Agro-ecology specific interventions/technologies recommended for doubling agricultural income in Nainital

Agro-ecological region: Region A (up to 1000 m)

A.General information about Agroeco-region
District: Nainital
Agro-ecological region: Region A (up to 1000 m)
Main Blocks in Region: Ramnagar, Haldwani, Kotabagh
Main village cluster in blocks: 1. Rajpur, Thari, Veerpur Tara, Veerpur Lachhi, Kandala
2. Bhawan Singh Navad, Jaipur Khima, Dhanpur, Jaipur bias, Bachhi Dharma
3. Ginti gaon, Devirampur, Pandey Gown, Bhatlani, Aawlakot, Pataliya

Irrigated Clusters:
Rainfed Clusters:
Existing rain water management facilities:
1. Collections from hill slope
2. Village ponds
3. Interflow harvesting

B. Productivity Enhancement
1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region
1. Roof top harvesting system
2. Conjunctive and multiple use of water resources
3. Better water conveyance system such as HDPE pipeline
4. Roof water harvesting system
5. Poly tank for water storage for scattered fields

2. Existing practices for soil health improvement
1. Use of undecomposed farmyard mannure/compost
2. Meagre/ no use of biofertilizers
3. Imbalanced/ insufficient nutrient use
4. Use of raw/partially decomposed FYM
5. Meagre/ compost making/recycling of crop residue
6. Mixed cropping of cereal and legume
7. Soil health card scheme launched in 2015

4. Specific Action / Interventions recommended to improve soil health in specific agro-ecological region
1. Bio-fertiliser/soluble fertiliser based farming
2. Soil test based fertilizer application
3. Promotion of pulse based crop rotation
4. Integrated fertilizer application
5. Maximum use of value added compost/FYM
6. Distribution of soil health cards to each and every farmer along with nutrient recommendation for different crops
7. Establishing soil testing labs for major and micro plant nutrients at Block level
8. Capacity building for scientific use of organic manures, Integrated Nutrient Management, use of biofertilizers, different soil amendments, vermicomposting, etc.
9. Organization of camps for general awareness regarding harmful effect of burning crop residues
10. Popularization of legume-cereal rotation for improving the soil fertility in the region
11. Availability of all inputs viz., fertilizers, micro nutrient, biofertilizers, etc. at Nyay Panchayat Level

i) 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. Green manuring with Sesbania in low land paddy
4. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
5. Use of FYM @4-5t/ha or application of vermicompost @2.5-3.0t/ha

(ii) 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

(iii) 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 Azotobacter/ 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

(iv) Sugarcane

1. Set inoculation with Acetobacter/ Azospirillum inoculant and Phosphorus solubilising microbial culture.
2. Recycling of sugarcane trash through windrow composting
3. Soil test based use of balanced fertilizers; INM shall be preferred
4. Use of FYM @8-10t/ha or application of vermicompost @2.5-3.0t/ha

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

1. The climatic projection suggesting increasing air temperature and erratic distribution of rainfall.
2. Therefore following strategy should be followed to increased income under changing climatic scenario:
   a. Rainfed agriculture with low cropping intensity
   b. Growing of vegetables and horticultural crops in very small area

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

1. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
2. In event of decreased water arability (Approximately 1500mm rainfall) in rainy season (June-September) the rain water should be properly stored (In polythene, to make bund) and harvested for Kharif season crops.
3. Short duration variety should be grown show that at least two crops in a year could be taken
4. Growing of Cheti/spring rice variety viz., (VL 206, VL207, VL 208, VL 209).
5. Organic mulch should be used to reduce the adverse impact of frost attack.
6. The area of off season vegetable should be increased at least by double by the year 2022.
   The area having slope 10-30% should be used for growing of horticultural crop viz, Apple, pear, peach, plum, Apricot, walnut should be grown in temperate regions and Mango, Litchi, Guava in Sub-tropical regions.
7. The wheat sowing in plain region of Nainital (Haldwani) should be advanced by approximately one week in tarai and bhabhar region for nullifying the adverse effect of increasing temperature and terminal rains.
8. Micro irrigation technique should be popularized in tarai and bhabhar region.
9. Upland rice should be replaced by horse gram and buck wheat.
10. According to the frost forecast the crop residue should be burnt in the tomato field (open area) to

increase energy level and to create a layer of smog for retardation of outgoing radiation.

11. In rain-fed lower hills Rice, Wheat, Soybean, Maize, in Rain fed mid hill, Rice, Wheat, French bean, and in Rain fed higher hills Finger millet, Wheat and Potato should be grown.
12. In order to minimize the impact of hail storms in mango and litchi the canopy geometry should be managed in a way that upper portion of tree should bear least fruit and bottom and middle portion should bear maximum fruits.
13. Use fodder crop i.e Sorghum, Lobia as supplementary crop
14. Transplanting of finger millet
15. Late sowing of horse gram
16. Sowing of radish /leafy vegetables as cash crop
17. Plantation of citrus / pome granate
18. sowing late sown varieties of wheat
19. Cultivation of off season vegetable

6 A. Name of Field Crop: Wheat

i. Existing varieties being used: Mundaria, lal mishri, VL-738, VL-616, dal bakhani, VL832, VL 738, HS 240, UP 1109, VL 804, VL 802, UP 2572, VL 616, HPW 251 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 *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, DBW-16, DBW-17, PBW-343, PBW-373, PBW-502, PBW-527, PBW-550, HD-2687, HD-2967, UP-2526, UP-2554, UP-2565, UP-2572, UP-2784, UP-2785, WH-542, UP-2684, UP 2628, UP 2748, HS-490, HS-507, HPW-349, UP 2584, RAJ-3765, RAJ-3077

iii. Existing package of practices being used:

1.Preparation of land- 1 or 2 ploughing with local plough no definit depth
2.Seed rate and seed sowing -150-175 kg/ha, Broad casting
3.Manure and fertilizer- use of un decomposed FYM (rainfed) and un decomposed FYM with small doses of chemical fertiliser by some progreesive farmers (in irrigated conditions)as per availability
4.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.Preparation of land- 2-2 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*)

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

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

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

Trichlorfon 50% EC	500	1000

Jassids:

Name of the Insecticides	(gm/ml)/ha	Waiting period
Carbofuran 3% CG	1250	41600

vii. Major disease associated with crop Rust, Loose smut, Leaf blight

viii. IPM Module for management of disease:

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

Sticker @ 1 ml per liter of water must be applied along with chemical pesticides to improve the effectiveness of chemical. For control of loose smut seed treatment with fungicide.

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

Biofungicides

Name of the Herbicides	(gm/Kg) /ha	Treatment
Pseudomonas fluorescens 1.75% WP (In house isolated Strain Accession no. MTCC 5176)	5 g/Kg seed 5 g/lit. water	**Seed Treatment:** Mix the required quantity of seeds with the required quantity of *Pseudomonas fluorescens* 1.75% WP formulations and ensure uniform coating. Shade dry and sow the seeds. **Foliar spray:** Dissolve 5 Kg of *Pseudomonas fluorescens* 1.75% WP in 1000 litres of water and spray.

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

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

Leaf blight of wheat: *Alternaria triticina*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Mancozeb 75% WP	1125-1500	1500-2000
Zineb 75% WP	1125-1500	1500-2000

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

Mexican prickly poppy: *Argemone mexicana* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
2,4-D Sodium salt Technical (80WP)	625-1000	90
MCPA Amine salt 40% WSC	2500	

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:

a. Wheat-Horse gram/Soybean(rainfed),
b. Wheat-Rice(irrigated),

3. Timely Sowing
4. Seed treatment
5. Use of HYV
6. FIRB
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 storages conditions
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,
4. Wild animal damages

5. Migration
6. Poor Irrigation facilities
7. SAAR practice(Shifting area practice)

6B. Name of Field Crop: Rice

i. **Existing varieties being used:** China-4, Nandhani, Lal dhan ,Saket 4, 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:**
Pant Sankar Dhan-3, Pant Dhan-12, Pant Dhan-23, Pant Dhan-26, Narendra Sankar Dhan -2, Pusa Sankar Dhan -10, Pant Sugandh Dhan-25, Pant Sugandh Dhan-26, Pant Sugandh Dhan-27, Pusa Sugandh -5, VL Dhan – 85, VL Dhan-65, PR-113, Pant Basmati-1, Pant Basmati-2, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355 plus) Rainfed- Chaitki Dhan-VL Dhan 208 and VL Dhan 209, Jethi dhan –Vivek Dhan 154, VL Dhan 156, VL Dhan 157 and VL Dhan 158

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(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,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
7. Use of IPM practices

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

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

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 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	

Thrips

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

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

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

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*

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**	**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	**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 latifolia, Cyperus* sp.*, Echinocloa* sp.*, Cynodon* sp.*, Digitaria sanguinales, Eclipta* sp.**,** *Eleusine* sp.

