* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
2,4 D Dimethyl amine salt 58% SL	2000	3440
Oxyflourfen 23.5% EC	100-200	425-850

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Selection of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja.
2. Seed treatment should be followed.
3. Planting of pre-sprouted tubers should be done.
4. Proper crop rotation to should be followed.
5. Winter/ summer ploughing of fields.
6. Use of organic mulching material in appropriate thickness especially under rain fed mid hills agro climatic conditions.
7. Dehaulming practise should be adopted by the farmers for long duration storage of tubers.
8. Medium size whole tuber should be used as planting material.

xii. Production constraints in agro-ecological region:

1. Seed treatment should be followed.
2. Planting of pre-sprouted tubers should be done.
3. Proper crop rotation to should be followed.
4. Winter/ summer ploughing of fields.
5. Use of organic mulching material in appropriate thickness especially under rain fed mid hills agro climatic conditions.
6. Dehaulming practise should be adopted by the farmers for long duration storage of tubers.
7. Medium size whole tuber should be used as planting material.

9F. Name of the vegetable crop: Brinjal

i. **Existing varieties being used:** Locally available varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Navkiran, Brinjal 704 (SunGro Seed), Navina, VNR212 (VNR Seed), IndameSupriya (Indo-American), Pant Rituraj, Pant Samrat (Pantnagar), Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Nursery- Nursery soil generally not sterilize by the farmers.
4. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
5. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
6. Sowing time: Feb-March
7. Transplanting- Farmers practices improper planting distance.
8. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
9. Fertilizers: Farmer use imbalance fertilizer
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
12. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Availability of purple and round varieties in cropping system.
2. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
3. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
4. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
5. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed orTrichoderma viride 4g/kg before sowing
6. Seed Rate- The recommended seed rate of brinjal: Hybrid-250g/ha, Open pollinated-500-600g/ha
7. Transplanting- Farmers should transplant seedlings properly as for non spreading type varieties-60cm x 60cm, spreading type varieties - 75cm x 60cm.
8. Manures and fertilizers- should be used as per soil testing , General recommendation are FYM-250q/ha Nitrogen: (Hybrid-200kg/ha, Open pollinated-100-120kg/ha) Phosphorus: (Hybrid-100kg/ha, Open pollinated-80kg/ha Potassium: (Hybrid-80/ha, Open pollinated-60kg/h), Micronutrient: should be used as per soil testing,
9. Irrigation- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at7-8days interval and in summer3-4 days interval. Augmenation of assured irrigation for optimal production.
10. Weed control- Farmers must know the about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically. Farmer can control the weeds by hand weeding along with pre-planting surface application @ of 1.0-1.5 kg/ha Alachlor.
11. Growth substances: Use 2,4-D @ 2ppm at flowering stage
12. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

v. Major insect pests associated with crop: Shoot and fruit borers

vi. IPM Module for management of insect pests:

Brinjal fruit & shoot borer: *Leucinodes orbonalis*

1. The damaged portions of the plants and fruits should be removed and destroyed.
2. Early removal of drooping shoots will reduce the fruit infestation.
3. Proper collection of all the infested flower buds, fruits during harvest.
4. Continuous cultivation of brinjal also favors the pest infestation.
5. Varieties like Punjab Barsati, (moderate resistant cultivar) Pusa purple round, Punjab Neelam found to be resistant to brinjal fruit borer.
6. Biological method recommended by IIHR, Bengaluru involving release of *Trichogramma chilonis* @10 to 15 lakh parasites/ha/season along with 2 sprays of *Bt* formulation found to be economically effective.
7. Installation of BSFB (brinjal shoot and fruit borer) pheromone traps Lucinure @3/ha to monitor and mass trap the male moths is effective.
8. Neem Seed Kernal Extract(NSKE)5 % per cent at the time of flowering is effective.
9. Prevent continuous growing of same group of crop at same field.
10. Rotate brinjal with cabbage or other crops

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC -	200	22
Emamectin Benzoate 5% SG	200	3
Thiacloprid 21.7% SC	750	5
Thiodicarb 75% WP	625-1000	6
Lambda cyhalothrin 5% CS	300	5
Cypermethrin 25% EC	150-200	1
Betacyfluthrin 8.49%+ Imidacloprid 19.81% OD	200	7
Triazophos 35% + Deltamethrin 1% EC	1250	3
Pyriproxyfen 5%+ Fenpropathrin15% EC	750	7

vii. Major disease associated with crop: Phomopsis blight and rot (*Phomopsis vexan*) is a serious problem in the hills.

viii. IPM Module for management of disease:

1. Use healthy seed materials for sowing.
2. Seed should be extracted only from disease free fruits.
3. After extraction of seeds it should be dried for a week and then stored.
4. Avoid continuous cultivation of brinjal. A rotation of brinjal - paddy - gingelly will helps to check the disease development.
5. In the fields the affected plants and debris should be collected and burnt
6. During summer deep ploughing should be given.
7. Spray following insecticides

Blight

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Zineb 75% WP	1125-1500	1500-2000

ix. Major weeds associated with crop: *Oxalis latifolia, Phyllanthus niruri, Amaranthus viridis,Euphorbia hirata, Solanum* sp.

x. IPM Module for management of weeds:

1. Hand weeding.
2. The field should be kept weed-free, especially in the initial stage of plant growth, as weeds compete with the crop and reduce the yield drastically.
3. Frequent shallow cultivation should be done at regular interval so as to keep the field free from weeds and to facilitate soil aeration and proper root development.
4. Deep cultivation is injurious because of the damage of roots and exposure of moist soil to the

surface.
5. Two-three hoeing and the earthing up are required to keep the crop free of weeds.
6. Preemergence application of Fluchloralin (1.5 kg a.i./ha) coupled with one hand weeding 30 days after transplanting is effective for control of weeds

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Use of hybrids can increase productivity 2 to 3 times higher.
2. Use of mulch in rainy season.

xii. Production constraints in agro-ecological region:

1. Wild animals problems
2. Marketing problem in rainy season
3. Non-availability of suitable hybrids and High prices of hybrid seeds
4. Post-harvest losses are more due to non availability of storage facility

9 G. Name of the vegetable crop: Chilli

i. **Existing varieties being used:** Local, Andhara Jyoti, LCA-206

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Kashi Anmol, Pant C-1, Tajwasni, Pusa Sadabhar, Punjab Lal, Panjab Surkh, CH-1 and CH-3

iii. Existing package of practices being used:

1. Growing local varieties.
2. No line transplanting.
3. Generally they plant two over aged seedling at one place.
4. No or very less use of fertilizer.
5. Sowing of untreated seed.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Grow high yielding varieties.
2. Treat the seed with copper containing fungicides before sowing.
3. Adopt soil testing.
4. Transplant one seedling at one place.
5. Transplant the seedlings when they attain 5-6 leaf stage.
6. Transplant the seedlings at proper spacing-
   Dwarf varieties like Kashi Anmol at 45 x 30 cm
   Tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm.
7. Apply recommended dose of fertilizer (15-20 t FYM + 120: 60:60NPK/ha) after soil test in irrigated condition, whereas under unirrigated condition apply half dose of recommended NPK.
8. Use of seed treatment like Pant bioagent 3 for managing seed and soilborne diseases.
9. Earthening up of plants within 45 days after transplantation to get rid off waterlogging
10. Use of high dose of organic manure i.e. 200 q/Ha increases productivity and incidence of dieback and Anthracnose.

v. Major insect pests associated with crop: Thrips problem is major problem

vi. IPM Module for management of insect pests :

1. Thrips *Franklinothrips vespiformis* (Crawford) and *Erythrothrips asiaticus* R. &. M. are predaceous in nature and their population may be encouraged by avoiding chemical sprays.
2. Yellow or blue sticky trap is effective for controlling this pest.
3. If still the population persist spraying of imidacloprid 70% WG @ 0.25ml/l or acetamiprid 20%SP @ 0.2g/l or thiomethoxam 25%WG @ 0.2g/l or metasystox@1.5ml/l is effective.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 30% FS (Seed Treatment)	7/Kg	
Imidacloprid 70% WS (Seed Treatment)	10-15/Kg	

Cyantraniliprole 10.26% OD	600	3
Emamectin benzoate 5% SG	200	3
Spinosad 480% SC	160	3
Acetamiprid 20% SP	50-100	3
Thiacloprid 21.7% SC	225-300	5
Indoxacarb 14.5%+ Acetamiprid 7.7% SC	400-500	5
Flubendamide 19.92%+ Thiacloprid 19.92%	200-250	5
Methomil 40% SP	750-1125	5&6
Lambda cyhalothrin 5% EC	300	5
Ethion 50% EC	1500-2000	5
Fipronil 5% SC	800-1000	7
Imidacloprid 17.8% SL	125-250	40

vii. Major disease associated with crop: Dieback and anthracnose is major disease of block.

viii. IPM Module for management of disease:

Dieback

1. Use of disease-free seeds is important in preventing the disease. Seed treatment with Thiram or Captan 4g/kg is found to be -effective in eliminating the seed-borne inoculum.
2. Good control of the disease has been reported by three sprayings with Ziram O. 25% Captan 0.2% or miltox 0.2%. Chemicals like wettable Zineb 0.15% not only reduced the disease incidence but also increased the yield of fruits.

Anthracnose

1. Seeds should be obtained from spotless fruits.
2. Debris of diseased crop should be collected and burnt.
3. Seed treatment with thiram or captan at the rate of 2.5 g/kg of seed.

ix. Major weeds associated with crop: *Euphobia hirta*, *Cynodon dactylon* , Cyprus and Oxalis

x. **IPM Module for management of weeds:** hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Non availability of quality seed.
2. Less irrigation facilities.
3. High cost of hybrid seeds.
4. Unaware about the insect-pest management.

xii. Production constraints in agro-ecological region:

1. High incidence of flower and fruit drop in chillies
2. Fruit losses due to high incidence of dieback and anthracnose.
3. Non availability of quality seed.
4. Less irrigation facilities.
5. High cost of hybrid seeds.
6. Unaware about the insect-pest management.

9H. Name of the vegetable crop: Pea

i. Existing varieties being used: Arkel or mixture of varieties

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Arkel, Azad Pea 3, VL-7, Pusa Pragati, Punjab Agetha 6

iii. Existing package of practices being used:

1. Sowing in Autumn month
2. No line sowing,
3. High seed rate,
4. Mature more than 120 days,
5. Stacking is done for tall varieties,

6. Dual purpose varieties
7. Sowing by broadcasting method, no seed treatment, using own saved seeds to grow crop

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Use of tall varieties sown in line with effective stacking methods. Mangement of powdery mildew, Aschochyta blight and other diseases and Fusarium wilt in autumn season
2. Sowing early maturing varieties at closer spacing (30 cm plant to plant and about 5-10 cm between plants) and higher seed rate (120 kg/ha).
3. Seed rate: 100 Kg/ ha
4. Treating the seed with 2 g Thiram /kg of seed and rhizobium culture if being sown in field for first time.
5. If available, at least one ton of farmyard manure per ha should be incorporated in the soil at the time of land preparation. Add fertilizers containing NPK as 30: 70: 50 kg/ha all apply as basal dose.
6. Water the crop as per need especially during flowering and pod setting.

v. Major insect pests associated with crop: Leaf miner

vi. IPM Module for management of insect pests: Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

vii. Major disease associated with crop:

1. Powdery mildew in all agroecological situations
2. Fusarium wilt in autumn sown crop
3. Aschochya blight in rainy season in high hills.

viii. IPM Module for management of disease:

1. Use of oganic inputs only
2. Use of rust and powdery mldew resistant strains.
3. Use TH colonized compost.
4. Seed biopriming with TH / PsF/ TH + PsF (10g/kg seed) or Seed treatment with Thiram + Carbendazim (2:1) @ 3.0 g/kg seed.
5. Cultivation of powdery mildew resistant varieties
6. Two to three sprays of (TH + PsF) or mancozeb (2.5 kg/ha) at 7 to 10 days interval beginning with appearance of foliar diseases (need based).

ix. Major weeds associated with crop: All seasonal weeds

x. IPM Module for management of weeds: Use pendimethaline @ 1kg ai/ha as pre-emergence and one hoeing 25-30 days after sowing.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Increasing crop intensity, Line spacing
2. Use of tall cultivars in cropping system
3. Standardization of time for seed sowing in pea viz. Septemeber sowing in high hills, Mid Nov sowing time for Mid hills can enhance productivity.

xii. Production constraints in agro-ecological region:

1. Monkey Menace
2. Need to increase seed production program in distt.

9I. Name of the vegetable crop: Capsicum

i. Existing varieties being used: Locally produced seed, California wonder, Hathi soond

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: California wonder, Bull nose, Arka mohini, Arka Gaurav, Indira, Bharat, Pusa Dipti

iii. Existing package of practices being used:

1. Poorly managed nurseries infected with damping off.

2. Overaged or less vital seedling utilization
3. No control measure of wilt

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. Seed sowing in line in nursery
2. Good nursery management
3. Control of damping off in nursery
4. Mangement of Fusarium and bacterial wilt

v. Major insect pests associated with crop: Fruit borer, aphid, cut worm

vi. IPM Module for management of insect pests: Cultural, mechanical and biological control

vii. Major disease associated with crop: Fusarium and bacterial wilt and anthracnose.

viii. IPM Module for management of disease:

In Nursery

1. Soil Solarization of nursery bed by covering with polythene sheet (25 – 50 □□) for 45 to 60 days during April-June.
2. Use TH/PsF colonized compost
3. Seed biopriming with TH / PsF or TH + PsF (10 g/kg seed).
4. Use resistant cultivars like Punjab Lal etc., if possible
5. Grow the nursery under tunnel of poly net of 50 mesh.