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

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	

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

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

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

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

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 (Transplanted rice)	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
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 %WDG (Transplanted rice)	83.3-100	110

Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
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
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)

Umbrella plant: *Cyperus rotundus* (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)

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. Jethi rice- 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. Care soil & water conservation measures
8. INM (Maximum use of value added compost/FYM and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Marketing of value added produce
13. Avoid early Nursery raising practice and use of 25-35 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
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities

6C. Name of Field Crop: Maize

i. Existing varieties being used: Lal makka, Kanchan, VL-Maize 16, VL-Maize 88, Navin, Shweta

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, DH 296, PEEHM-1 to 5, Vivek QPM 9, Vivek Maize Hybrid 45, Vivek Mize Hybrid 53, CMVL Sweet Corn 1, CMVL Baby Corn 2, Vivek Sankul Makka 31 Gaurav, Pant Sankar Makka-1, Kiran, Navjot, HM-4, HM-10, Prabhat, Kisan, HM-11, Buland, P-3522

iii. Existing package of practices being used:

1. Sown as mixed cropping
2. Traditional seed variety
3. Undecomposed FYM 1.5-2.0qt./nail
4. 1-2 inter culture
5. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
6. They also do not follow balance use of chemical fertilizers.
7. 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. 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,Use of IPM practices

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

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

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, Blight, Ergot

viii. IPM Module for management of disease:

Leaf blight of maize: *Stenocarpella maydis, Glomerella graminicola*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Mancozeb 75% WP	1125-1500	1500-2000
Ziram 75% WP	1125-1500	1500-2000

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 weed

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

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:

A.Sowing of Baby corn and Sweet corn Shot duration hybrid Varieties

1. Seed treatment
2. HYV
3. Inter cropping
4. Gap filling
5. Weed Management
6. Organic cultivation,
7. Adoption of low-cost based cultivation practices,

B.Maize- Wheat/Lentil/Barley/oat (fodder) (rainfed),
Maize+Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),

1. Timely Sowing
2. Seed treatment,
3. Use of HYV
4. Gapfilling/Transplating
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
3. Climate changing
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities

6D. Name of Field Crop: Barley

i. Existing varieties being used: Azad, Jagriti, PRB-502, HBL-113

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VLB-85, VLB-118, PRB-502,UPB-1008, VLB-94

iii. Existing package of practices being used:

1. Most of the farmers using their own produced seed
2. Farmers do not applied proper dose of fertilizers
3. Farmers also not adopting proper plant protection measures and effective herbicide for weed

management.

4. Use of undecomposed FYM.

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

1. Sowing should be done in Ist & IInd fortnight of October to proper utilized moisture for seed germination.
2. Application of proper seeds rate to maintain optimum crop density.
3. Promotion of inter/mix cropping with other crops to minimize the loss of crop failure in case of drought.
4. Proper weed management, proper monitoring and management of insect and pest.
5. Besides the above measure need to create irrigation facilities by construction of water harvesting tank.
6. Balanced use of nutrients to be applied in the soil as per the soil testing report. Quality seed of high yielding varieties should be chosen after that seed must be treated with proper fungicide to check the various seed born disease. Promotion of cluster based farming in integrated approach.
7. Proper utilization of Fallow land by planting short duration pulse ,vegetable and other horticulture crops,

v. Major insect pests associated with crop: Aphid, white grub

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

Barley aphid: *Macrosiphum* sp.)

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Carbofuran 3 %CG	1000	33300
Phorate 10 %CG	1000	10000

For management of **white grub**, drenching of chlorpyriphos 1 ml per liter of water should be done. Light trap be used during adult emergence in the month of June-July for mass trapping.

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

viii. IPM Module for management of disease:

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

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

ix. Major weeds associated with crop: *Phalaris minor, Chenopodium*, wild oat

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

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

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

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

1. Need of agriculture diversification with horticultural crops along with live stocks management.
2. Adoption of proper cropping pattern
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,

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.

6E. Name of Field Crop: Finger millet

i. Existing varieties being used: PRM-1, VLM 149, VLM 315, VLM176, PM3, VLM 146

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, PRM-1, PRM-2, PES-110, PES-176, Pant Mandua-3

iii. Existing package of practices being used:

1. Majority of the farmers using practices of rice cultivation without proper consideration of rainfall and soil moisture conditions.
2. Use low yielding and old varieties which are susceptible against various pests and diseases.
3. Farmers also not using proper compost before rice cultivation
4. They use imbalanced chemical fertilizers.
5. Due to lack of proper knowledge, majority of the farmers do not adopt proper plant protection measures which adversely affect the productivity.

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

1. Proper application of compost and farm yard manure and Green manuring must be followed before two months of planting.
2. Moong can be grown during summer season to improve the soil health.
3. Line planting must be done in area were irrigation facilities available, to minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
4. Water harvesting tank need to be created in rain fed areas to provide timely irrigation.
5. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.
6. 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.

v. Major insects associated with crop: stem borer

vi. IPM Module for management of insect-pests:

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: For management of blast disease, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha on need basis.

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

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. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management.
3. Adoption of proper cropping pattern
4. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.
5. Cluster based farming
6. Inter cropping.
7. 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.

7A. Name of the Pulse crop: Lentil

i. Existing varieties being used: Chota masoor, lal masoor, VL-125, PM-4, PM-5, VL-103, PL-406

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, DPL-15, DPL-62, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL *Masoor 514*

iii. Existing package of practices being used:

1. Traditional seed variety.
2. Undecomposed FYM 1.5-2.0qt./nail, 1-2 inter culture
3. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
4. They also do not follow balance use of chemical fertilizers.
5. It is also observed that due to lack of knowledge.
6. 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. 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: White fly, Fruit borer, Thrips

vi. IPM Module for management of insect pests: For management of major insect pest application of Dichlorovos, Imidachloropid 200 ml/ha, Dimetheoate (1 liter/hac)

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

viii. IPM Module for management of disease (except organic areas): Seed treatment with Carbendazim 1.0 gm. + Thiram 2.0 gm./kg. For management of blast disease, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha on need basis 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: Bathuwa, Broad leaf and narrow leaf weeds

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)
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

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

i. 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, re sowing
6. Care soil & water conservation measures
7. INM (Maximum use of value added compost/FYM
8. and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

ii. 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.

7B. Name of Pulse crop: Urd

i. Existing varieties being used: Narendra Urd 1, Pan urd 19, Uttara, Pant Urd-30

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-6, PU-31, PU-35, PU-40, Shekhar-2

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,
3. It is also observed that due to lack of knowledge,
4. 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 IInd fortnight of June to July.
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 :

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	
Phorate 10% CG	10000	

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

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

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

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. Need of agriculture diversification with horticultural crops along with live stocks management,
2. 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. 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.

7C. Name of Pulse Crop: Moong

i. Existing varieties being used: Pant moong 2, Narendra moong-1,

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 Moong-4, Pant Moong-5, Pant Moong-7, Pant Moong-8, PDM-11, Samrat, Narendra Moong-1

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.

3. 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 just after harvesting of wheat if sown in jayad.
2. If sown in kharif season Mid July to Mid August sowing should be done.
3. 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.
4. Seed treatment with *Rhizobium* and P.S.B. Proper application of compost and farm yard manure.
5. Sowing in line must be promoted for proper intercultural operations.
6. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
7. Arrangement of irrigation facilities in case of drought should be available.
8. 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 :

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
Phorate 10% CG	10000

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

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

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.
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.
4. Cluster based farming.
5. Inter cropping.
6. 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.

7D. 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-3, Pant Arhar-291, UPAS-120, Pusa-992, VL Arhar 1, Bahar, Amar, Narendra Arhar-1

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.
3. 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 diseases.
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. 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(except organic areas):

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. 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.

7E. 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 Kabuli Chana-1, GNG-1969, Aman, GNG-1958, Aadhar, Pusa-547, Pusa-256, Pusa-1053, JGK-1

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.
3. 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. 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.
2. Seed treatment with *Rhizobium* and P.S.B. Proper application of compost and farm yard manure.
3. Sowing in line must be promoted for proper intercultural operations.
4. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
5. Arrangement of irrigation facilities in case of drought should be available. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: Gram Pod borer

vi. IPM Module for management of insect pests :

Gram Pod Borer; *H. armigera*

1. Field sanitation and deep ploughing in the summer
2. Adopt proper crop rotation
3. Weeds like *Melilotus*, *Vicia* and *Chenopodium* should be weeded between 30-40 days after sowing of the crop
4. Intercropping/mixed cropping with coriander, linseed, etc.
5. Early planting during mid- October to mid -November
6. Growing of marigold as trap crop to attract adults for egg laying. Later the trap crop should be removed.
7. Use of light trap for destruction of adult insects.
8. Setup pheromone traps @ 5-6 traps/ha for monitoring of adult of *H. armigera*
9. Conservation of natural enemies like *Campoletis chloridae,* Chrysopid, wasp, and spider
10. Chickpea intercropping with coriander and linseed attract more number of *Campoletis chloridae*.
11. Install bird perches @ 15-20/ha for the increasing bird population like black drongo, king crow, myna, Blue jay which preys upon larvae. But these pirches should be removed from the field at maturity of the crop

12. First spray with biorational insecticides like NPV@ 250 LE/ha /NSKE 5% /B.t. @ 1 kg formulation/ha with 0.1% UV retardant such as (Tinopal and 0.5% jaggery) during initial stages of flowering/ and podding stages of the crop to conserve natural enemies followed by need based, judicious and safe application of following any insecticide viz.

Name of the insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	125	11
Emamectin benzoate 5% SG	220	14
Novaluron 10 % EC	750	7
Lambda cyhalothrin 5% EC	500	6
Deltamethrin 2.8% EC	10-12.5	400-5003
Monocrotophos 36% SL	1000	
Quinalphos 25% EC	1250	
Ethion 50% EC	1000-1500	21

Bio-insecticides

Name of the Bio- insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var kurstaki 0.5% WP serotype 3a,3b,3c, Strain DOR Bt-1	2000
Beauveria bassiana 1% WP Strain no: NBRI-9947	3000
Beauveria bassiana 1% WP Strain no: SVBPU/CSP/Bb-10	3000
NPV of *Helicoverpa armigera* 2.0% AS Strain No. IBH-17268	500
NPV of *Helicoverpa armigera* 2.0% AS Strain No. BIL/HV-9 POB	250-500
NPV of *Helicoverpa armigera* 2.0% AS Strain No. IBL-17268	250-1000
NPV of *Helicoverpa armigera* 0.5% AS	250

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

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

Yellow mosaic

Control of yellow mosaic control of white fly or its vector by application of Imidacloropid 200 ml/ha, Dimetheoate 1 lit/ha, Seed treatment with Thiram+Carbendazim 2:1@3gm/kg seed.

For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per 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.
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.
4. Cluster based farming
5. Inter cropping.
6. 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.

7F. Name of Pulse/oilseed Crop: Soyabean

i. **Existing varieties being used:** Kala bhatt(Oval), VLS-47, PS-1024, PRS-1, Shilajeet, PS-1042

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, PS-1092, PS-1241, PRS-1, PS-1347, PS-1225, PS-19, PS-21, PS-22, PS-23, PS 1347, VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65 and PS-19

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

1. Traditional seed variety
2. Undecomposed FYM 1.5-2.0qt./nail
3. 1-2 weeding
4. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
5. They also do not follow balance use of chemical fertilizers.
6. 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. Preperation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing -100-125/ha,
3. Manure and fertilizer -10 tonne FYM ,
4. NPK 20-80:40,
5. Irrigation-usually maximum area is rain fed
6. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence, Use of IPM practices
7. Timely sowing of crop in Ist fortnight of June to IInd fortnight of July.
8. 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.
9. Seed treatment with *Rhizobium* and P.S.B. Proper application of compost and farm yard manure.
10. Sowing in line must be promoted for proper intercultural operations.
11. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
12. Arrangement of irrigation facilities in case of drought should be available. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. **Major insect pests associated with crop:** Semilooper, Leafy catter piller, Whitefly, Girdle beetle, 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

Tobacco caterpillar: *Spodoptera litura*

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Indoxacarb 15.8% EC	333	31

Green semilooper: *Plusia orichalcea*

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	22
Indoxacarb 15.8% EC	333	31
Lambda cyhalothrin 4.9 % CS	300	31
Profenofos 50% EC	1000	40

Leaf eating caterpillar

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Dichlorvos 76% SC	225-300	282-376

White fly : *Bemisia tabaci*

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Carbofuran 3% CG	1500	50000

Jassids

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Imidacloprid 48% FS (Seed Treatment/Kg)	0.75	1.25

Girdle beetle

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	22
Thiacloprid 21.7% SC	750	17
Triazophos 40% EC	625	30
Profenofos 50% EC	1000	40
Profenofos 50% EC	1500	30

Bio-insecticides

Tobacco caterpillar (*Spodoptera litura*)

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

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

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

Semilooper (*Chrysodeixis acuta*)

Name of 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, Phyllanthus niruri ,Amaranthus viridis, Euphorbia hirata, Solanum* sp., *Tribulus* sp., *Cyperus* sp.

x. IPM module for management of weeds:

Flat sedge: *Cyperus* sp. (annual-perennial, monocot, narrow leaves, sedge)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Metalachlor 50% EC	1000	2000

Asthma weed: *Euphorbia hirta* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Imazethapyr 10% SL	1000	75
Pendimethalin 30% EC	2500-3300	110
Pendimethalin 38.7% CS	1500-1750	40
Imazamox 35% + Imazethapyr 35% WG	100	56

Stone breaker: *Phyllanthus niruri* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Chlorimuron ethyl 25% WP	36	45

Green amaranth: *Amaranthus viridis* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Alachlor 50 %EC	5000	
Metalachlor 50% EC	2000	
Pendimethalin 30% EC	2500-3300	110
Pendimethalin 38.7 CS	1500-1750	40
Pendimethalin 30% + Imazethapyr 2% EC	2500-3000	90

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 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. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing,
4. Wild animal damages
5. Migration,
6. Poor Irrigation facilities
7. Lack of ICT tools due to poor awareness and inter net connectivity

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-30, PT-303, 507, Uttara, PPS-1, Pant Sweta, Type-9, Bhawani, VL Toria-3, Urvashi, Rohini, Vardan, Vasanti, PR-20

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:** One ploughing followed by 2-3 harrowings and planking; 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. Seed treatment: Apron 35 SD @ 5g/kg. 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:** About 20-25 days after sowing maintaining a plant to plant space of 10 cm. The thinned out plants could be used as **green forage**.
6. **Nutrient management:**
   Vermicompost: 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.
7. Excess use of nitrogenous fertilizers should be avoided.
8. **Nitrogen:** 120kg/ha
   60-80 kg/ha for *toria*
   Half of the N as basal and remaining half be top dressed about 25- 30DAS
   Phosphorus: 40 kg/ha as basal
   Potassium: 20 kg/ha as basal
   Phosphorus be applied as SSP; if SSP is not available, 20 kg/ha Sulphur shall be applied as basal.
9. **Water management:**
   Rosette (25-30 days) and pre-flowering stages are the most sensitive to water deficit. Hence, irrigations shall be made at these stages wherever possible.
10. **Harvesting and threshing:**
    The crop should be harvested when about 75 % of the siliquae turn yellowish brown. After threshing, seeds should be stored with less than 8% moisture.
    Use of IPM

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

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

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 Insecticides	(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

Hairy caterpillar

1. Mechanical destruction of egg masses and early instar larvae which feed gregariously.
2. Spray with

Emamectin Benzoate 5 SG	250ml/ha
Lufenuron 5EC	800ml/ha
Triazophos 40EC	750ml/ha

Monocrotophos 36 WSC 1250 ml/ha.

vii. Major disease associated with crop : Blight, Rust, 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: *Cyperus* spp.

x. IPM Module for management of weeds:

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

Name of the Fungicides	(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
4.HYV
5.IPM

xii. Production constraints in agro-ecological region:

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

8A. Name of the Fruit crop: Litchi

i. Existing varieties being used: Rose scented, Calcuttia

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, gandaki Sampada, Gandaki lalima, Gandaki yogita (suitable for high density plantation

iii. Existing package of practices being used:

1. Most of the farmers do not use balanced dose of chemical fertilizers in their orchard
2. They also do not apply chemical pesticides judiciously for management of various pests and diseases.
3. Farmers also do not use micro nutrients in their orchards to reduce fruit dropping and improve the

fruit quality.

4. It has been also observed that very few farmers apply liquid fertilizers to improve the productivity and quality.

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

1. Management of various pests and diseases is important
2. Balanced use of chemical fertilizers must be done
3. Proper pollination by honey bees must be provided
4. Decomposed farm yard manure should be used in the orchard.
5. Problem of fruit dropping, fruit growth, colour development and shining in the fruit can be overcome by applying micro nutrients and NPK 18:18:18 and NPK 0:0:50.
6. Canopy management is generally not care by the farmers which is also responsible for low yield and quality.

v. Major insect pests associated with crop: Fruit borer, litchi bug,Litchi mite ,Litchi leaf roller

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.

Application of Monocrotophos or Quinolphos @ 2ml/l of water at new flush

vii. Major disease associated with crop: Anthracnose, brown spot

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

For management of anthracnose disease, copper oxy chloride 3 g per liter of water can applied on need basis.

For management of brown spot, difenconazole 0.5 ml per liter of water may be applied as per need.

ix. Major weeds associated with crop: Local weeds

x. IPM Module for management of weeds: Inter cultural operations in the orchard reduces the weed infestation.

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

1. Management of pests and diseases will help in improving the productivity and quality.
2. Balanced use of chemical fertilizers will also help in increasing the productivity and quality.
3. Balanced use of liquid fertilizers like NPK 18:18:18 and NPK 0:0:50 has been found very effective in improvement of yield and quality.
4. Mulching in rain fed areas, reduces fruit dropping, accelerate fruit growth and improve the productivity and quality.
5. Canopy management play an important role in improving the fruit quality and productivity as it gives proper shape to the plant for ideal vegetative growth and development and it was also observed in the orchard where canopy management is done.
6. Incidence of various pests and diseases is low.

xii. Production constraints in agro-ecological region:

1. Poor management of pests and diseases
2. Imbalanced use of chemical fertilizers and liquid fertilizers

3. Poor canopy management
4. Cultivation of litchi in rain fed areas etc

8B.Name of the Fruit crop: Mango

i. **Existing varieties being used:** Dushari, Langra, Chausa

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Dushari, Langra, Chausa, Amrapali, Mallika, Bombay green, Pusa surya, Pusa Arunima, Arunika, Pusa shreshta, Pusa Lalima

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

1. Farmers do not use balanced dose of chemical fertilizers in their orchard
2. They also do not apply chemical pesticides judiciously for management of various pests and diseases.
3. Farmers also do not use micro nutrients in their orchards to reduce fruit dropping and improve the fruit quality.
4. It has been also observed that very few farmers apply liquid fertilizers to improve the productivity and quality.

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

1. Management of various pests and diseases is important
2. Balanced use of chemical fertilizers must be done
3. Decomposed farm yard manure should be used in the orchard.
4. Problem of fruit dropping, fruit growth, colour development and shining in the fruit can be overcome by applying micro nutrients and NPK 18:18:18 and NPK 0:0:50.
5. Canopy management is generally not care by the farmers which is also responsible for low yield and quality.

v. **Major insect pests associated with crop:** Shoot gall psylla, Mango hopper,Mango fruit fly ,Mango mealy bug ,Mango 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.
3. Insert cotton plug soaked in kerosene or petrol or DDVP into the holes and paste them with mud.