On Crop

1. Use TH/PsF colonized compost.
2. Use of healthy seedling.
3. Root dipping of seedlings in TH/PsF suspension (10 g/l water).
4. Roguing of virus infected plants and destruction of weeds followed by need based spraying of systemic insecticides for vector management
5. Need based spraying of mancozeb (2.5 kg/ha) at 15 days interval.
6. For the management of soil borne diseases follow crop rotation
7. Soil drench (near seedling) with TH/ TH + PsF (10 g/l) for the management of root rot and wilt.
8. Two to three spays of TH + PsF (1 kg/acre) to manage foliar diseases (need based).

ix. Major weeds associated with crop: *Trifolium alexenderum*

x. IPM Module for management of weeds: Manual weeding in hills.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. Seed sowing in in line in nursery
2. Control of damping off in nursery
3. Control of fusarium and bacterial wilt
4. Proper fertilizer use
5. Use of mulch

xii. Production constraints in agro-ecological region: Non availability of quality seed, damping off and wilt disease

9J. Name of the vegetable crop: Onion

i. Existing varieties being used: Nasik red, locally grown seed

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Agri found light red, Agri found dark red, Pusa red, Pusa ratnar, VL onion 3

iii. Existing package of practices being used:

1. Poorly managed nurseries.
2. Overaged or less vital seedling utilization
3. No control measure of purple blotch

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological

region: Good quality seed, seed sowing in line in nursery, proper use of fertilizer, control of purple blotch

v. **Major insect pests associated with crop:** Thrips

vi. **IPM Module for management of insect pests:**

Onion thrips *Thrips tabaci* Hood (Thripidae: Thysanoptera)

1. Use of sticky trap
2. Overhead irrigation is quite effective to wash off thrips
3. Younger plots should be planted upwind of older plots, relative to prevailing winds, to make it harder for the thrips to find the new plantings
4. Mixed cropping of carrots and onions also may reduce thrips population
5. If thrips population exceed over 5 thrips/plant, following insecticides can be used-

Name of the Insecticides	**(gm/ml) /ha**
Imidacloprid 17.8 %SL	125
Acetamiprid 20%SP	1000
Thiamethoxam 25%WG (15-30 DAT)	100
Fipronil 5%SC	1000
Spinosaid 45%SC	160
Phorate 10% CG	10000

vii. **Major disease associated with crop:** Purple blotch

viii. **IPM Module for management of disease:-**

ix. **Major weeds associated with crop:** Non grassy weeds

x. **IPM Module for management of weeds:** Apply Oxyflurofen 23.5 % EC @ 0.1-0.2 kg a.i/ha within 3 days after planting to control grassy and non grassy weeds.

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of good quality seed,
2. Control of thrips and purple blotch

xii. **Production constraints in agro-ecological region:**Thrips and purple blotch

10A.Name of the fodder crop: Fodder Maize

i. **Existing varieties being used:** Local varieties, , Ganga safed, Naveen, African Tall

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Ganga-2, Ganga-5, QPM

iii. **Existing package of practices being used:** Broadcasting of seed, no fertilizer used

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. HYV, Line sowing at 25-30cm Line to line and 10cm plant to plant, 80-100 kg N, 40-60 kg P
2. Soil: Well drained alluvial soil with soil PH 5.5-7.5.
3. Field preparation: 4-5 harrowing + leveling
4. HYVS: African Tall, J-1006. Pratap Makka Chari-b.
5. Seed rate: 50kg/ha
6. Spacing : 30-45 cm(row to row distanced)10-15 cm (plant to plant)
7. Sowing time
   Rainfed: Onset of monsoon
   Irrigated : Feb to July
8. Sowing method : Line sowing is proposed over broadcasting
9. Fertilizer : 100-120 : 60:40: 20::
   : P_2O_5 : K_2O: ZnSo4 kg/ha
10. Irrigation: Fodder maize grown under irrigated condition should be irrigated at 20 days interval. Spring/summer crop requires 5-6 irrigations.
11. Weed control: Pendimethalin @ 0.75 kg ai/ha (PE) application.

12. Harvesting: The crop should be harvested at tasseling /silling stage or 50-55 days after sowing.
13. Yield: Green fodder: 350-450q/ha.

v. Major insect pests associated with crop: Borer
vi. IPM Module for management of insect pests: -
vii. **Major disease associated with crop:** YMV
viii. IPM Module for management of disease: -
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:
Mixed cropping with Maize+ Lobia
xii. Production constraints in agro-ecological region:
Lack HYV, Fertilizer, Rainfed conditions

10B.Name of the fodder crop: Jai (Oat)

i. Existing varieties being used: Local varieties, Kent
ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: JHO-851, UPO-94, OS-6
iii. Existing package of practices being used: Broadcasting of seed, no use of NPK, Rainfed conditions
iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

1. HYV, Use of recommended NPK,
2. Soil : Loam soils
3. Field preparation : 2-3 Harrowing + leveling
4. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
5. Seed rate: 100 kg/ha
6. Spacing : 30cm line to line distance
7. Sowing time: first week of October to last October

v. Major insect pests associated with crop: Borer
vi. IPM Module for management of insect pests: -
vii. **Major disease associated with crop:** YMV
viii. IPM Module for management of disease: -
ix. Major weeds associated with crop: Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: HYV, Use of recommended NPK
xii. Production constraints in agro-ecological region:
Lack HYV

10C.Name of the fodder crop: Hybrid Napier

i. **Existing varieties being used:** Pusa giant
ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: IGFRI-3,6,10 NB-21
iii. Existing package of practices being used: Planting on bunds and wasteland near gadhera in rainy season
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. LxL-75-90cm; PxP -45cm
2. Rootslip -25000-30000 /ha
   200q FYM, N:P 50kg/ha BD
3. Soil : Loam soils to clay soil

4. Field preparation : 2-3 Harrowing + leveling
5. HYVS: Phule Jaywant, NB-37, CO-3, BAIF-10, PBN-83, PBN 233, Hybrid-3 Napier.
6. Seed rate: 40000 rooted slips or stem cutting (3 buds)/ha
7. Spacing : 75 cm x 50cm
8. Sowing time: Onset of monsoon or month of February
9. Fertilizers: 60kg/ha + 60 kg P_2O_5 + 40kg K_2O/ha at sowing time followed by 30kgN top dressing after each cut.
10. Irrigation: Irrigate crop after each 20-25 days interval during summer season. Normally irrigation is not required during rainy season.
11. Cutting management: First cut after 50-55 days of sowing and subsequent cuttings are taken after 30 days interval.
12. Yield: 1500-2000q/ha green forage

v. Major insect pests associated with crop:
vi. IPM Module for management of insect pests: -
vii. **Major disease associated with crop:**
viii. IPM Module for management of disease: -
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:

1. LxL-75-90cm; PxP -45cm
2. rootslip -25000-30000 /ha
3. 200q FYM, N:P 50kg/ha BD should be grown on waste and community land

xii. Production constraints in agro-ecological region:
Lack HYV

10D.Name of the fodder crop: Gini grass

i. Existing varieties being used: Local
ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PGG-1,9 Bundel gini ghas 1,2
iii. **Existing package of practices being used:**
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** seed rate 4-5 kg/ha, transplanting of seedling 4-6 wk at a distance of 50 cm. FYM 200q /ha, urea 1Q/ha
v. **Major insect pests associated with crop:**
vi. IPM Module for management of insect pests:
vii. **Major disease associated with crop:**
viii. IPM Module for management of disease:
ix. Major weeds associated with crop: Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: seed rate 4-5 kg/ha, transplanting of seedling 4-6 wk at a distance of 50 cm. FYM 200q /ha, urea 1Q/ha
xii. Production constraints in agro-ecological region:
Non availability of HYV

10E.Name of the fodder crop: Gini grass

i. Existing varieties being used: Local
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** PGG-1,9 Bundel gini ghas 1,2
iii. **Existing package of practices being used:** Leaves Suitable for livestock feeding , can be grown in cold climate in a temp range of 2-38 degree centigrade and at the rainfall of 1200-

2500mm. leaves are used in Oct-Feb and May-June 35-130kg green fodder/tree 18% CP

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** increase the no. of plants in community land, Forest

v. **Major insect pests associated with crop:**

vi. IPM Module for management of insect pests:

vii. **Major disease associated with crop:**

viii. IPM Module for management of disease:

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Leaves Suitable for livestock feeding , can be grown in cold climate in a temp range of 2-38 degree centigrade and at the rainfall of 1200-2500mm. leaves are used in Oct-Feb and May-June

xii. Production constraints in agro-ecological region:
Non availability of HYV

10F.Name of the fodder crop: Khadik

i. **Existing varieties being used:** Local

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Leaves Suitable for livestock feeding, can be grown in cold climate in a temp range of 2-38 degree centigrade and at the rainfall of 1200-2500mm. leaves are used in Oct-Feb and May-June.

iii. **Existing package of practices being used:** 35-130kg green fodder/tree 18% CP

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** increase the no. of plants in community land, Forest

v. **Major insect pests associated with crop:**

vi. IPM Module for management of insect pests:

vii. **Major disease associated with crop:**

viii. IPM Module for management of disease:

ix. Major weeds associated with crop: Local weeds

x. **IPM Module for management of weeds:** Hand weeding

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Leaves Suitable for livestock feeding , can be grown in cold climate in a temp range of 2-38 degree centigrade and at the rainfall of 1200-2500mm. leaves are used in Oct-Feb and May-June

xii. Production constraints in agro-ecological region:
Non availability of HYV

10G.Name of the fodder crop: Utis

i. **Existing varieties being used:** Local

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**Local

iii. **Existing package of practices being used:** available in forests, orchards, kitchen garden

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Leaves Suitable for livestock feeding , can be grown in cold climate in a temp range of 0-38 degree centigrade and at the rainfall of 1200-2500mm. leaves are used in Oct-Dec and April-July. No tannin so more digestible leaves, Resistant to frost and snowfall, 900-2800m. Can not be fed to pregnant animals.leaves 60-190 kg/tree

v. **Major insect pests associated with crop:**

vi. IPM Module for management of insect pests:

vii. **Major disease associated with crop:**

viii. IPM Module for management of disease:

ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Leaves Suitable for livestock feeding , can be grown in cold climate in a temp range of 0-38 degree centigrade and at the rainfall of 1200-2500mm. leaves are used in Oct-Feb and May-June. No tannin so more digestible leaves, Resistant to frost and snowfall, 900-2800m
xii. **Production constraints in agro-ecological region:** needs more plantation in community land and forests