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

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

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	

ix. Major weeds associated with crop: Local weeds

x. IPM Module for management of weeds: Inter cultural operations in the orchard reduces the weed infestation.

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

1. Management of pests and diseases will help in improving the productivity and quality.
2. Balanced use of chemical fertilizers will also help in increasing the productivity and quality.
3. Balanced use of liquid fertilizers like NPK 18:18:18 and NPK 0:0:50 has been found very effective in improvement of yield and quality.
4. Mulching in rain fed areas, reduces fruit dropping, accelerate fruit growth and improve the productivity and quality.
5. Canopy management play an important role in improving the fruit quality and productivity as it gives proper shape to the plant for ideal vegetative growth and development.

6. It was also observed in the orchard where canopy management is done, incidence of various pests and diseases is low.

xii. Production constraints in agro-ecological region:

1. Poor management of pests and diseases
2. Imbalanced use of chemical fertilizers and liquid fertilizers
3. Poor canopy management
4. Cultivation of mango in rain fed areas etc.

9A. Name of the vegetable crop: Cabbage

i. Existing varieties being used: Pride of India, Golden acre as open pollinated varieties and Varun, Pragati as hybrid 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: All hybrid varieties, Seeds are available in Multinational companies

iii. Existing package of practices being used:

1.Use of organic manures
2.No knowledge of crop geometry
3.Use of hybrid varieties only
4.Serious weed management problem

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.

v. Major insect pests associated with crop: Cabbage butterfly, Aphids, *Plutell*a and bugs

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, 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:**

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 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

xii.Production constraints in agro-ecological region:

1. Less heading in open pollinated cabbage.
2. Boron deficiency is becoming serious.

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

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** A large number of hybrids are used in the distt., There is no specific hybrid available for farmers in the state.

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

1. Traditional cultural practices
2. Line spacing is not done
3. Poor crop geometry
4. Use of organic manure
5. Less or no used of organic pesticides.
6. High incidence of insect and diseases.

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- Farmers should use improved varieties/ hybrids
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.
8. 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.
9. Transplanting- Farmers should transplant seedlings properly as for early (30x30cm), medium (45x30cm), and late (60 x 45 cm).
10. 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.
11. 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.
12. 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.
13. 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 :

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

vii. Major disease associated with crop: Black rot and stalk rot are serious problem

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.

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.
3. 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

9C. Name of the vegetable crop: Radish

i. Existing varieties being used: Dunagiri, Chinese Pink, 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: Early Mino, Japnese white

iii. Existing package of practices being used: Mixed cropping.

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.

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 weeds

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
2. Non pithy
3. Coloured varieties for year round production.

xii. Production constraints in agro-ecological region:

1. Pithyness problem in low hills

9D. Name of the vegetable crop: Tomato

i. **Existing varieties being used:** Avinash-2, Shansah, Badsaha, 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: Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852

iii.Existing package of practices being used:

1. Without soil and seed treatment
2. Poorly managed nurseries
3. Subterreaen staking
4. Non- judicious use of fertilizers.

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:

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 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

Leaf miner, *Liriomyza trifoli*

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

Aphid, *Aphis gossypii*

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Thiamethoxam 70 %WS (Seed Treatment/ Kg)	6	
Cyantraniliprole 10.26% OD	900	3

Thrips, *Thrips tabaci*

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 70 %WS (Seed Treatment/ Kg)	6	
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(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 alaxenderium, Cyperus rotundus, Cynodon dactylon*

x. IPM Module for management of weeds:

1. Cultural practices.
2. 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.
2. Can enhance the productivity of tomato manifold.
3. Polyhouse technogy is a boon for small and marginal farmers with fragmented holdings.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continous cultivation.
2. Poor nursery management in the crop
3. Poor staking and pruning techniques.
4. Poor technical knowhow

9E. Name of the vegetable crop: Brinjal

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

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 and Ankur etc are hybrid available in local market.

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.

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

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 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 toward 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.

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Carbendazim 50% WP	150	300

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

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

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

1. Use of hybrids can increase productivity 2to 3 times higher.
2. Use of mulch in rainy season.

xii. Production constraints in agro-ecological region:

1. Non-availability of suitable hybrids
2. Wild animals problems
3. Poor technical knowhow
4. Marketing problem in rainy season

9F. 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

2.No seed treatment
3.Poor nursery management
4.Tranplanting on or before rainy or monsoon season
5.Crop geometry knowledge is poor
6.Poor dry fruit storage.

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.

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

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: Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

ix. Major weeds associated with crop: *Euphobia hirta, Cynadon dactylon ,Cyperus* and *Oxalis* 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: Use of tall hybrids supplentation of organic packages of practices to be followe

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.

9G. 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:

Pusa Udhay, Pusa Barkha,Shubhangi, Himangi, Punjab Nuri, Malini No786, Aviva, Majesty and

other parthenocarpic cucumber strains available in local market.

iii. For open field condition: 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

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.

v. Major insect pests associated with crop:

Leaf miner , white fly, thrips, leaf eating caterpillar, fruit fly, cut worm, Red pumpkin beetle

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: Wilt, Mildew, Mosaic

viii. IPM Module for management of disease:

1. Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

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: *Trifolium alexenderium, Cyperus rotundus, Cynodon dactylon, Fagopyrum* species.

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: Polyhouse technology and hybrid cultivars can increase productivity 3-4 times

xii. Production constraints in agro-ecological region:

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

9H. Name of the vegetable crop: Pea

i. Existing varieties being used: Traditional field pea , Arkel and Azad pea 3

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

iii. Existing package of practices being used:

1. Sowing in of Autumn month
2. Broadcasting method,
3. No line sowing,
4. High seed rate,
5. Mature more than 120 days,
6. Stacking is done for tall varieties,
7. Dual purpose varieties

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.
2. Mangement of powdery mildew
3. Aschochyta blight and other diseases and Fusarium wilt in autumn season

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: Powdery mildew in all agroecological situations
Fusarium wilt in autumn sown crop

viii. IPM Module for management of disease:

1. Use of ogananic inputs only
2. Use of rust and powdery mldew resistant strains.

Powdery mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Benomil 50% WP	100	200
Carbendazim 50% WP	150	300

ix. Major weeds associated with crop: *Trifolium alexendrium, Cyperus rotundus, Cynodon dactylon, Fagopyrum* species.

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. September 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.

9A.Name of the fodder crop: Lobia

i. **Existing varieties being used:** UPC-5286

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: EC-4216

iii. Existing package of practices being used:

1.Traditional seeds
2.No use of fertilizer
3.Non availability of variety of seeds

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

1. Preparation of land, 1 or 2 ploughing with mould plough.
2. Timely sowing of June-July.
3. Proper seed rate 40 kg/ha.
4. Apply 2-3 irrigation.

v. Major insect pests associated with crop: Aphid, Jassids

vi. IPM Module for management of insect pests:

vii. Major disease associated with crop:

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

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.Apply low cost based cultivation practices.
2.Timely sowing.
3.Use of high yielding variety.
4.Use of fertilizer in time.
5.Timely irrigation.
Cutting at the time of maximum foliage.

xii. Production constraints in agro-ecological region: Lack of knowledge

9B.Name of the fodder crop: Oat

i. Existing varieties being used: 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: UPO212

iii. Existing package of practices being used:

1. No use of FYM
2. Use of local available seed
3. No seed treatment.
4. Less availability of inputs

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

1. Use of proper amount of seed rate @ 60 kg./ha.
2. 3-4 irrigation should be apply
3. Timely sowing i.e. 60-62 kg./ha.
4. Proper use of fertilizer as per recommended dose of fertilizer i.e. 100 kg. Urea of to split doses
5. Soil : Loam soils
6. Field preparation : 2-3 Harrowing + leveling
7. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
8. Seed rate: 100 kg/ha
9. Spacing : 30cm line to line distance
10. Sowing time: first week of October to last October

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. Preparation of land 1-2 of ploughing
2. Timely sowing
3. 3-4 Irrigation should be applied
4. Timely cutting

xii. Production constraints in agro-ecological region: Lack of knowledge

10A.Name of the ornamental crop : Rose

i. **Existing varieties being used:** Commercial varieties available with private companies

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Commercial varieties available with private company's varieties to meet the demand of market (may be procured from Sakata seeds)

iii. Existing package of practices being used: Raising crop in poly house with package of practice provided by private firm who supply plant material

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

1. Plant density 6-9 plants per square meter area in polyhouse.
2. Soil test based micronutrient application

3. Soil sterilization with formaldehyde (2%), ensure regular de-suckering
4. Drip system of 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:

x. IPM Module for management of weeds:

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

1.Clubbing of 4-5 different coloured varieties
2.Drip irrigation
3.Soil test based fertilizer application.
4.Important colours are Red, yellow, Pink, Orange and white.

xii. Production constraints in agro-ecological region:

1.High cost of plating material and high initial cost of poly house
2.Heavy feeder and labour intensive crop
3.Problem of thrips and powdery mildew bother the farmers

C. Livestock: Livestock: Gotatory/Fisheries/Poultry

1.A Existing breeds available:

1. **Cattle:** Crossbred(Sahiwal, Red Sindhi,HF, Jersey) and Purebred (Sahiwal, Red Sindhi,HF, Jersey)
2. **Buffalo:** Upgraded Murrah, Upgraded Nili Ravi, Tarai and Native buffalo
3. **Goats:** Chaugarkha, Black Bengal, Beetal, Barbari
4. **Poultry:** Hybrid Breeds in broiler, and croilers

1.B Specific breeds to be introduced:

1. **Cattle:** Sahiwal and H.F.
2. **Buffalo:** Murrah, Nili Ravi, Bhadwari
3. **Goats:** Jamunapari
4. **Poultry:** Hybrid Breeds

2.A Existing feeds being used:

1. Leaves of trees such as bhemal, Mulberry , barley oats, berseem,
2. Sugarcanetops, Napier and other wild grasses

2.B Specific feeds to be introduced / advised:

1. Barley oats
2. Berseem,

3.A Existing health services:

State animal husbandry department :

1. Vet. Hospital (28)
2. LEO Centers (98)
3. BAIF
4. 1 mobile hospital
5. KVK

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

1. Doing first aid and vaccination at village level animal hospital
2. Advanced polyclinics with ultrasound and Xray facilities,
3. Provision for small portable ultrasound units which can be used at field level.

4.A Existing management practices:

1. Animal houses lack proper ventilation and hygiene
2. Weaning is not practiced
3. Administration of dewormers and mineral mixtures' is inadequate.
4. Concentrate mixtures is given in small amounts without considering lactation and pregnancy status.
5. Reducing calf mortality

6. No balance feed should be provided
7. Less management
8. In adequate feeding practices
9. No use of vaccination

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

1. Scientific housing management
2. Balance feed should be provided to the animal
3. Timely provided to Vaccination, Deworming, and breeding practices
4. Hygienic housing
5. Weaning
6. Timely administration of dewormers and mineral mixtrures.
7. Concentrate mixtures' to be administered as per lactation and pregnancy status
8. Reducing calf mortality
9. Improving awareness for vaccination

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

1. Poor breeds
2. Poor housing management
3. More no. of unproductive animals

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

1. Lack of local available good quality grains as concentrate feed reduce the health condition of animals
2. Due to inbreeding and anorexia the morbidity and mortality is very high.

D. Integrating Farming system

1.A Existing farming system: Cattel+Crop/Vegetable

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

1. Protected cultivation+ Composting+Goatry/backyard poultry
2. Fodder production+ Mini dairy + Composting + Protected cultivation
3. Seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea) + Planting material supply + Mushroom

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: Mannual

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

A.For grains:

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

B.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: Few units available in fruits

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

A.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

B.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.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.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

B.For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
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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: Use of tradicitional bins only

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

A.For grain:

1. Multipurpose 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

B.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: A few check dams/ trenches are constructed.

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

Adoption of practices developed by institutes like IISWC,

2.A Existing plantation: Plantation on eroded/waste lands, and check dams for gully control.

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. Plantation of suitable trees/brushes in waterlogged and eroded areas;

2. Rejuvenation/repair of faulty/abandoned terraces;
3. Stabilization of eroded land using biological/engineering measures;
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. 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.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. Contour trenching (staggered/continuous).
8. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
9. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
10. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
11. 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: Berseem, Maize, oat

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:

Plantation of fodders like berseem

Napier etc. needed

A.Guinea grass (Panicum maximum),

1. Seed rate(Kg/ha)- 3-4
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management-60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

B.Setaria grass (Setaria anceps)

1. Seed rate(Kg/ha)- 1.5 2.0
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 100:50:40::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 (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

C.Spear grass (Hetropogon contortus)

1. Seed rate(Kg/ha)- 4-5
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 60:50:40::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 (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting

D.Rhode grass (Chloris gayana)

1. Seed rate(Kg/ha)- 3-5
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha Sowing time- Onset of monsoon (rainfed) and

February to July (Irrigated)

3. Fertilizer management- 60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
4. Irrigation management- Crop must be irrigated after each cut provided water is available.
5. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

E.Marvel grass (Dicanthium annulatum)

1. Seed rate(Kg/ha)- 4-6
2. Spacing (cm)- 50cm x 30cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 60:50:40::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 (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

Packages of practices to be advised for

Waste Land Development

1. Rejuvenation/repair of faulty/abandoned terraces;
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).

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.

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.Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.

2.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.

3.Sewage water from cities should be treated by municipal corporations or other agencies.

G. Reduced cultivation cost

1.A Existing inputs being given:

Rice-wheat,Maize-Sugarcane/Lentil/ Soybean / Urd bean

1. Annexure–II is enclosed for N,P and K.
2. 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
3. Foliar spray of 1% $FeSO_4$ in rice nursery, maize and sugarcane ratoon.
4. 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 .
5. In deficient soils, application of 215 kg gypsum/ha, if S deficiency exist in field.

1.B Soil test based inputs to be suggested in the specific agro-ecological region of district:

If required then deficit fertilizers and micronutrients may be provided

2.A Existing mechanization:

I. Sugarcane

1. Seedbed preparation using disc harrow and ridge making by tractor drawn ridger.
2. Manual sett cutting / or by tractor PTO operator sett cutter.
3. Manual planting.
4. Tractor operated cultivator and manual weeding for Interculture.
5. Manually operated sprayer for plant protection.
6. Manual harvesting.

II. Wheat

1. Conventional tillage by offset disc harrow/ rotavator followed by Planker
2. Conventional seed-cum-fertilizer drill / manual broadcasting for sowing
3. Manually operated sprayers for plant protection / tractor operated high pressure sprayers.
4. Manual and chemical weed control
5. Combine harvester / manual harvesting
6. Multi-crop / wheat thresher
7. Bhusa combine / straw reaper in combine harvested field.

III. Paddy

1. Conventional method of nursery raising.
2. Conventional tillage using disc harrow.
3. Puddling by paddy disc harrow / rotavator/ cultivator/peg type puddler.
4. Manual transplanting.
5. Manual / chemical weed control.
6. Manual top dressing of urea and zinc.
7. Manual / combine harvesting.
8. Threshing by axial flow power thresher.

IV. Rapeseed - Mustard

1. Conventional tillage using disc harrow and planker.
2. Sowing by manual broadcasting.
3. Chemical weed control and plant protection using manually operated sprayers / dusters.
4. Manual harvesting.
5. Manual threshing / tractor treading.

2.B Mechanization required for reducing cost of cultivation in the specific agro-ecological region of district:

I.Sugarcane :

1. Seedbed preparation using rotary plough.
2. Tractor operated sugarcane sett cutter planter.
3. Sugarcane rotary power weeder (tractor / self-propelled).
4. Tractor operated fertilizer placement-cum-earthing up machine.
5. High pressure canopy sprayer for plant protection / power operated ULV sprayers.
6. Self-propelled sugarcane harvester.
7. Ratoon manager

II.Wheat:

1. Seedbed preparation by rotary plough /rotavator
2. Sowing by zero-till drill / roto –till drill / happy seeder
3. Tractor operated high capacity power sprayers/ power operated ULV sprayers for plant protection.
4. Combine harvesting and bhusa making using bhusa combine.
5. Self-propelled reaper binder / tractor drawn vertical conveyor reaper windrower.
6. High capacity power wheat thresher.
7. To avoid wheat straw burning and its useful application recovery of wheat straw using tractor drawn baler.

III.Paddy:

1. Transplanting by self-propelled transplanter and mat type nursery raising.
2. Seedbed preparation by rotavator / conventional disc harrow.
3. Puddling by rotavator / peg type puddler.
4. Cono-weeder / powered paddy weeder for weed control.
5. Promotion of Direct Seeded Rice using DSR Seed drill.
6. Promotion of rice drums seeder for sowing of pre-germinated rice.
7. Chemical weed control using high capacity power sprayers in DSR / drum seeded rice.
8. Harvesting by self-propelled combine harvester.
9. Harvesting by tractor / power tiller operated vertical conveyer reaper windrower.
10. Threshing by axial flow thresher.
11. To avoid paddy straw burning and its useful application recovery of paddy straw using tractor drawn baler.

IV. Rapeseed – Mustard:

1.Seedbed preparation by rotary plough / rotavator / disc harrow followed by planker.
2.Precision drill for sowing.
3.Power operated rotary weeder.
4.Plant protection using power operated ULV sprayers.
5.Manual harvesting to be replaced by mechanical harvesters.
6.Power thresher.

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: Chemical Fertilizers, Insecticides, Pesticides, Farm Yard Manure, Seed, Water and Tillage Machinery

3.B Collective inputs suggested for reducing cost of cultivation in the specific agro-ecological region of district:

Bhabhar and Lower Hills

1. Fertilizer application should be based on soil test value at right time, right place and right method.
2. Basal application (50%N+100% P&K) at the time of sowing and 02 foliar application of N, secondary and micronutrients on standing crop.
3. Apply well decomposed organic manure and composts such as vermicompost, biofertilizer, green manure and crop residue incorporation to supplement costly fertilizers to reduce cost up to 25-30%.
4. Inclusion of pulses in crop rotation.
5. Encourage use of organic manures and biofertilizers; reduce the dose of chemical fertilizers.
6. Need based and recommended concentration of plant protection chemicals using correct method of application.
7. Enhanced use of bio-agents to control disease and pests.
8. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons.
9. Use optimum and recommended seed rate at optimum spacing and depth.