11A. Name of the Medicinal crop: Kuth

i. **Existing varieties being used:** Local
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Wild / Local collection
iii. **Existing package of practices being used:** No proper management after cutting
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region**
Proper drying of heads is essential for obtaining viable seeds.
Harvesting of roots should be done before flowering to ensure quality of roots.
Preferably crop should be grown above 2200 m height
v. **Major insect pests associated with crop:**
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:**
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Natural reserves and wild nurseries to retain the medical efficacy of plants in their natural habitats
xii. **Production constraints in agro-ecological region:** Absence of local pharmaceutical production; poor knowledge of package and practices

11B. Name of the Medicinal crop: Jambu

i. **Existing varieties being used:** Local
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Wild / Local collection
iii. **Existing package of practices being used:** No proper management after cutting
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region**Proper drying of herb is to be ensured for getting profitable production
v. **Major insect pests associated with crop:**
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:**
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Natural reserves and wild nurseries to retain the medical efficacy of plants in their natural habitats
xii. **Production constraints in agro-ecological region:** Absence of local pharmaceutical production; poor knowledge of package and practices

12A. Name of the Floriculture crop: Rose

i. **Existing varieties being used:** local ornamental and old varieties

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**
For Gulabjal and oil_ Noorjahan, Ranisahiba
For flowers_ First red, Sonia, Noveleze, etc

iii. **Existing package of practices being used:** Plantation of rose cutting

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
1. Spacing
2. Fertilizer:40:20:20 NPK , fertilization using drip irrigation
3. Proper flower storage
4. High yielding varieties.
5. Adequate technological interventions.
6. To be cultivated in polyhouses.

v. **Major insect pests associated with crop:** Aphid, leaf miner, white fly, thrips, stem borer, rat

vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.

vii. **Major disease associated with crop:** blight and comrot, collar rot, leaf spot, Damping off

viii. **IPM Module for management of disease:** As per requirement through recommended pesticides.

ix. **Major weeds associated with crop:** Parthenium, *Chenopodium album*, Krishnil, Teepatiya

x. **IPM Module for management of weeds:**Weeding and Hoeing

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**
1. Spacing
2. Fertilizer:40:20:20 NPK , fertilization using drip irrigation
3. Proper flower storage –

xii. **Production constraints in agro-ecological region:** availability of quality seeds and adequate marketing of flowers. Availability of quality plants and adequate marketing of flowers

12B. Name of the Floriculture crop: Gladiolus

i. **Existing varieties being used:** Local

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** American buty, Oscar friendship, Shobh Sapna Poonam

iii. **Existing package of practices being used:** Plantation of of bulb with ridge bed

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
Bulb treatment with Bavistin, 40:20:20 NPK/ ha
LxL- 30cm, PxP-15 cm

v. **Major insect pests associated with crop:** Aphid, leaf miner, white fly, thrips, stem borer, rat

vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.

vii. **Major disease associated with crop:** blight, collar rot, leaf spot, Damping off

viii. **IPM Module for management of disease:** As per requirement through recommended pesticides.

ix. **Major weeds associated with crop:** Parthenium, *Chenopodium album*, Krishnil, Teepatiya

x. **IPM Module for management of weeds:**Weeding and Hoeing

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**
1. HYV varieties
2. Bulb treatment with Bavistin,

3. 40:20:20 NPK/ ha
4. LxL- 30cm, PxP-15 cm
5. Flower care and marketing

xii. Production constraints in agro-ecological region: availability of quality seeds and adequate marketing of flowers.

C1. Livestock: Buffalo

1.A Existing breeds available: Mostly non-descript, Neeli-Ravi cross, Murraha cross

1.B Specific breeds to be introduced: Murraha, Neeli-ravi,

2.A Existing feeds being used: Wild grasses, paddy straw, wheat straw, wild dried grasses, Leaves of trees such as silver oak, bhemal, khadeek, mulberry

2.B Specific feeds to be introduced / advised:

1. UMBB, Feed blocks, Fodder maize, multi cut chari, multi Berseem, Hybrid napier, tall fascue, Italian rai, cox foot, orchard grass fodder trees etc
2. Fortification of local Fodder, use of Chaff cutter and mangers etc
3. Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

3.A Existing health services:

State animal husbandry department (Vet. Hospital, LEO Centers)
BAIF, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:

Village level workers for first aid, vaccination and AI

4.A Existing management practices:

1. Housing, hygiene, drainage: Under Developed, Conventional Housning, Poor Drainage and Malnutrition
2. Feeding & watering practice: Traditional Feeding habits
3. Others: Introduction of Chef cutter, Mangers and Waters

Improper and unhygienic housing,
Improper and inadequate feeding management,
Shortage of feed and fodder,
Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:

1. Breed Improvement, Availability of Balanced Ration and Appropriate Marketing from The door Step Of Farmer For All Dairy Products
2. Proper scientific housing,
3. Scientific feeding management,
4. Manger and chaff cutter introduction,
5. Proper and timely vaccination and deworming, timely health and breeding facilities

5.A Problems of livestock system- Goatary, Poultry, Fisheries: Poor breeds, shortage of feed and fodder, improper feeding, poor housing and management of animals, Improper health services, mostly unproductive animals,

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Feed and fodder shortage, local breed, low cost of milk

C2. Livestock: Cattle

1.A Existing breeds available: Mostly non-descript, Badri, Cross bred of Jursey, HF, Sahiwal

1.B Specific breeds to be introduced: Jursey, HF, Sahiwal

2.A Existing feeds being used: Wild grasses, paddy straw, wheat straw, dry grasses, Leaves of trees as silver oak, bhemal, khadeek, mostly rearing on grazing

2.B Specific feeds to be introduced / advised:

Fodder maize, multi cut sorgam (chari), Barseem, Hybrid napier, fodder trees etc

Fodder treatment, Chaff cutter, mangers etc

3.A Existing health services:

State animal husbandry department,
BAIF, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination and AI

4.A Existing management practices:

1. Housing, hygiene, drainage: Under Developed, Conventional Housning, Poor Drainage and Malnutrition
2. Feeding & watering practice: Traditional Feeding habits
3. Others: Introduction of Chef cutter, Mangers and Waters

Improper and unhygienic housing,
Improper and inadequate feeding management,
Shortage of feed and fodder,
Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:

1. Breed Improvement, Availability of Balanced Ration and Appropriate Marketing from The door Step Of Farmer For All Dairy Products
2. Proper scientific housing,
3. Scientific feeding management,
4. Manger and chaff cutter introduction,
5. Proper and timely vaccination and deworming, timely health and breeding facilities

5.A Problems of Livestock system- Goatary, Poultry, Fisheries:

Poor breeds, shortage of feed and fodder, improper feeding, poor housing and management of animals, Improper health services, mostly unproductive animals

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Feed and fodder shortage, local breed, low cost of milk

C3. Livestock: Goat

1.A Existing breeds available: Mostly non-descript,Chobarkha, Udaipuri

1.B Specific breeds to be introduced: Barbari, Jamunapari

2.A Existing feeds being used: Grazing

2.B Specific feeds to be introduced / advised: Grassland Development and Plantation of Perennial roots in Van Panchayat Forest Land (Kikoi Grass) Extenstive Palntion of Fodder Tree and Storageg of Agriclutre Productes and Saileg Making Prosess; Distribution of Feed Supplement Demonstrations Supsiti on Cattle Feed and Transport Cattle Feed

3.A Existing health services: State animal husbandry department

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination

4.A Existing management practices:

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,
3. Shortage of feed and fodder,
4. Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Development of pasture land, scientific management

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Lack of range land management

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of range land management, managemantal problems as proper vaccination, ecto and endo parasite control, breed improvement

C4. Livestock: Sheep

1.A Existing breeds available: Mostly non-descript, gaddi, black sheep

1.B Specific breeds to be introduced: Gaddi, selective breeding of local breed

2.A Existing feeds being used: Grazing

2.B Specific feeds to be introduced / advised: Grassland Development and Plantation of Perennial roots in Van Panchayat Forest Land (Kikoi Grass) Extenstive Palntion of Fodder Tree and Storageg of Agriclutre Productes and Saileg Making Prosess; Distribution of Feed Supplement Demonstrations Supsiti on Cattle Feed and Transport Cattle Feed

3.A Existing health services:

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination

4.A Existing management practices: State animal husbandry department

1. Housing, hygiene, drainage: Under Developed, Conventional Housning, Poor Drainage and Malnutrition
2. Feeding & watering practice: Need to improve
3. Shearing: Machine shearing required
4. Others: Use of Sheep Feed is not in Prectice Improper and unhygienic housing,
   Improper and inadequate feeding management,
   Shortage of feed and fodder,
   Improper vaccination, long calving interval, inbreeding

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Breed improvement and machine shearing,feeding of balanced sheep ration

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Lack of range land management

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of range land management, managemantal problems as proper vaccination, ecto and endo parasite control, breed improvement

C5. Livestock: Poultry

1.A Existing breeds available: Poultry: Local, Croiler, RIR, uttara fowl

1.B Specific breeds to be introduced: Poultry: Croiler, Kadaknath, Cob, Cari-davendra, cari-nirbheek

2.A Existing feeds being used: kitchen waste

2.B Specific feeds to be introduced / advised: Starter, grower, finisher feed according to age

3.A Existing health services: State animal husbandry department, KVK

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Village level workers for first aid, vaccination

4.A Existing management practices:

1. Housing, hygiene, drainage: Under Developed, Conventional Housning, Poor Drainage and Malnutrition
2. Feeding & watering practice: Need to improve
3. Shearing: Machine shearing required
4. Others: Improper and unhygienic housing,
   Improper and inadequate feeding management,
   Shortage of feed and fodder,
   Improper vaccination, inbreedi

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Skill developement for dressing,establishment of dresssing sale counter,locally availability of poultry feed

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Poor breed and management; Lack of range land management

5.B Specific problems related Poultry due to which income is not increasing: Lack of range land management, managemantal problems as proper vaccination, ecto and endo parasite control, breed

improvement

Problems of Animal Husbandry

Specific problems due to which income is not increasing	Poor accessibility	Under Developed Marketing, Roots are not Available imporvement of livestock Products Quailty and in Quantity linkages of local Market Needed
	Water scarcity	Yes, in some Villages
	Natural disasters	Disaster Prone
	Wild life conflicts	Common
	Marketing of animals	No availability of structured market
	Marketing of products	Under developed Marketing
	Budget	Farmers are having shortage of budget,banking support is required
	Manpower shortage	Shortage
	Capacity building	Required
	Equipment & Implements (old/ shortage, etc.)	Yes
	Mobility	Required
	Risk cover (Insurance)	Yes
	Relook to policies	Yes

D. Integrating Farming system

1.A Existing farming system: Animal husbandry+crop/Vegetable

1.B Specific farming system for doubling income in specific agro-ecological region:

Agri-HortAnimal-processing based farming system

Activity	Area
A. Cropping system:	8 nali
Rice/Ragi/Maize-lentil	
Horsegram/ricebean/soybean-wheat	
Tomato/Capsicum-cabbage/Cauliflower-frenchbean	
Hybrid Napier/Rai grass/Gini grass + forestry	
B . Horticulture	8 nali
Peach/Pear/citrus (Malta)/Walnut+ginger/turmeric/fodder grass (As intercrop)	
Polyhouses (for growing tomato/capsicum/cucumber)+ polytunnel(for raising vegetable seedling)	
Water harvesting structure	
Mushroom Production Unit	
C Livestock	2 nali
a. Cow/buffalo	2no.
b. Backyard poultry	25 Birds
c. Goat farming	5+1
d. Bee kepping	
e. Rabbitary	
D. Vermicomposting/Processing-	2 nali
Washing and cleaning of season vegetables, biogas/vermicompost/biopesticides	

Total cost : Rs 90,000.0
Total income : Rs 2.0 lakhs
Net income : Rs 1.1 lakh (Approx.)

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: Not available in area

1.B Grading facilities to be advised/ setup for doubling income in the agro-ecological region of district:

Establishment of minimal processing plants in various location based on crop and area specific.

For grains:

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

For horticultural crops:

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

2.A Existing processing facilities: Food proccessing units of Deptt of Horticulture. Units of some NGOs

2.B Processing facilities to be advised/ setup for doubling income in the agro-ecological region of district:

For grains:

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity

For horticultural crops:

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

3.A Existing packing facilities: Few farmers

3.B Packing facilities to be advised/ setup for doubling income in the agro-ecological region of district:

A factory based on plastic cartoon, *Kilta*, *Dalia* of various grade and size based on weight of the fruit is needed at least at distt level to meet the requirement of apple and seasonal vegetables.

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity
3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)

4. IRRI bags for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables
3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed
8. Litchi peeling and shredding unit

4.A Existing storage facilities: At present no storage facilities are available in the distt.

4.B Storage facilities to be advised/ setup for doubling income in the agro-ecological region of district: A Cold storage for hill potato is required.

F. Waste land development and waste water

1.A Existing practices of soil water conservation: Using indegeneous technology use for water conservation include formations of bund, growing of Napier and other parennial grasses, multiple forest species as per need are requirement.

1.B Package of practices to be advised/ developed for management of wasteland and wastewater in the agro-ecological region of district:

1. Storage of wastewater by using low cost water harvesting technology as *kuchha* and *Pucca* tank. Polytank cane be constructed as (5x3x2m) capacity to meet the lean season demand of seasonal vegetables and for non agricultural use also.
2. In wasteland, a wide scope of fodder plantation of *Morus, Chhanchru, Melilotus* sp can be utilized. In dry and unirrigated situation there is scope of bael, amla can be included. There is need to put fodder trees and grasses in wasteland.

2.A Existing plantation: Tun, shirish, Bheemal, Kachnar, Kharik, shisham in low and mid hills Utis, banj,chhanchru, leucinia, Mulberry.

2.B Plantation suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:

Morus, Shirish, Kharik, Utis,Oak, Bheemal,Kachnar, Vilyati khair etc are useful as dual purpose species to meet fodder, firewoodr and other requiremnt of the farmes. Sufficient plants are avaialble at forest nurseries for planations.

1. Stabilization of eroded land using biological/engineering measures;
2. Plantation of suitable trees/brushes in waterlogged and eroded areas;
3. All agricultural operations should be done on contours i.e. across the existing land slope.
4. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
5. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
6. Diversion of runoff through ditches from upper slopes to safer places.
7. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
8. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
9. Contour trenching (staggered/continuous).
10. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.

11. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
12. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
13. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

3.A Existing fodder production: Crop stobbers, wild grasses, Forest leaves etc.

3.B Fodder suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:

Tall fescue (*Festuca arundinacea)*
Rye grass (*Lolium perenne*)
White clover (*Trifolium repens*)
Red clover (*Trifoliun pretense*)

Tall fescue

1. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
2. Fertilizer management- 60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
3. Irrigation management- Crop must be irrigated after each cut provided water is available
4. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval

Rye grass

1. Seed rate(Kg/ha)- 18-20
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

White clover

1. Seed rate(Kg/ha)- 6-8 Kg
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal)
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

Red clover

1. Seed rate(Kg/ha)- 6-8 Kg
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal)
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

4.A Type of waste water:

1. Effluent from kitchen and bathroom
2. Effluent from industries;
3. Sewage water from cities being discharged into surface and groundwater resources

4.B Existing treatment facilities: NA

4.CTreatment facilities to be advised/ developed for waste water treatment and utilization in the agro-ecological region of district:

1. Multistage filteration unit should be established to recycle the waste water for multiple use.
2. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
3. Industrial wastewater should not be used for irrigation directly; and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.
4. Sewage water from cities should be treated by municipal corporations or other agencies.

G. Reduced cultivation cost

1.A Existing inputs being given:

Traditional and unprocessed inputs are used in agricultural practices. Drudgery prone implements/tools are in practice for various operations.

Rice-wheat/Groundnut-wheat-Potato/French bean

Annexure–II is enclosed for N,P and K.

In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn) /ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop

Foliar spray of 1% $FeSO_4$ in rice nursery and groundnut.

In Mn deficient soils, application of 30 kg $MnSO_4$/ha, if Mn deficiency exist in field or two foliar spray of 0.5% $MnSO_4$ + 0.25% lime before first irrigation and one month after .

Dip potato seeds in a solution of 30 g borax/l for a half hour and dry under shade.

Tomato/Green Pea/Radish/Capsicum/Cabbage/Okra

In Cu deficient soils, application of 4-5 kg $CuSO_4$/ha or foliar spray of 0.25% $CuSO_4$ + 0.125% lime in standing crop

In Zn deficient soils, application of 10 (sandy loam)- 20 (Clay loam) kg $ZnSO_4$ (21% Zn) /ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop

Foliar spray of 1% $FeSO_4$ in rice nursery and groundnut.

In Mn deficient soils, application of 20 kg $MnSO_4$/ha, if Mn deficiency exist in field or two foliar spray of 0.5% $MnSO_4$ + 0.25% lime before first irrigation and one month after .

Two foliar spray of 0.2% Borax at interval of 20-30 d.

In Cu deficient soils, application of 2-4 kg $CuSO_4$/ha or foliar spray of 0.25% $CuSO_4$ + 0.125% lime in standing crop

1.B Soil test based inputs to be suggested in the specific agro-ecological region of district:

Application of nutrients based on soil test basis as major and micro elements.

1. Encourage water harvest technology for irrigation.
2. Sprinkler and drip method for irrigation should be encouraged to improve water use efficiency.
3. Use of mulches and available composts/organic manures
4. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
5. Promote reduced tillage operations.

2.A Existing mechanization:

Limited use of power driven implements in land preparation. Small tools like sickle, handhoe etc are being adopted by progressive farmers.

Limited use of power driven implements in land preparation. Small tools like sickle, handhoe etc are being adopted by progressive farmers.

I. Amaranth

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting / line sowing / manual thinning
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

II. Millets

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker
2. Manual broadcasting / line sowing / manual thinning or by animal drawn Danala.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

III. French Bean

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual line sowing.
3. Manual weed control .
4. Manual fertilizer application.
5. Manual picking for vegetable beans and harvesting.
6. Manual threshing for seed.
7. Cleaning by Winnowing fan.

IV. Potato

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Furrow making manually or by animal drawn Nasuda
3. Manual planting and ridge making.
4. Manual weed control.
5. Manual fertilizer application.
6. Manual harvesting / using animal drawn Nasuda.
7. Manual grading

V. Management of Orchards

1. Manual digging of holes for sapling planting.
2. Manual watering of plants.
3. Manual interculture operations.
4. Manual pruning of branches.
5. Manual plant protection.
6. Manual picking of fruits.
7. Manual grading.

2.B Mechanization required for reducing cost of cultivation in the specific agro-ecological region of district:

Power tiller, power weeder, shrub cutter, Multiple crops threshers are becoming popular and are available in pockets. Old wooden based impelents are being replaced with iron/alloy (Plough, danalla,) based tools are available.

I. Amaranth

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Broadcasting by centrifugal manual broadcaster.
3. Manual thinning by three prong wheel hoe.
4. Weed control by improved wheel hoe.
5. Plant protection by manually operated sprayers.
6. Manual harvesting using improved sickles.
7. Manual threshing.

II. Millets

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Manual line sowing / improved millet seed drill.

3. Weed control by improved wheel hoe .
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.
6. Threshing by VPKAS millet thresher .

III. French Bean

1. Seedbed preparation by using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Light weight power tiller operated inclined plate planter.
3. Weed control by improved wheel hoe / power weeder.
4. Plant protection by manually operated sprayers.
5. Manual picking and harvesting.
6. Threshing by multi-crop thresher.

IV. Potato

1. Seedbed preparation by using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Furrow making manually or by animal drawn Pant hill plough / furrower.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Earthing by power tiller operated or animal drawn ridger.
5. Plant protection by manually operated sprayers.
6. Harvesting by animal / power tiller operated potato digger.
7. Grading by mechanical potato grader.

V. Management of Orchards

1. Digging of holes by light weight power tiller operated post hole digger.
2. Watering by fertigation using drip method.
3. Pruning by power chain saw / mechanical pruners.
4. Fruit picking by mechanical hand held pickers .
5. Plant protection by aero blast sprayer.
6. Grading by mechanical graders.

3.A Existing collective inputs: Community pasture land, Service bulls, Irrigation channel and source, Irrigation tanks

3.B Collective inputs suggested for reducing cost of cultivation in the specific agro-ecological region of district:

1. Custom hiring energy based implements viz. Small tractor, tiller, Power spryers, Mandua thresher, Hydrum irrigation can reduce the cost of cultivation along with reduction of farm labour.
2. Encourage use of well decomposed organic manures and biofertilizers; avoid excessive use of chemical fertilizers.
3. Reduce the dose of chemical fertilizers and avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
4. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
5. Need based application of insecticides and pesticides, preferably enhanced the use of bio-agents; avoid the use of costly chemicals.
6. Follow line sowing of seed instead of broadcasting.
7. Encourage water harvest technology for irrigation.
8. Sprinkler and drip method for irrigation should be encouraged to improve water use efficiency.
9. Use of mulches and available composts/organic manures
10. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
11. Promote reduced tillage operations.
12. Incorporate crop residue or green manure 15 days prior to sowing along with slight dose of N.

Factors responsible for increasing cost of cultivation in the specific agro-ecological region of district:

Mid hills

Area better suited to human settlement due to forest free cultivated land and maximum exposure to sunlight and represent sub-temperate climate. About 75% of total precipitation is received during rainy season, 12% in winter and 13% in summer. The situation is dominated by chir (pine) forest vegetation. Most of the area is rainfed. The soils are eroded, chirty/gravelly sandy loam to silty loam. Soils are heterogenous and poor in fertility.

The irrigated area is 8% by gulls. It has good cover of oak and its association. Duration of exposure to sunlight is the major factor influencing the microclimate and type of vegetation. Relative humidity is high (60-70%). Temperature is moderately low due to vegetation and high shading effect. Rainfall is high with occasionally snowfall. About 75% precipitation is received during rainy season, 15% in winter and 10% in summer. The soils are moderately to highly acidic in nature especially at mid and high elevation areas.

High hills

The irrigated area is only 4-5% by gulls. Region represents temperate climate with mean annual temperature ranging from 11-150C, about 90% of rainfall is received during rainy season, 8% in winter and 2% in summers. The soils are highly acidic, high in un-humified organic matter.

Factors responsible for increasing cost of cultivation

1. Heterogeneous soils, soils of each situation differ widely in their physical, physico-chemical characteristics as they are developed from a variety of rocks and minerals under joint influence of vegetation, physiography and climate.
2. Sloping lands with high rate of removal of soil and nutrients from surface through erosion resulting to depletion of soil fertility.
3. Scattered holding and marginal land size.
4. 90 % of areas of mid and high hills are rainfed.
5. High rates of migration from hills to plains of males and young boys in search of jobs.
6. Women based farming system without technical knowledge – how and inputs.
7. Low efficiency of conventional farm tools and implement.
8. Indigenous breed of livestock with low production and working efficiency.
9. Poor quality of FYM. The method of preparation and application of FYM are defective generally heaped in an open area resulting into loss of nutrients.
10. Mostly soils are slightly to strongly acidic in nature depending upon elevation, vegetation and development of soil from rocks and minerals causing nutrient imbalance in soil and impose hidden nutrient toxicity and deficiency symptoms in crops retard growth and yield.
11. Minimum use of fertilizers: farmers are mostly small and marginal economically backward, not able to apply recommended doses of fertilizers. The average consumption is < 10 kg N:P:K ha-1.
12. Non availability of quality seeds of varieties recommended for rainfed upland situations.
13. The inputs are costly and therefore, the small and marginal farmers are not able to adopt the improved technology.
14. Non availability of inputs at right time and right place.
15. Sowing of crops is at the mercy of rains which are erratic. Thus planting is delayed and not done on suitable time. Sowing are done more than once either because of insufficient moisture mostly in rabi crops or due to crust formation in kharif.
16. Farmers follow practice of dry sowing. In such situation the seeds are eaten by birds and grubs resulting in inadequate plant population.
17. Due to limited moisture and nutrient supply the growth of crops is not proper and vegetative phase of growth (flowering and fruiting) are advanced.
18. Improper seed bed preparation: in order to utilize moisture, the farmers do not wait for fine preparation of fields and rush for sowing. This results in improper germination and infestation of

weeds.