10. Use good quality of water and avoid excess use of water for irrigation.
11. Use of delivery pipe for irrigation to check seepage losses.
12. Sprinkler and drip methods for irrigation should be encouraged to save water.
13. Promote reduced tillage operations.
14. 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:

1. No proper and timely supply of water in canal and govt. owned tube well systems under irrigated condition.
2. Faulty roistering system of water.
3. Unavailability of farm labourers in agricultural operations during sowing to harvesting of crops.
4. Non availability of farm machinery, tools and implements for small and marginal farmers.
5. Gentle to moderate slopes in farm
6. Land causing surface runoff of soil and nutrients.
7. Timely non availability of farm inputs viz., HYV seeds, N:P:K fertilizers, micronutrient containing fertilizers, low cost FYM, vermi compost, pesticides and effective insecticides.
8. Application of high rate of fertilizer without knowing the nutrient status of their soil.
9. Non/inadequate application of FYM/Vermi compost.
10. Negligence among farmers for testing of their soils for soil health and application as per crop needs.
11. Non availability of mobile soil testing labs van for spot testing of their soils.
12. No efficient irrigation and fertigation system in orchards.
13. No proper drainage system on farm lands of small and marginal farmers.
14. Lack of storage facilities (cold rooms and houses) and processing units for their produce.
15. Involvement of middle man in crop trading system.
16. Lack of interest among govt. machinery for dissemination of technologies, input and subsidies to small and marginal farmers.

H. off-farm income

1.A Existing SHGS operative in specific agro-ecological region of district:

1. Department of Agriculture, Horticulture,
2. ATMA,
3. Watershed Management,
4. Central Himalayan rural Action Group (CHIRAG) Shitla,
5. UPASAK (NGO)
6. Uttarakhand Parvateya Ajeevika samvardhan company Almora,
7. Himani Bhimtal,
8. CCF & Chestha Jeolikote,
9. NABARD,
10. VPKAS Almora,
11. IFFCO Haldwani,
12. National fertilizers Limited,
13. Suchetana, Shivansh,Chetna (chopra),
14. Vridhi devi(Jyolikot),
15. Durga(Sariyataal),
16. Saraswati (Sariyataal),
17. Laxmi(Bhagtyura),
18. Unnati(Bhagtyura),
19. Jai Ma Kali (Paniyali),
20. Jaimata di(Jaipur padli),
21. Prerna(Jaipur padli),
22. Jai Santoshi(Paniyali),
23. Ekta(Bithorria No-1),
24. Navjeevan (Bithorria No-1),

25. Vanshita(Bithorria No-1),
26. Bhomiya Golu(Bamoritalli),
27. Santoshi (Belparao),
28. Bhumiya (Khempur),
29. Ekta (Berajhal),
30. Ujala(Berajhal),
31. Kadri (Berajhal),
32. Van devi(Gabua),
33. Vaibhav (Gabura khas),
34. Shanti (Tear),
35. Shiv(Madanpur),
36. Khusboo(Tera),
37. Jai durga(Kheempur),
38. Bhagwati(Madanpur),
39. Shivaji(Choti haldwani),
40. Santoshi(Choti haldwani),
41. Himani(Devirampur),
42. Navjyoti(Mayarampur),
43. Ekta (Avalakot),
44. Shanti(Pataliya),

1.B SHGS to be created/ encouraged in the specific agro-ecological region of district for doubling agricultural income:

1. Technology backstopping to existing SHG.
2. Creation of new SHG of Commodity wise
3. SHG already formed and need to be encouraged:

Chetna(chopra), Durga(Sariyataal), Saraswati(Sariyataal), Unnati (Bhagtyura), Jai Ma Kali(Paniyali), Jaimata di(Jaipurpadli), Jai Santoshi(Paniyali), Ekta(Bithorria No-1), Navjeevan (Bithorria No-1),Vanshita (Bithorria No-1), Bhomiya Golu (Bamoritalli), Santoshi (Belparao), Bhumiya (Khempur), Ekta (Berajhal), Ujala (Berajhal), Van devi(Gabua), Vaibhav(Gabura khas), Shanti(Tear), Shiv (Madanpur), Khusboo(Tera), Jai durga(Khempur), Bhagwati (Madanpur), Shivaji(Choti haldwani), Santoshi(Choti haldwani), Himani(Devirampur), Navjyoti(Mayarampur), Ekta(Avalakot)

4. 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.
5. 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.
6. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
7. 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.
8. 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.
9. Loan procedure should be made more flexible with less interest rate.
10. 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.
11. 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.

12. 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.
13. Enterprises need to be identified depending upon local resources- human and material.
14. Market linkages need to be developed so that people can sell their produce gainfully.
15. To encourage SHG's better planning, training and sustained efforts on long term basis are required.
16. Target should not be only to form large number of SHGs but care should be taken that formed SHG may be in less number are functioning properly.

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:

1. Dairy
2. Aipan designing
3. Handloom weaving
4. Candle making

2.B Micro-entrepreneur employment to be generated in the specific agro-ecological region of district for doubling agricultural income:

1. Tie and die technique
2. Candle making
3. Mushroom cultivation
4. Beekiping.
5. Survey need to be conducted regarding locally available crops, fruits, vegetables and other things.
6. On the basis of these enterprise can be generated.
7. Aipan designing can be promoted in cloth, paper in the form of greeting cards, envelops, calenders etc.
8. That has market value at national and international level.

3.A Existing skill development facilities:

1. Skill development facilities are available at KVK
2. Office of Development commissioner (handicrafts)
3. Handicraft marketing,
4. Service and extension centre

3.B Skill development facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Vocational training courses should be
2. Training centre
3. Processing and packaging units as per the locally available resources

4.A Existing women skilling facilities: ITI

4.B Women skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

Local, traditional skill like Aipan (iM+) should be improved and proper marketing linkage should be provided to women SHG's

5.A Existing youth skilling facilities: Zila udyog Kendra, Educational institute and NGOs.

5.B Youth skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

Vocational training course should be started

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.

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: Oct.- Mar. (02 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 Feb-April & Aug.-Oct. (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.

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: April-Sept. (02 crops)

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.

I. Enabling Policies

1.A Existing policies related with agriculture and animal husbandry: Promote agriculture & animal husbandry in the state for better income of farmer community.

1.B Policies to be suggested for doubling income in the specific agro-ecological region:
Minimum support price for Peach crops should be declared by govt.

2.A Existing Institutions:

1. ICAR Institutes
2. Department of Agriculture, Horticulture, Animal Husbandry, Fisheries,
3. Dairy Development Board
4. KVK
5. NGOs

2.B Institutions to be suggested for doubling income in the specific agro-ecological region of district:

1. ICAR Institutes
2. Department of Agriculture, Horticulture, Animal Husbandry, Fisheries,
3. Dairy Development Board,
4. KVK, NGOs

3.A Existing Incentives: Subsidies on almost all the inputs are available in the state

3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district: Transport facilities in remote areas stretching of local mandi

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: Minimum support price for major fruits and vegetable crop should be declared

J. Marketing and value addition in specific agro-ecological region

1.A Existing marketing facilities: Local market

1.B Marketing facilities to be suggested for doubling income in the specific agro-ecological region: Value addition of turmeric

2.A Existing grading facilities:

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:

A.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

B.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 :

A.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

B.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: High transportation cost

K. Online Management and Evaluation

1.A: Existing online management structure available:

1. Internet etc. is available at cities.
2. Internet literacy at village level is also a challenge.

1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district: Mobile apps/ software for online management and evaluation may be developed and

farmers as we well as concerned experts may be linked with it.

2.A: Existing evaluation procedure: Manual

2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online evaluation.

3.A: Existing monitoring system: Physical

3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online monitoring.

4.A: Existing feedback system: Manually

4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online feedback.

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: Reading manuals may be developed/ published for easy operation of Mobile apps/ software developed for online management and evaluation for farmers as we well as concerned experts linked with it.

Specific action plan for doubling agricultural income in agro-ecological region

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, DBW-16, DBW-17, PBW-343, PBW-373, PBW-502, PBW-527, PBW-550, HD-2687, HD-2967, UP-2526, UP-2554, UP-2565, UP-2572, UP-2784, UP-2785, WH-542, UP-2684, UP 2628, UP 2748, HS-490, HS-507, HPW-349, UP 2584, RAJ-3765, RAJ-3077
2. Promotion of high yielding varieties of Paddy Irrigated (Pant Sankar Dhan-3, Pant Dhan-12, Pant Dhan-23, Pant Dhan-26, Narendra Sankar Dhan -2, Pusa Sankar Dhan -10, Pant Sugandh Dhan-25, Pant Sugandh Dhan-26, Pant Sugandh Dhan-27, Pusa Sugandh -5, VL Dhan – 85, VL Dhan-65, PR-113, Pant Basmati-1, Pant Basmati-2, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355 plus) Rainfed- Chaitki Dhan-VL Dhan 208 and VL Dhan 209, Jethi dhan –Vivek Dhan 154, VL Dhan 156, VL Dhan 157 and VL Dhan 158
3. Promotion of high yielding varieties of Soybean (PS-1042, PS-1092, PS-1241, PRS-1, PS-1347, PS-1225, PS-19, PS-21, PS-22, PS-23, PS 1347, VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65 and PS-19
4. Promotion of high yielding varieties of Maize (Surya, Kanchan, Naveen, DH 296, PEEHM-1 to 5, Vivek QPM 9, Vivek Maize Hybrid 45, Vivek Mize Hybrid 53, CMVL Sweet Corn 1, CMVL Baby Corn 2, Vivek Sankul Makka 31 Gaurav, Pant Sankar Makka-1, Kiran, Navjot, HM-4, HM-10, Prabhat, Kisan, HM-11, Buland, P-3522
5. Promotion of high yielding varieties of Barley (PRB-502, UPB-1008, VL Jau 118 and VLB 94)
6. Promotion of high yielding varieties of Finger millet (Ragi/mandua) (, VL Mandua 324, and VL Mandua 352, PRM-1, PRM-2, PES-110, PES-176, Pant Mandua-3)
7. Promotion of high yielding varieties of Urd (PU-6, PU-31, PU-35, PU-40, Shekhar-2)
8. Promotion of high yielding varieties of Moong (Pant Moong-4, Pant Moong-5, Pant Moong-7, Pant