19. Severe infestation of insect-pest: white grubs and cut worms are the serious polyphagous pests, kill plants and reduce plant population up to 70-80 %. Due to non availability of suitable plant protection chemicals as well as high cost they are beyond the means of farmers. Besides, non availability of water for solution also pose problems.
20. Weeds; common weeds of the upland rainfed areas are Tipatiya (Oxalis latifolia), Pardeshi(Galensojaparviflora), Gajar grass (Parthenium Sp.)Kuni(Lantena camera) Kala bansa (Eupatorium sp.).The loss in general in food crops is high from 50-75 %.
21. Improper terrace management: most of terraces developed by farmers are on steep slopes with outward gradient.
22. Lack of proper drainage system for safe disposal of excess rainwater. The heavy runoff of water washes away the top fertile soil lead to steady depletion of nutrients and organic matter.
23. Coarse textured soils (charty/gravely) with low moisture and nutrient retention capacity.
24. Lack of proper storage facilities for crops (cold storage).
25. Lack of awareness for protected cultivation techniques and facilities for commercial high value crops (poly houses, poly tunnels, poly for raising nursery and cash crops.
26. No good marketing facilities.
27. Lack of proper irrigation facilities for minor irrigation and drip irrigation with fertigation.
28. Poor connectivity of road transport system.
29. Lack of farmer's participatory approach models for crop production technologies under hill agricultural system for the state. No storage facilities for perishable product
30. No chilling plant for milk

H. off-farm income

3.A Existing SHGS operative in specific agro-ecological region of district:

HIMANI, ATMA, CHIRAG, AAJIVIKA, NABARD,

1.B SHGS to be created/ encouraged in the specific agro-ecological region of district for doubling agricultural income:

Vegetable collection and procurement group
Vegetable and fruits processing groups
Gola Nashpati group
Malta collection and procurement group
Cheura collection and extraction group
Milk collection and chilling group
Goat production group

1. There is need to have regular monitoring and follow up of SHG's by the forming agencies and time to time evaluation of the group.
2. Regular monitoring by the concerned agency must be ensured like ensuring regular meeting of the SHG, checking their register, regular collection of the money, help during conflicts, solving problems occurring during banking etc. and submitting the monitoring report to their concerned officials so that steps can be taken by the high officials to ensure regular continuity of the SHG.
3. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
4. A large number of groups discontinued as they were not having knowledge regarding income generating activities that can be started (what activities can be taken up, how to operate it, where to market the produce etc.) So there is need of encouragement, motivation along with imparting knowledge, skills and linking them to market.
5. Trainings should be provided to the rural women on income generating activities as per the need of rural women, marketing potential and availability of locally available resources.
6. Loan procedure should be made more flexible with less interest rate.
7. As there were problems like non-cooperation among members, confusion regarding money matter,

lack of confidence on office bearers with respect to group money etc., there is need of organizing training on good governance, democratic election and how to solve financial and administrative issues.

8. SHG's formed should be grouped into clusters, federations and registered cooperatives so as to converge with govt. schemes, facilitate collective purchase of input and marketing of products.
9. To encourage people to form and sustain SHG's so that new enterprise developed, intensive work needs to be done with them in sustainable manner.
10. Enterprises need to be identified depending upon local resources- human and material.
11. Market linkages need to be developed so that people can sell their produce gainfully.

1.C Problems related with SHG:

1. Not interested in continuing the group
2. Non-cooperation among the members
3. Problem in getting loan
4. Lack of resources like money, space
5. Lack of knowledge regarding various income generating activities,
6. Lack of trainings
7. Lack of follow-up and monitoring from the forming agencies.
8. In hills farm holdings are very small and large part is rainfed depending upon rains with very low and uncertain productivity.
9. Young people do not stay in villages and move to other areas or take up other profession such as tourism, transport, hospitality etc.
10. People remaining in villages are not very enterprising.
11. It is seen in the survey that all individuals who took loan increase their livestock only that is their traditional work and did not start any other enterprises.

2.A Existing Micro-entrepreneur employment:

Five groups are working for collection of small fruits for juice preparation

2.B Micro-entrepreneur employment to be generated in the specific agro-ecological region of district for doubling agricultural income:

1. Improved hill agriculture implements
2. Kumaoni and local food products for tourism
3. Mushroom production and processing units
4. Honey and honey products unit
5. Milk and milk products shops

3.A Existing skill development facilities: Extension training institute

3.B Skill development facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Mushroom production and training facilities
2. Development of advanced horticultural handling units
3. Fish ponds
4. Dairy/Poultry/ gottary units
5. Value addition and food chain centre
6. Storage, grading and Packaging centre
7. Silk worm based skill development units
8. Bioagant and biofertilizers production lab
9. Tissue culture lab for massive production of elite planting material
10. Medicinal plant growing and processing units
11. Development of rosary and extraction units

4.A Existing women skilling facilities: NA

4.B Women skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Khadi and Kargha training for women skill
2. Drugery reduction practices for high efficiency
3. Herbal dye based skill training and skill for local textiles.
4. Value addition skill for women
5. Training centre, processing and packaging units as per the locally available resources

5.A Existing youth skilling facilities: Extension training institute

5.B Youth skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Mushrrom production and training facilities
2. Development of advanced horticultural handling units
3. Fish ponds
4. Dairy/Poultry/ gottry units
5. Value addition and food chain centre
6. Storage, grading and Packaging centre
7. Silk worm based skill development units
8. Bioagant and biofertilizers production lab
9. Tissue culture lab for massive production of elite planting material
10. Medicinal plant growing and processing units
11. Development of rosary and extraction units

Beekeeping

Beekeeping is an environment friendly and agro-forestry based occupation. It provides enormous potential for income generation, poverty alleviation and sustainable use of forest resources. Beekeeping is one of the oldest traditions in India for collecting the honey. Honey bee farming is becoming popular due its demand in national and international markets as well. *Apis cerana indica* is the indigenous bee, is known to be the ideal pollinator for organically grown mountain crops due to its capacity to significantly enhance agricultural productivity. India has a potential to keep about 120 million bee colonies that can provide self-employment to over 6 million rural and tribal families. In terms of production, these bee colonies can produce over 1.2 million tons of honey and about 15,000 tons of beeswax.

Less Investment: Bee Farming is not a manufacturing activity, as such costly machine and tools are not required. There is nothing like production capacity as well. Only small wooden frames with boxes are needed. Their sizes are also standardized. To begin with around 15 such sets/boxes can be purchased or assembled at rate of Rs.1500.00 per box that would cost Rs.22, 500/- for 15 Boxes. Honey extractors would cost to the tune of Rs.5, 000/- each with filtration facilities. For other miscellaneous expenditures including training and consultancy services a sum of Rs.5000.00 can be earmarked. That means total of Rs.32, 000.00 would be required to start Bee Farming with 15 Boxes which is equivalent or less than the cost of cultivation of one acre of paddy field.

More Returns: As per the established norms, each box comprises 7-8 hives which is able to harvest around 30-35 kg of honey in a year. The annual harvest of honey starting with 15 bee boxes could be 450-525 kg depending on the flowering season. Even after considering very conservative selling price of Rs. 150/- per kg; the annual realisation would be to the tune of Rs. 67,500/- to Rs.78,750/-. Therefore, Bee Farming can be considered as an excellent, profitable agro-based green enterprise for landless farmers and entrepreneurs.

Beekeeping in Uttarakhand: Beekeeping has been an integral part of human society since centuries in hill regions of Uttarakhand state. The state of Uttarakhand has a predominantly agrarian economy and large number of small and marginal farmers in the mountainous state call for augmenting agricultural production by organic means. The indigenous bee sub-species *Apis cerana indica* commonly is ideal pollinator for organically grown mountain crops, with the capacity to significantly enhance agricultural productivity with an indirect but vital role in combating soil degradation by pollinating wild plants thereby enabling improved regeneration of bio mass, to be returned to the soil. Beekeeping

with *Apis cerana indica F*. is a common practice in hills of Garhwal and Kumoun Himalaya which is carried out mostly by using traditional methods since long past and is stationary in nature. In these regions, beekeeping is also carried out with *Apis mellifera,* but in winter season, due to temperature lower than 20ºC, colonies are being migrated to plains. According to report given by KVK Jeolikot(2017), in Uttarakhand, there are about 4,790 beekeepers with 45,247 number of *A. cerana indica* colonies yielding 546.70 mt of honey production. Whereas, in Almora region of Uttarakhand, there are about 400 beekeepers with 1,165 number of *A. cerana indica* colonies yielding 16.4 mt of honey production. The Uttarakhand state has extremely rich bee forage plants. In most of the remote areas where *Apis cerana indica* beekeeping is common, the use of pesticides and chemicals is negligible, the level of dangerous chemicals in the atmosphere is insignificant and the environmental pollution is at minimal level. Honey produced from such areas is purely natural, free of any residues and can be sold as an organic product. There is vast potential for beekeeping in the country. However, due to lack of knowledge, scientific beekeeping is not being practiced by, most of the beekeepers. It is necessary for beekeepers to participate in the trainings / other capacity building programmes on the subject to gain scientific knowledge on the subject. Selection of good apiary site, good quality bees and proper management are the main keys for success of beekeeping. Following are the important points to start beekeeping and further management practices.

1. Selection of good apiary site: Select apiary site by considering the following:

1. Apiary ground should be clean & free from dry leaves etc. to avoid fire during summer
2. Apiary site should be away from power station, brick kilns, highway and train tracks
3. Site should be open & at dry place having shade
4. Site should be easily accessible by road
5. Fresh running water should be easily available near the apiary
6. It should have natural / artificial wind breaks
7. Site should receive early morning and afternoon sunshine
8. There should not be other commercial apiary within 2-3 kilometers from the apiary site
9. There should not be any source of stagnant / dirty water, chemical industry/ sugar mill, etc., nearby the apiary
10. Area should be rich in bee flora

2. Selection of good quality bees: Beekeeping depends on floral resources, climatic conditions, management and also quality of bees, particularly queen. Therefore, the following should be kept in mind to select the bee colonies:

1. Buy disease free bee colonies from existing reputed beekeepers after getting training on the subject.
2. Select and multiply honey bee colonies only from disease resistant, high honey yielding, young, healthy and high egg laying capacity queen, less swarming tendency etc.
3. Keep colonies with good prolific queens
4. Capture few bee colonies from their natural abodes in forests which may be used for further breeding/ multiplication to prevent inbreeding.

3. Management of apiary:

A. Placement of colonies in apiary

1. Hives should be as per specification of BIS/ISI and should be of locally available seasoned light weight wood. Unseasoned and heavy wood should be avoided
2. Avoid nailing the bottom board with the brood chamber
3. Restrict number of bee colonies in a apiary from 50-100
4. Keep row to row and box to box distance as10 and 3 feet, respectively

Hives used for traditional beekeeping in hilly areas are

Wall hives: Wall hives locally known as 'Khadra', 'Jaala' or 'Jalota' are rectangular structures made in the walls of houses and 'Chhaan' or 'Sunni' (cattle sheds) at the time of construction. Each hive has a small round or rectangular opening on the outer side as an entrance for bees. The size of 'Jalotas'

varies in different locations; usually they are 45-60 cm in length, 25-30 cm in width and 20-30 cm in height . Generally one hive is made in each wall, but numbers may vary from 2-4. The interiors of hives are smoothed with cow dung and clay. In winters due to lack of floral resources and extreme cold in the hills, the population of *Apis cerana* colonies decreases to a great extent. Thick wall hives provide considerable insulation in such conditions.

Log hives: Two types of log hives are found, Type I: These are made up of cylindrical hollowed pieces of tree trunk 60-100cm long and 20-40 cm in diameter; however size depends upon the circumference of available trunks. This type of log hives is usually made from the trunk of *Quercus leucotrichophora, Q. floribunda, Rhododendron arboreum and Pinus roxburbhii.* The entrance is made at the mid front side. Both sides are plastered with a mixture of cow dung and clay. Type II: Old cooperages locally known as 'Pariya' or 'Dokha' when rendered useless for milk products, are used as hives. These are about 70-90 cm long with the diameter at top from 25-35 cm and thickness of log 3-5cm. An entrance is made towards the outside and the hive is placed horizontally on a raised platform of stones or the wall of a courtyard. It is mainly made up of the wood of *Ougeinia oogeinesis, Rhododendron arboreum, Toona* spp. A stripe of old comb is fixed to the upper part, inside the hive, and is plugged with a wooden or metal cover, then sealed with a mixture of clay and cow dung. The wooden lid is fixed at the top with an entrance on it.

Miscellaneous Types: These are rectangular box hives made up of separate wooden boards with movable top cover . Their size varies in different localities. Usually these are 80-110 cm long, 25-30 cm wide and 40-50 cm high. During extraction, the top cover is removed along with attached combs and bees, and taken away from the hive, then each comb is smoked and shaken gently. Bees return to the hive and beekeepers cut combs easily.

All hives are made from locally available materials, thus are economically cheaper and environmentally friendly. These hives have thicker walls as compared to modern hives thus provide protection to bees from extremely low and high temperatures. In higher hills traditional hives are more suitable than modern hives but for the drawback in colony management.

B. Inspection of colonies

1. Adopt general colony and personal hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board, top cover, etc. frequently
2. Check the colonies periodically for any abnormalities or changes in behaviour of bees
3. Inspect colonies on clear sunny days preferably at temperatures between 20 and 30°C
4. Do not inspect colonies in cold, windy and cloudy days
5. Use smoker when needed to subdue the bees
6. Use protective dress and veil while inspecting colonies
7. Handle colonies gently, avoid jerks
8. Avoid crushing bees as it could lead to stinging
9. Isolate the diseased colonies from healthy ones.
10. Handle diseased and healthy colonies separately

C. Provision of fresh water in the apiary

Ensure availability of fresh water preferably in shallow containers near the apiary to maintain a healthy apiary. Water is needed for the following

1. Maintenance of adequate humidity in a colony to ensure proper incubation of eggs
2. For feeding bee bread by nurse bees, the mixture of honey and pollen of certain consistency is required for which water is needed
3. When temperature in the apiary increases beyond 37°C, water is used by bees to evaporate and cool the colony

D. Dearth period management

1. Provide 50% sugar syrup to the colonies during dearth periods when honey stores in the colonies is not adequate and nectar is not available in the area. The syrup should be prepared by boiling clean water in the vessel and sugar added with slow stirring for few minutes. Cover the vessel

with lid and let it cool. Feed cooled syrup.

2. Sugar syrup should be kept in such a way that the bees should not drown in it. This should be ensured by using shallow vessels with straw to facilitate easy feeding
3. Do not prepare the feed in open in the apiary and avoid dripping on the ground to prevent robbing by bees and ants
4. Feed the colonies in the evening preferably after sunset
5. Feeding should be given to all colonies in the apiary at one time
6. Pollen substitute comprising of fat free soyabean flour (3 parts) + Brewer's yeast (1 part) + skimmed milk powder (1 part) + sugar (22 parts) +honey (50 parts) made in the form of patties should be provided when pollen stores in the colonies is not adequate and pollen is not available in the area
7. Provide fresh water near the colony in shallow vessels
8. Extra frames should be stored in air tight chambers and fumigated with sulphur powder regularly
9. Old and dark combs should be discarded

E. Care during honey extraction

1. Use honey extractor, containers and other bee hive tools /equipments made of stainless steel / food grade plastic. Don't use tins & containers made of other degraded material
2. Wash all the equipments / containers etc. thoroughly with warm water before honey extraction
3. Extract honey from super chambers only
4. Select frames only with 75% sealed cells with ripened honey for extraction
5. Cover the entrance gate of the colony with small branches or twigs to avoid robbing
6. Extract honey in a closed room and not in the open to avoid robbing
7. Do not leave super and brood frames, after extraction of honey open in the apiary;
8. Do not spill honey in the apiary

F. Care during migration

1. Migrate colonies during non-availability of flora to areas with abundant flora.
2. Before migration survey the area to assess the availability of the flora to locate the colonies
3. Ensure honey extraction before migration
4. Close the entrance gates of the colonies in the evening after all worker bees are inside the colony
5. Pack the colonies internally and externally before migration to avoid jerking
6. Colonies in the vehicle should be packed in such a way that the entrance side should face the front side of the vehicle
7. Start migration late in the evening and ensure the colonies reach the destination within 10-12 hrs. the next day morning and entrance gates are opened after landing in the new location
8. Avoid jerking in the way while transporting bee colonies

G. Seasonal management of apiary

a**) Summer Management**

1. Keep the colonies in thick shade
2. Regulate the microclimate of the apiary by using wet gunny bags over top cover and sprinkling water around the colonies in the apiary during noon hours.
3. Provide fresh water in/near the apiary

b) Monsoon management

1. Clean and bury deep the debris lying on the bottom board
2. Keep the surroundings of the colony clean by cutting the unwanted vegetation which may hamper free circulation of the air
3. Provide artificial feeding (sugar syrup and/or pollen substitute) as per requirement of the colony
4. Check the robbing within the apiary
5. Unite weak/laying worker colonies
6. Control predatory wasps, ants, frogs, lizards in the apiary

c) Post monsoon season management

1. Provide sufficient space in the colony
2. Strengthen the colonies to stimulate drone brood rearing
3. Control ectoparasitic mites, wax moth and predatory wasps

(d) Winter management

1. Examine the colonies and provide winter packings in weak colonies specially in hilly areas
2. Feed sugar/pollen substitute to weak colonies as stimulative feeding to provide energy and initiate brood rearing
3. Shift the colonies to sunny places
4. Protect the colonies from chilly winds by using wind breaks
5. Unite the weak colonies with stronger ones

e) Spring management

1. Unpack the colonies, clean the bottom board, replace the worn out hive parts and provide sufficient space
2. Provide stimulative sugar/pollen substitute to increase brood rearing
3. Equalise the colonies
4. Extra frames should be raised by providing comb foundation sheets
5. Replace the old queens with new ones through mass queen rearing or divide the colonies
6. Manage the colonies in such a way to prevent swarming
7. Monitor regularly for ectoparasitic mites and adopt control measures

H. Protecting colonies from pesticides

1. Persuade the farmers not to use pesticides or use selective pesticides that are less harmful to bees at recommended concentrations
2. Avoid the use of dust formulations as they are more harmful to bees than spray formulations
3. Prior information about spraying would help in reducing poisoning of bees
4. Avoiding spraying of pesticides during flowering of the crop and peak foraging time of the bees would help in reduction in the mortality of foraging bees
5. Spraying may be done in the evening after sun set when bees do not forage
6. Colonies may be temporarily shifted if heavy spraying schedule is fixed
7. If shifting of the colonies is not possible, feed with 200 ml sugar syrup and close the gate by using wire screen for the day of spraying.

I.Methods of attracting and catching swarms

1. Swarming is a natural process for propagation of honey bees. Swarms are the lone source of bees in traditional beekeeping of *Apis cerana* while only a few empty hives are inhabited by absconded or feral colonies.
2. Empty hives are cleaned and smeared with clay, cow dung or both. Honey or jaggery are put inside hive to be used as bait to attract the swarm.
3. Flowering shoots of *Brassica campestris, or Raphanus sativus* can also be used just above the hive entrance, hoping that scout bees will find their home in the empty hive.
4. When swarms is found in the vicinity, water can be sprinkled and soil or ash can be thrown to settle them. 'Tofri' or 'Garori' (special baskets) made up of 'Ringal' (bamboos); 'Jhola' (bag) can be used to catch and carry swarms. 'Kutrine' (burning cotton cloth) is used as a traditional smoker and 'Talikh' (a cloth) to save faces while catching the swarm.
5. To catch a swarm layer of jaggery or honey is applied at the inner base of the basket and hang it inverted near the settled cluster. The cluster is gently displaced from the other side with smoke to direct the bees towards the basket. As the swarm makes a cluster on the basket, it is transferred to the hive. When the bees are settled the basket is removed. Finally the hive is closed with its wooden cover and be smeared with a mixture of cow dung and clay.

J. Management of Honey Bee Diseases and pest

Honey bees could be affected by diseases and the real cause of abnormality or any disease present in

the honey bee broods need to be ascertained before taking up any control measures. It is best to contact the researchers/scientists/beekeeping experts at the nearest centre or university or Government department working on honey bees. After the exact diagnosis of the causal agent of the particular disease, the guidelines/ recommendations given by the expert should be followed in true letter and spirit. However, general advisory for the management of common diseases of honey bees is given below:

1. Select good site to locate the apiary preferably in an open, dry place with shade.
2. Adopt general colony hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board frequently.
3. Select and multiply honey bee colonies only from disease resistant stocks.
4. Keep colonies with good prolific queens.
5. Create broodlessness in colony for at least 15 days by enclosing the queen in a queen cage.
6. Check the colonies periodically for any abnormalities or changes in behaviour of bees.
7. If you observe any colonies with disease, isolate them from healthy ones. Handle diseased and healthy colonies separately.
8. Keep the colonies strong by adding sealed brood comb or worker population only from healthy colonies and also by providing adequate food during dearth periods.
9. Prevent robbing, drifting, absconding and avoid migration of bee colonies when you notice disease symptoms.
10. Follow 'Shook Swarm' or shaking method to remove contaminated combs completely by transferring entirely new combs in one operation to the colonies with disease symptoms. Destroy the removed combs by burning.
11. Sterilise the combs and equipments by any one of the following methods:
12. Disinfect the empty combs and equipments with 80 per cent acetic acid @ 150 ml per hive body in piles for few days at a protected place. Air the treated materials before use.
13. Dip the contaminated equipments and combs in soap solution containing 7 per cent formalin for 24 hours. Then wash the treated material with water, dry and use.
14. Use of antibiotics to control honey bee diseases is likely to result in contamination of honey causing problems in export of honey.
15. The traditional method to check the entry of ants is spreading ash or turmeric powder in their way.

K. Honey Extraction

The main honey seasons in hilly areas are '*Chait*' (April), '*Baisakh*' (May) and '*Ashaad*' (July-August). In some localities, an additional extraction during '*Kartik*' (October) is also done. Colonies yield most honey in '*Chait*'-'*Baisakh*' and the least in '*Kartik*'. Traditional tools used are '*Dathule*'. (sickle) to open the cover or wooden plug and '*Buwan*' (traditional brush) made up of '*Babul*' (*Eriophorum comosum*) to brush off bees. Besides these traditional smokers, large pans for keeping combs, a pot with water and '*Parunla*' or knife for cutting '*Faur*' or '*Fwar*' (bee combs) are required at the time of harvest. Honey is mostly extracted at night but a few beekeepers do it in day time also. Combs are cut down, leaving the innermost comb for feeding and to attract swarms the next year. Honey combs are squeezed after removing the brood area from the cut combs. The harvested honey has many impurities like insect body parts, wax cells, etc. Usually, squeezed combs are thrown away after extraction, which can be fed to cattle especially bulls. Honey is stored in plastic or metal containers and in bottles.

The beekeepers doing beekeeping with modern hives should use honey extractors to harvest honey. The quality of honey extracted using honey extracting machine is much better than squeezing method.

Mushroom cultivation

The shrinking land, demand for functional foods, priorities for recycling agricultural residues and changing trades in view of globalization are going to play an important role in the agricultural scenario, and secondary agriculture is likely to play a pivotal role. Our country can emerge as a major

player in mushroom production in wake of availability of plenty of agricultural residues and labour. To remain competitive it will be important to harness science and modern technologies for solving the problems of production and bio-risk management. Mushroom being an indoor crop, utilizing vertical space offers solution to shrinking land and better water utility. Packages and practices of mushroom cultivation in Almora is as follow:

1. **White Button Mushroom (*Agaricus bisporus*)**

Button mushroom scientifically known as *Agaricus bisporus* and has he widest acceptability. Cultivation of this mushroom is a complex process and requires two different temperature i.e. 22-26^{0}C for spawn run and 14-24^{0}C for fruit body formation. Besides specific temperature, it require proper humidity (80-90%) and enough ventilation during fruit body formation.