Moong-8, PDM-11, Samrat, Narendra Moong-1)

9. Promotion of high yielding varieties of Arhar (Pant Arhar-3, Pant Arhar-291, UPAS-120, Pusa-992, VL Arhar 1, Bahar, Amar, Narendra Arhar-1)
10. Promotion of high yielding varieties of Chickpea (Pant Kabuli Chana-1, GNG-1969, Aman, GNG-1958, Aadhar, Pusa-547, Pusa-256, Pusa-1053, JGK-1)
11. Promotion of high yielding varieties of Lentil (PL-4, PL-7, PL-8, DPL-15, DPL-62, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL *Masoor 514*)
12. Promotion of high yielding varieties french bean (VL Bauni Bean 1 and VL Bean 2), Vegetable pea (Vivek Matar 10, and Vivek Matar 12)
13. Promotion of high yielding varieties of Toria/Sarson (PT-30, PT-303, 507, Uttara, PPS-1, Pant Sweta, Type-9, Bhawani, VL Toria-3, Urvashi, Rohini, Vardan, Vasanti, PR-20)
14. Promotion of high yielding varieties of Litchi (Rose scented, calcuttia, gandaki Sampada, Gandaki lalima, Gandaki yogita (suitable for high density plantation)
15. Promotion of high yielding varieties of Mango (Dushari, Langra, Chausa, Amrapali, Mallika, Bombay green, Pusa surya, Pusa Arunima, Arunika, Pusa shreshta, Pusa Lalima)
16. Promotion of high yielding varieties of Tomato (Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852)
17. Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
2. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
3. Creation of trenches for high percolation of water in most of the area of *Bhimtal, Haldwani and Ramnagar* block.
4. 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 senile orchards of mango and litchi in *Ramnagar, Haldwani and Kotabagh* blocks.
2. Rejuvenation of senile orchards of Gola pear with improved varieties like Wartlet, Max Wartlet etc. in the region of *Bhimtal* block
3. Establishment of high density orchards of mango, guava, litchi, banana, aonla and jackfruit in *Ramnagar, Haldwani* and *Kotabagh* blocks.
4. Cultivation of Cinnemon (Tejpatta) plants at low hills in *Bhimtal* block particularly Dogda, Jeolikote, Aampadao, Aamiyagaon clusters.
5. Promotion of ginger cultivation in all *blocks of the region*.
6. Promotion of organic cultivation of turmeric in *Haldwani* and *Bhimtal* blocks.
7. Promotion of onion and garlic cultivation in *Bhimtal* belt.
8. Promotion of off season vegetables cultivation in *Bhimtal* block.
9. Promotion of production of tomato cultivation in Golapar cluster of *Haldwani* block and Gintigaon, Siyat and Ranikota cluster in *Kotabagh* with the use of proper crop rotation.
10. Promotion of production of vegetable pea, okra in *Kotabagh* and *Haldwani* block.
11. Promotion of production of black gram and pigeonpea in, *Haldwani* block.
12. Promotion of production of lentil and blackgram in Thari, Rajpur, Kandla, Beria, Veerpur Tara and Veerpur Lakshi, Chhoi, Chilkiya, Jogipura, Sawalde clusters of *Ramnagar* block.
13. Promotion of organic production of basmati rice in Thari, Rajpur, Kandla, Beria, Veerpur Tara and Veerpur Lakshi, Chhoi, Chilkiya, Jogipura, Sawalde clusters of *Ramnagar* block.

Management of wild animal problem

1. Promotion of live fencing of Karonda surrounding the field in Ramnagar, Haldwani and Kotabagh block.
2. Promotion of protected cultivation of flowers in Ramnagar, block.

3. Promotion of protected cultivation of vegetables in Bhimtal block.
4. Promotion of cultivation of lime/lemon at larger scale in Ramnagar, Haldwani and Kotabagh block.
5. Promotion of cultivation of garlic, ginger and turmeric in Ramnagar, and Kotabagh block.
6. Promotion of cultivation of Kafal, Mango, Hishalu and other wild fruits in different pockets in forest areas for wild animals
7. Enacting legislative measures for protection of crop from wild animals.

Adoption of Farm mechanisation (Power tiller, thresher etc)

1. Promotion of serrated sickle, maize sheller for drudgery reduction of farm women in all the blocks of the region.
2. Popularization of multi crop thresher and Power Tiller/ Mini Tractor at Nyay Panchayat level in all the blocks.

Adoption of efficient irrigation techniques

1 Micro Irrigation (Drip and Sprinkler Irrigation) where water is available, etc.
2 Drip Irrigation in integration with water harvesting structure where water for irrigation is limited
3. Green House Cultivation for Vegetables with drip irrigation

Management of soil health in low or valley areas

1. Promotion of vermi compost unit and green manuring in all the villages of this region.
2. Promotion of cultivation of green manuring crops like Sesbania, Sunhemp, and lobia in different blocks.

Others

1. Cluster approach for holistic development.
2. Adoption of Soil health improvement practices.
3. Selection of right crop & variety.
4. Adoption of only well decomposed FYM/ value added compost.
5. Seed treatment through bio agent/ chemical means strictly in the cluster.
6. Judicious use of fertiliser.
7. Improvemnt of Moisture conservation practices.
8. Promotion to focus on timely weed management
9. Promotion and Adoption of IPM techniques
10. Adoption of Farm mechanisation(Power tiller, thresher etc)

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of high milk breeds of cows, buffaloes and goats in all the blocks.
2. Establishment of Fodder Bank in *Bhimtal* to meet fodder requirement of area.
3. Establishment of milk chilling plant at Haldwani, Kotabagh and Ramnagar blocks.
4. Promotion of Urea, Molasses, Multinutrient Blocks at *Nyaypanchayat* level.
5. Establishment of hatcheries for need of broilor or croilor at block level at *Bhimtal*, Haldwani and Ramnagar
6. Introduction and promotion of cross Heiffer for increasing income of marginal farmer.
7. Strengthening of traditional water bodies/ rivulets with Mahaseer or carps at Bhimtal. **Strategy 3 : Integrating Farming system**

Promotion of different Integrated Farming System modules such as :

1. Protected cultivation+ Composting+Goatry/backyard poultry
2. Fodder production+ Mini dairy + Composting + Protected cultivation
3. Seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea) + Planting material supply + Mushroom

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of mini fruit grading plant for malta and pear at Jeolikote, Bhawali and Aampadao, Naukuchiyatal, Chafi and nearby area of *Bhimtal.*
2. Establishment of Food Processing Units for Litchi at *Ramnagar,* Aonla at *Kotabagh and* Mango at *Haldwani* block and Citrus fruits, pear at Bhimtal.
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 tiller, Mini Thresher and other equipments at Nyay Panchayat level in *Haldwani, Kotabagh, Bhimtal, Ramnagar blocks*.
5. Establishment of small processing units for tertiary and value addition of mango, citrus fruits, pear in Haldwani, Ramnagar and Bhimtal blocks.

Strategy 5 : Waste land development and waste water

1. Contour making for arable purpose in waste land in Bhimtal.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in Bhimtal block.
3. Promotion of plantation of mulberry (*Morus*), wild fruit plants in Ramnagar block, wild fruit plants and fodder trees (*Grewia, Alnus, Celtis,Quercus*) in Bhimtal block.
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland of all blocks.
5. Popularization of trenches for percolation of water to avoid surface run off in Bhimtal block.
6. Construction of check dam and artificial structure to maximize water percolation rate in Bhimtal and ponds in Haldwani, Kotabagh and Ramnagar block.
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. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in *Haldwani, Ramnagar and Kotabagh block.*
2. Promotion of line sowing and balanced fertilizers application in crops.
3. Promotion of recommended seed rate, spacing and depth.
4. Promotion of need based application of pesticides and other agricultural inputs.
5. Promotion of hand tools in agricultural and horticultural operations.
6. Adoption of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers
7. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
8. Promotion of pressurized irrigation techniques in horticultural crops.

Strategy 7 : Off-farm income

1. Promotion of subsidiary occupations like poultry, goatry, fish farming and mushroom production in Bhimtal and poultry, fish farming in Haldwani and Kotabagh.
2. Promotion of apiculture for small and landless farmers in Bhimtal.
3. Promotion of sericulture in Ramnagar.
4. Promotion of cultivation and collection of medicinal plants in Bhimtal.
5. Promotion of skill development in women and youth in all three blocks
6. Encouragement to existing SHGs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. may be provided for better performance in all three blocks.
7. Creation of New SHGs in other villages of three blocks.

Strategy 8 : Enabling Policies

1. Increasing institutional support by providing subsidises and incentives to small and marginal farmers in three blocks.
2. Labelling of organic inputs and certification mechanism for various crops in all three blocks.
3. Popularization of Udhyan and KCC for widespread use of government incentives/ subsidies to farmers.
4. Establishment of wood bank at *Jeolikote and Bhawali* to meet the present and future demand of germplasm in horticultural crops.
5. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
6. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.