Steps of cultivation process

Compost preparation: Compost is an artificially prepared growth medium from which mushroom is able to derive important nutrients required for growth and fructification. Cemented floors and shade over the floor are required for making good quality compost. There are two main methods for compost preparation:

Long method of composting: This is an outdoor process and takes around 28 days in its completion with a total of seven turnings. The following materials are required for long method of compost:

Wheat straw	1000 Kg	Urea	10 kg
Wheat bran	50 kg	Gypsum	100 kg
Ammonium sulphate or calcium ammonium nitrate	30 kg	Furadan	500 g
Super phosphate	10 kg	B.H.C.	500 g
Muriate of Potash	10 kg		

Before making compost, wheat straw is spread on cemented floor and is turned many times with water being sprayed at regular intervals.

Day 0: At the stage, there should be around 75% humidity content in the wheat straw, to which wheat bran, calcium ammonium nitrate, urea, murate of potash, and super phosphate are mixed thoroughly and evenly. The material is then piled 1.5m thick x1.25m high with the help of wooden rectangular block. The blocks are removed. Once the entire material has been stacked up or piled up. Water is sprayed twice or thrice to keep the substrate moist. Temperature should be in the range of 70-750C.

1st turning Day 6: On the sixth day first turning is given to the stack. The purpose of turning is that every portion of the pile should get equal amount of aeration and water. If the turnings are not given, then anaerobic condition may prevail which may lead to the formation of non-selective compost. In the stack, the central zone is fermenting at its peak and has maximum temperature rest of the portion is either not at all fermented or ferments improperly. The correct method of turning is as: Removing about 15cm of compost from the top and spread it on one side of the floor, the rest part of compost on the other side of the floor. Now turning is done by shaking the outer (top most) part and the inner part of the compost, first separately and then missing them altogether thoroughly with the help of wooden buckets.

2nd turning (Day 10): On the tenth day, again the top most part and the inner part of the compost is separated, water is sprayed on the top part. Again the two parts are piled up together in such a way that now the top part is inside and the inner part is on the top of the stack.

***3rd turning (day 13)*:** it is also done in the same way as described earlier and required quantity Gypsum mixed at this stage.

***4th turning (day 16)*:** The same process of turning is followed. The required quantity of furadan & lindane are added during this turning.

***5th turning (day 19)*:** The compost is turned in the same manner.

***6th turning (day 22)*:** The same process of turning is followed. The required quantity of furadan and

lindane are added during this turning.

***7th turning (day 25)*:** The compost is turned in the same manner

8th *turning (day 28)*: if no ammonia persists in the compost, spawning is done.

Short method of composting: Compost prepared by short method of composting is superior in production quality and the chances of infection and disease is quite low. Composting by this method requires special infrastructures; equipments etc. that initial cost is to high, therefore, the farmers can purchase the readymade compost from the authentic composting units. The compost when ready for spawning should have the following characteristics:

Moisture	About 68%	**Ammonia**	Below 0.006%
pH	7.2-7.5	**Nitrogen**	Around 2.5%
Fire fangs (Actinomycetes)	Excellent growth		

Proper timing for cultivation: Feb.-Nov. (03 crops)

Cultivated strain: Delta, U-3, S-11, MC-465, A-15

Spawning :The process of mixing of the spawn in the compost is known as spawning. Spawn is thoroughly mixed in the compost at the rate of 600-750 gm per 100 kg of compost (0.6-0.75%). The spawned compost is filled in tray or polypropylene bags covered with formalin treated news papers. In case of bags, they should be folded at the top and covered up. After spawning, temperature and humidity of crop room should be maintained at 22-26^{o}C and 85-90%, respectively for spawn run. Water should be sprayed over the covered news papers, walls and floors of the crop room. After 12-14 days of spawning white mycelial growth is seen running the entire length of the tray/bag. This is then covered with casing soil on the surface.

Casing soil : The significance of casing soil is to maintain the moisture content and exchange of gases within the surface of the compost which helps in the proper growth of the mycelium. The pH of the casing soil should be 7.5-7.8 and must be free from any infection or disease. In our country casing soil is prepared from the following ingredients.

Two years old manure + garden soil	3:1
Two year old manure + garden soil	2:1
Two year old manure + spent compost	1:1
Two year old manure + spent compost	2:1

Pasteurization of casing soil: The casing soil is piled on cemented floor and is treated with 4% formalin solution. Thorough turning of the soil is done and it is covered with polythene sheet for the next 2-3 days. After that remove the polythene cover and turn the casing soil so that it is free from the smell of formalin.

Using the casing soil: A layer of casing soil (3-4cm thick) is being spread uniformly on the compost when the surface has been covered by white mycelium of the fungus. Formalin solution (0.5%) is then being sprayed. Temperature and humidity of the crop room should be maintained at 14-18^{o}C and 80-85%, respectively. Proper ventilation should be arranged with water being sprayed once or twice a day.

Harvesting of crop: Pin head initiation takes place after 12-18 days of casing and the fruiting bodies of the mushroom can be harvested for around 50-60 days. The crops should be harvested before the gills open as this may decrease its quality and market value.

Productivity: From 100 kg compost prepared by long method of composting 14-18 kg of mushroom can be obtained. Similarly, 18-22 kg mushroom can be obtained from pasteurized compost (Short Method Compost).

2. Oyster mushroom

The species of the genus *Pleurotus* are commonly known as oyster mushroom or dhingri mushroom. This mushroom can be cultivated at a temperature range between 20-28^{o}C and relative humidity between 75-90 per cent.

Steps of cultivation process

Substrate and its preparation

The tropical wastes like rice straw, wheat straw, corncobs, dried water hyacinth, sugarcane bagasse, banana leaves, cotton waste or sawdust are used as substrate for cultivation. The straw should be cut into small pieces (3-5cm long) to facilitate proper wetting as well as to increase surface area. Although this mushroom can be cultivated on simple water soaked straw but there are chances of crop failure due to presence of contaminants. In order to avoid contaminations the straw should be treated by hot water and chemical.

Hot water treatment-The substrate should be is treated with hot water at 65^{o}C for 1 hour. The excess water is then drained off and substrate cool down to room temperature for spawning.

Chemical treatment- The materials are usually soaked in water chemically sterilized with carbendazim (7-10g) and formalin (120-150 ml)/ 100 litre of water for 16-18 hours. After that straw is taken out from solution and spread on clean cemented floor or on polythene sheet to evaporate the excess water. The ready substrate should contains 65-68 per cent moisture.

Proper timing for cultivation May- Aug. (02 crops)

Cultivated spices: *P. sajor-caju, P. florida, P. sapidus, P. eryngii, P. cornucopiae, P. flabellatus, P. djmore, P. eous, P. ostreatus*

Spawning and crop management : Oyster mushroom spawn should be about 15-20 days old when mycelium has formed complete coating around the grain. The normal rate of spawning in a pasteurized substrate is 2-3% of the wet substrate. The spawning is usually done by mixing the spawn throughout substrate. Before filling the substrate in polythene bags, holes of about 1 cm diameter are made at 10-15 cm distance all over the surface for free diffusion of gases and heat generated inside. The optimum temperature for growth of mycelium is 23 ±2^{o}C. Relative humidity in growing room should be range between 85-90% during spawn-run. Spawn run usually takes about 15-20 days. After complete spawn run, polythene removed completely with help of sharp knife carefully. Usually 3-4 days after opening the bags, mushroom primordial (pin heads) begin to form. After opening the bags water should be sprayed 2-3 time per day regularly.

Harvesting and yield: Mature mushrooms become ready for harvesting in another 2-3 days. An average biological efficiency (fresh weight of mushrooms harvested divided by dry substrate weight x 100) can range between 70-80% and sometimes even more. To harvest the mushrooms, they are grasped by the stalk and gently twisted and pulled. A knife should not be used.

III. Enabling Policies

1.A Existing policies related with agriculture and animal husbandry:

Subsidies and incentives are given on all agricultural inputs. 50 to 90% subsidies are granted on all inputs and implements.

1.B Policies to be suggested for doubling income in the specific agro-ecological region:

1. Section of crop and area specific crop production program
2. Timely and assured supply of agricutural inputs to farmers at door.
3. Popularization of polyhouse technogy for vegetables and flower production
4. Inclusion of hybrid seed programe for crop production.
5. Establishment of seed production units for temperate crops.
6. Need to establish more food processing unts.
7. Availabilities of credit at minimum rate.
8. Assured buyback policy for agricultural produce.

2.A Existing Institutions: ICAR Institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK, NGOs

2.B Institutions to be suggested for doubling income in the specific agro-ecological region of district:

1. Establishment of food proceesing units at distt level to procure and marketing of surplus.
2. Need to develop or establish animal breeding/Grading up program

3. Testing of new crops in nontraditional areas for doubling the crop production.

3.A Existing Incentives:

3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district:

1. An assured bonus to farmers to grow new crop or higher production potental
2. Selection of farmers at village for trendsetter for dessimination of technical knowlwdege and technolgy may be awarded
3. Free access to libraray and one institute at least once in a year.

4.A Existing risk coverage facilities: Crop and Animal Insurance Schemes

4.B Risk coverage facilities to be suggested for doubling income in the specific agro-ecological region:

1. Risk coverage may be applicable for all agricultural products and animals
2. Declaration and minimum support price be fixed well in time

J. Marketing and value addition in specific agro-ecological region

1.A Existing marketing facilities: No organized procurement agency/mandi

1.B Marketing facilities to be suggested for doubling income in the specific agro-ecological region:

1. Contractual farming,
2. Linkages with MNCs and NCs,
3. Mahila hat, local hat, weekly bazaar and local mandi,
4. AC van,
5. Online portal for sale

2.A Existing grading facilities: Nil

2.B Grading facilities to be suggested for doubling income in the specific agro-ecological region:

Mechanical grading facilities should be made available on cluster basis for cereals and vegetables & fruits

For grains:

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

For horticultural crops:

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

2.C Processing facilities to be created for better marketing and value addition in the district:

Modern and cost effective Grading and packaging facilities, small scale fruit and vegetable processing units

For grains:

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets

9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity
10. Sugarcane crusher, open pan evaporator, moulds for jaggery, packaging unit at village level

For horticultural crops:

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

2.D Packing facilities to be created for better marketing and value addition in the district :
Packing facilities for packing of processed food item like tetra pack. can packing. Ecofriendly packing material for small and big quantities etc are required.

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity
3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)
4. IRRI bags for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables
3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed
8. Litchi peeling and shredding unit

3. Existing marketing and value addition problems in the specific agro-ecological region: No marketing facility, No value addition facility, High transportation cost

K. Online Management and Evaluation

1.A: Existing online management structure available: Internet facility upto block level is available In border areas like Dharchulla, Munsyari Munakot and Munsyari poor internet facility is available

1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district: Each village should be connected by Internet facility with proper device, awareness about internet user. Awareness about computer application

2.A: Existing evaluation procedure: Manual, through regular visits at village level group meeting

2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district: Internet , GPS, Email, Whatup, ITC tools

3.A: Existing monitoring system: Physical

3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district: Regular visits and online report submission, farmer's feed back

4.A: Existing feedback system: Manually

4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district: Internet portal and proper software for evaluating ongoing activities

5.A: Existing reading system: Literature, Booklets, Hindi Extension Journals etc

5.B: Reading system required for online management and evaluation in specific agro-climatic region of district: Farm advisery portal, online helpdesk services, mobile advisory

Specific action plan for doubling agricultural income in agro-ecological region

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties for increasing productivity

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 (from 1500 to 1700m amsl), VL Gehun 832 and HPW 155, HS 365 and UP 2572(from 1700 to 2400m amsl)) in *Bin, Munakot, Kanalicheena, Dharchula, Ddhat, Berinag and Gangolihaat* blocks.
2. Promotion of HYV of specialty corn (CMVL Sweet Corn 1, CMVL Baby Corn 2(upto 2000m amsl)
3. Promotion of high yielding varieties of finger millets (and VL Mandua 352 upto 2000m amsl) and Barnyard millet (PRJ-1, VL Madira 172 and VL Madira 207 upto 2000m amsl) in *Bin, Munakot, Kanalicheena, Dharchula, Ddhat, Barinag and Gangolihaat* blocks.
4. Promotion of high yielding variety of lentil (PL-4, PL-7, PL-8), Buckwheat (VL Ugal 7, PRB 1), soybean (PS 1042, PS 1092), Rajmash (VL Rajma 63, VL Rajma 125) in Munsyari, *Bin, Munakot, Kanalicheena, Dharchula, Ddhat, Barinag and Gangolihaat* blocks.
5. Promotion of high yielding varieties of vegetable pea (Vivek Matar 11 for main season & VL Ageti Matar 7 for August sown, Arkel, Azad Pea 3, Pusa Pragati, Punjab Agetha 6), French bean (VL Bean 2), Capsicum (VL Shimla Mirch 3 utp 1800m amsl, California wonder, Bull nose, Arka mohini, Arka Gaurav, Indira, Bharat, Pusa Dipti), Cabbage (T-621, Pragati, Indica,, Pusa Mukta, Sri Ganesh Gole), tomato (VL Tamatar 4 upto 1800m amsl, Avinash (A-2), Himsona), Onion (Agri found light red, Agri found dark red, Pusa red, Pusa ratnar, VL Piaz 3), Garlic (VL Lahsun 2) in Bin, Munakot, Kanalicheena, Dharchula, Ddhat, Barinag and Gangolihaat blocks.
6. Promotion of high yielding varieties of Apple (Early Red one, Washington spur Pink Lady, Oregeon), Citrus (Malta : Blood red, Valencia; Kinnow; Lemon & lime: Pant lemon 1, Kagzi lime, Orange), Peach (Alxander, Red Globe, Crest heaven, Glo Heaven etc Nectarine- Snow Queen), Pear (Max Bartlette, Red Bartlette, Willium, Starkrimson, Hokoi, Plum (Italian plum, Prunes viz Frontier), Apricot (DK 5, Harcot, New castle, Shakarpara, Charmagz), kiwi (Allison, Bruno, Hayward, Tomari, Abbott, Monty) in Bin, Munakot, Kanalicheena, Dharchula, Ddhat, Barinag and Gangolihaat blocks.
7. Promotion of high yielding variety of fodder crop Hybrid Napier (IGFRI-3,6,10 NB-21), Gini grass (PGG-1,9 Bundel gini ghas 1,2), *Bin, Munakot, Kanalicheena, Dharchula, Ddhat, Barinag and Gangolihaat* blocks.

Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Development of water harvesting and roof harvesting techniques for water storage in all blocks.
2. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
3. Creation of rain water harvesting structure in private as well as government buildings in all blocks.
4. Creation of trenches for high percolation of water in most of the area of *Kanalichhinna, Berinag, Gangolihat, Didihat, Munakot and Dharchula* blocks.
5. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in low or valley areas of all the blocks of this region.

Adoption of cluster approach for holistic development

1. Rejuvenation of existing orchards of Citrus, Pear, Peach, Plum and stone fruits (Almonds, Apricot, walnut) in *Munsyari, Gangolihat, Berinag, Didihat, Kannalichinna, Bin, Munakot and Dharchula.*
2. Promotion of onion, potato and garlic cultivation in all *blocks of the region*.
3. Promotion of off season vegetables (tomato, capsicum, cole crops etc.,) cultivation in *all blocks*.
4. Promotion of production of vegetable pea, Ginger, Turmeric in *Bin, Munakot*, *Didihat, Gangolihat, Berinag* and *Kannalichhina* block.

Management of wild animal problem

1. Promotion of live fencing of wild Apricot, Jatropha, Cheura, lime/ lemon at larger scale in fruit crops, ginger or turmeric in shady areas, Lemon grass to ward off wildlife in cultivated field.
2. Enacting legislative measures for protection of crop from wild animals.
3. Promotion of protected cultivation of vegetables (Tomato, Capsicum, Cabbage, Cauliflower and Cucumber) in *all blocks.*

Adoption of Farm mechanisation (Power tiller, thresher etc)

1. Popularization of multi crop thresher and Power Weeder at Nyay Panchayat level in all the blocks.
2. Promotion of improved Naveen sickle, Dung collector, Vivek Millet thresher cum pearler and Vivek small tool kit for reduction in drudgery of hill farmers.

Adoption of efficient irrigation techniques

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available,
2. Drip Irrigation in integration with water harvesting structure where irrigation water is not available
3. Green House Cultivation for Vegetables

Management of soil health in low or valley areas

1. Popularization of soil testing in intensive mode and distribution of soil health card to farmers for judicious use of fertilisers.
2. Promotion of Forti fication of composting unit, adoption of legume based cropping system and green manuring techniques in concern areas of all blocks.
3. Organic cultivation of millets, spices and local grains in all blocks.

Others

1. Cluster approach for holistic development.
2. Promotion of timely and local availability of high yielding varieties of all the cereal, pulse, High Value Crops like vegetable, fruits, spices, etc.
3. Cultivation of fodder grasses like Tall fescue, Italian rye, Gini grass, Hybrid Napier, Bheemal) plants.
4. Adoption of only well decomposed FYM/ value added compost.
5. Promotion of efficient and timely use of INM, IPM and IDM modules.
6. Compulsion of seed treatment through bio agent/ chemical in the cluster.
7. Adoption of moisture conservation practices like mulching with local straw or black mulch in all blocks.
8. Promotion to focus on integrated weed management.

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of high milk breeds of cows (Jursey, HF, Sahiwal), buffaloes (Murrah, Neeli-ravi) and goats (Barbari, Jamunapari), sheep (Gaddi, selective breeding of local breed), fish (Mahasheer, Silver carp, grass carp and common carp) in *Bin, Munakot, Kannalichhinna, Didihat, Dharchula, Berinag, Munsyari and Gangolihat* block and Angora rabbit in *Dharchula, Munsyari and Didihat*.
2. Establishment of Fodder Bank in *Bin, Dharchula, Munsyari, Gangolihat, Didihat, Kanalichhinna and Berinag* particularly during lean period.
3. Establishment of milk chilling plant at *Munakot ,Dharchula, Gangolihat, Berinag, kannalichinna* and *Bin* block.
4. Promotion of Urea, Molasses, and Mineral mixer blocks at *all blocks.*
5. Establishment of hatcheries for need of broilor or croilor in *Berinag, Gangolihat*, *Didihat, Dharchula and Munsyari blocks.*
6. Availability of feed material with low prices & timely health check-ups of animals.
7. Introduction and promotion of Cross breed milch breed of animal for increasing income of marginal farmer.

Strategy 3 : Integrating Farming system

Following Integrated farming system model may be developed in all blocks:

Agri-HortAnimal-processing based farming system

Activity	Area
A. Cropping system:	8 nali
Rice/Ragi/Maize-lentil	
Horsegram/ricebean/soybean-wheat	
Tomato/Capsicum-cabbage/Cauliflower-frenchbean	
Hybrid Napier/Rai grass/Gini grass + forestry	
B . Horticulture	8 nali
Peach/Plum/Apricot/Walnut/Apple_ginger/garlic/turmeric +fodder grass (As intercrop)	
Polyhouses (for growing tomato/capsicum/cucumber)+ polytunnel(for raising vegetable seedling)	
Water harvesting structure:	
Mushroom Production Unit	
C. Livestock	2 nali
a. Cow/buffalo	2no.
b. Backyard poultry	25 Birds
c. Goat/Sheep farming	5+1
d. Bee kepping	
e. Rabbitary	
D. Vermicomposting/Processing-	2 nali
Washing and cleaning of season vegetables, biogas/vermicompost/biopesticides	

Total cost : Rs 90,000.0

Total income : Rs 2.0 lakhs

Net income : Rs 1.1 lakh (Approx.)

Strategy 4 : Reducing post harvest losses and value addition

1. Development of mini processing unit at *Munsyari, Dharchula* blocks for rajma and local pulses and grains.
2. Establishment of mini fruit grading plant for apple, plum, peach, pear and stone fruits in all blocks.
3. Establishment of Food Processing Units for Malta and citrus at *Bin, Munakot, kannalichinna, Berinag and Dharchula* blocks.
4. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all the blocks.
5. Promotion of common resources on custom hire basis viz. Power weeder/tiller, Mini thresher and other equipments at Nyay Panchayat level in *all blocks*.
6. Establishment of Food and Processing Units at *Bin, Munakot, Kannalichinna, Berinag, Gangolihat and Dharchula* for pickle making using *chilli, & citrus*.
7. Establishment of Food and Processing Units at *Bin, Munakot, Kannalichinna, Didihat, Gangolihat and Dharchula* for Ketch up of Tomato and jam- jellies of Apple, Plum.
8. Promotion of common resources on custom hire basis viz. Power tiller in *all blocks.*

Strategy 5 : Waste land development and waste water

1. Contour making for arable purpose in waste land in *Bin, Munakot, Kannalichinna, Gangolihat, Berinag, Gangolihat and Dharchula* and other and other high hills areas.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in all blocks.
3. Plantation of Wild fruit plants, Fodder trees (*Grewia*, *Quercus* etc.) may be promoted in *all blocks*
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland of all blocks.
5. Popularization of trenches or silages for percolation of water to avoid surface run off in *Bin, Munakot, Kannalichinna, Didihat, Gangolihat and Dharchula* blocks.
6. Construction of check dam and artificial structure to maximize water percolation rate all blocks.
7. Construction of tank for storage of water for lean season in all blocks.
8. Establishment of storage system for rain water in monsoon season.
9. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Adaption of integrated nutrient management techniques and promotion of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc.
2. Provision of mechanization (Use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers etc.)
3. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in all blocks.
4. Promotion of line sowing and balanced fertilizers application in crops.
5. Sowing of crops with recommended seed rate, spacing and depth.
6. Promotion of need based application of pesticides and other agricultural inputs. `
7. Promotion of hand tools in agricultural and horticultural operations.
8. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
9. Promotion of pressurized irrigation techniques in horticultural crops.

Strategy 7 : Off-farm income

1. Promotion of apiculture/ mushroom/poultry/fisheries/goatry/sheep production for small and landless farmers in all blocks.
2. Promotion of cultivation and collection of medicinal plants in *Kannalichinna, Didihat, Berinag, Gangolihat, Dharchula, Munsyari* blocks.
3. Promotion of skill development in women and youth in all blocks.
4. Creation of new SHGs in other villages of all blocks.
5. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Pickle making, Jam & Jelly making, Spice cultivation, Ghee making & packing, weaving of Sheep wool, woollen clothes, handlooms etc. may be provided for better performance in all blocks.

Strategy 8 : Enabling Policies

1. Ensure Buy back of farmer's produce through common agencies.
2. Announcement of Minimum Support Price of crop in each block by the government before sowing.
3. Land consolidation is essentially required.
4. Implementation of policies for control of wild animal menace in agricultural areas.
5. Implementation of Soil Health Card Scheme in each block.
6. Increasing institutional support by providing subsidises and incentives to small and marginal farmers in all blocks.
7. Labelling of organic inputs and certification mechanism for various crops in all three blocks.
8. Popularization of Udhyan and KCC for widespread use of government incentives/ subsidies to farmers.
9. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
11. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.

Strategy 9 :Marketing and value addition in specific agro-ecological region

1. Development of local hats at Block level on weekly basis.
2. Establishment of linkages of farmers with the different private companies to ensure proper marketing.
3. Farmer's produce collection center should be developed at road head of the villages.
4. Creation of better transportation facilities with cool chain van at Block level.
5. Creation of direct linkages with food processing industries for better prices.
6. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
7. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural

surplus with proper labelling.

8. Installation of mini grading machines at village level.
9. Establishment of godowns with latest technology in all blocks.
10. Development of proper marketing network to check the interference of middle men in marketing of agricultural produce of the farmers.

Strategy 10 : Online Management and Evaluation

1. Development of Mobile apps/ software for online management and evaluation at district level.
2. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
3. Organization of monthly review meeting at district to solve the problems related with farmers.
4. Promotion of use of community radio, TV talks and Whatsapp etc. for effective implementation of programme.