7. Implementation of Soil Health Card Scheme in each block.

Strategy 9 :Marketing and value addition in specific agro-ecological region

1. Creation of better transportation facilities with cool chain van at Block level.
2. Creation of direct linkages with food processing industries for better prices.
3. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
4. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
5. Installation of mini grading machines at village level.
6. Establishment of cold room in Haldwani, Kotabagh and Ramnagar.
7. Promotion of local *Hatt* at Jeolikote, Ranibagh, Okhaldunga in Bhimtal block, and Devalchaur, Golapar, Haripur Bachhi, Babori in Haldwani block and Kaladungi, Gintigaon, Bailbadao, Dola, Aamgadi in Kotabagh and Chilkiya, Jogipur, Sawaldae, Chhoi, Thari in Ramnagar block.

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 radio, TV talks and Whatsapp etc. for effective implementation of program.

Agro-ecological region: Region B (1000 m-1500m)

A.General information about Agroeco-region
District: Nainital
Agro-ecological region: Region B (1000 m-1500m)
Main Blocks in Region: Bhimtal, Dhari, Betalghat, Ramgarh
1. **Main village cluster in blocks:** 1. Dogara, Mora, Suryajala, Lamjala
2. Sariyatal, Dhakakhet, Bhaluti, Kosani, Jyoli
3. Gaithiya, Beerbhatti, Krishnapur, Malla Belwakhan, Rushi
4. Syalikhet, Dangar, Chopara, Ropara
5. Siloty, Mehara gown, June Estate
6. Jarapani, Thalari quaidal
7. Sarna, Guniyalekh, Ratidhar
8. Pokhrar, Kol, Silang chokhuta, Sunkiya
9. Sakuna, Pichaltanda, Talla Ramgarh, Naikana

Irrigated Clusters:
Rainfed Clusters:
Existing rain water management facilities:
1. Collections from hill slope
2. Village ponds
3. Interflow harvesting

B. Productivity Enhancement
1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region
1. Roof top harvesting system
2. Conjunctive and multiple use of water resources
3. Better water conveyance system such as HDPE pipeline
4. Roof water harvesting system
5. Poly tank for water storage for scattered fields

2. Existing practices for soil health improvement
1. Use of undecomposed farmyard mannure/compost
2. Meagre/ no use of biofertilizers
3. Imbalanced/ insufficient nutrient use
4. Use of raw/partially decomposed FYM
5. Meagre/ compost making/recycling of crop residue
6. Mixed cropping of cereal and legume
7. Soil health card scheme launched in 2015

4. Specific Action / Interventions recommended to improve soil health in specific agro-ecological region
1. Bio-fertiliser/soluble fertiliser based farming
2. Soil test based fertilizer application
3. Promotion of pulse based crop rotation
4. Integrated fertilizer application
5. 5.Maximum use of value added compost/FYM
6. Distribution of soil health cards to each and every farmer along with nutrient recommendation for different crops
7. Establishing soil testing labs for major and micro plant nutrients at Block level
8. Capacity building for scientific use of organic manures, Integrated Nutrient Management, use of biofertilizers, different soil amendments, vermicomposting, etc.
9. Organization of camps for general awareness regarding harmful effect of burning crop residues
10. Popularization of legume-cereal rotation for improving the soil fertility in the region
11. Availability of all inputs viz., fertilizers, micro nutrient, biofertilizers, etc. at Nyay Panchayat Level

i) 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. Green manuring with Sesbania in low land paddy
4. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
5. Use of FYM @4-5t/ha or application of vermicompost @2.5-3.0t/ha

(ii) Pulses and soybean

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 Azotobacter/ 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

(iii) Vegetables and spices

5. 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).
6. Seedling inoculation with Azotobacter/ Azospirillum inoculant and Phosphorus solubilising microbial culture at transplanting.
7. Soil test based balanced use of fertilizers; INM shall be preferred
8. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

(iv) Sugarcane

1. Set inoculation with Acetobacter/ Azospirillum inoculant and Phosphorus solubilising microbial culture.
2. Recycling of sugarcane trash through windrow composting
3. Soil test based use of balanced fertilizers; INM shall be preferred
4. Use of FYM @8-10t/ha or application of vermicompost @2.5-3.0t/ha

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

No contingencies plan is used by farmers

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

1. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
2. In event of decreased water arability (Approximately 1500mm rainfall) in rainy season (June-September) the rain water should be properly stored (In polythene, to make bund) and harvested for Kharif season crops.
3. Short duration variety should be grown show that at least two crops in a year could be taken
4. Growing of Cheti/spring rice variety viz., (VL 206, VL207, VL 208, VL 209).
5. Organic mulch should be used to reduce the adverse impact of frost attack.
6. The area of off season vegetable should be increased at least by double by the year 2022.

The area having slope 10-30% should be used for growing of horticultural crop viz, Apple, pear, peach, plum, Apricot, walnut should be grown in temperate regions and Mango, Litchi, Guava in Sub-tropical regions.

7. The wheat sowing in plain region of Nainital (Haldwani) should be advanced by approximately one week in tarai and bhabhar region for nullifying the adverse effect of increasing temperature and terminal rains.
8. Micro irrigation technique should be popularized in tarai and bhabhar region.
9. Upland rice should be replaced by horse gram and buck wheat.
10. According to the frost forecast the crop residue should be burnt in the tomato field (open area) to increase energy level and to create a layer of smog for retardation of outgoing radiation.
11. In rain-fed lower hills Rice, Wheat, Soybean, Maize, in Rain fed mid hill, Rice, Wheat, French bean, and in Rain fed higher hills Finger millet, Wheat and Potato should be grown.
12. In order to minimize the impact of hail storms in mango and litchi the canopy geometry should be managed

in a way that upper portion of tree should bear least fruit and bottom and middle portion should bear maximum fruits.

13. Use fodder crop i.e Sorghum, Lobia as supplementary crop
14. Transplanting of finger millet
15. Late sowing of horse gram
16. Sowing of radish /leafy vegetables as cash crop
17. Plantation of citrus / pome granate
18. sowing late sown varieties of wheat
19. Cultivation of off season vegetable

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 2526, UP 2554, UP-2572, UP 2628, VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349, HS-277, HS-295, HS-420

iii. Existing package of practices being used:

1. Preperation of land- 1 or 2 ploughing with local plough no definit depth
2. Seed rate and seed sowing -150-175 kg/ha, Broad casting
3. Manure and fertilizer-
4. Use of un decomposed FYM (rainfed) and un decomposed FYM with small doses of chemical fertiliser by some progreesive farmers (in irrigated conditions)as per availability 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. Preparation of land- 2-2 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*)

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

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

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

Jassids:

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Carbofuran 3% CG	1250	41600

vii. Major disease associated with crop Rust, Loose smut, Leaf blight

viii. IPM Module for management of disease:

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

Sticker @ 1 ml per liter of water must be applied along with chemical pesticides to improve the effectiveness

of chemical. For control of loose smut seed treatment with fungicide.

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

Biofungicides

Name of the Herbicides	(gm/Kg) /ha	Treatment
Pseudomonas fluorescens 1.75% WP (In house isolated Strain Accession no. MTCC 5176)	5 g/Kg seed 5 g/lit. water	**Seed Treatment:** Mix the required quantity of seeds with the required quantity of *Pseudomonas fluorescens* 1.75% WP formulations and ensure uniform coating. Shade dry and sow the seeds. **Foliar spray:** Dissolve 5 Kg of *Pseudomonas fluorescens* 1.75% WP in 1000 litres of water and spray.

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

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

Leaf blight of wheat: *Alternaria triticina*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Mancozeb 75% WP	1125-1500	1500-2000
Zineb 75% WP	1125-1500	1500-2000

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

Mexican prickly poppy: *Argemone mexicana* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4-D Sodium salt Technical (80WP)	625-1000	90
MCPA Amine salt 40% WSC	2500	

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	

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. Adption of low-cost based cultivation practices:
c. Wheat-Horse gram/Soybean(rainfed),
d. Wheat-Rice(irrigated),
3. Timely Sowing
4. Seed treatment
5. Use of HYV
6. FIRB
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 storages conditions
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,
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities
7. SAAR practice(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:

Pant Sankar Dhan-3, Pant Dhan-12, Pant Dhan-23, Pant Dhan-26, PR-113, Pant Basmati-1, Pant Basmati-2, Pant Sugandh Dhan-26, Pant Sugandh Dhan-27, Irrigated 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), Pant Dhan-11, PB-1509

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(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,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
7. Use of IPM practices

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

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

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:

VII. Apply insecticide only when necessary, not regularly.
VIII. Apply insecticide only when the pest population reaches Economic Threshold Level.
IX. Applying a selective insecticide which is less toxic to natural enemy.
X. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.
XI. Use selective formulation and application method.
XII. 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 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	

Thrips

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

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

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

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*

2. 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	**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 latifolia, Cyperus* sp.*, Echinocloa* sp.*, Cynodon* sp.*, Digitaria sanguinales, Eclipta* sp.**,** *Eleusine* sp.

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

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	

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

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

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	100	71

(Postemergence)		
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

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

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 (Transplanted rice)	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
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 %WDG (Transplanted rice)	83.3-100	110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
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
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)

Umbrella plant: *Cyperus rotundus* (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)

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. Jethi rice- 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. Care soil & water conservation measures
8. INM (Maximum use of value added compost/FYM and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Marketing of value added produce

13. Avoid early Nursery raising practice and use of 25-35 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
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities

6C. Name of Field Crop: Barley

i. Existing varieties being used: Azad, Jagriti, PRB-502, HBL-113

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 Jau 118 and VLB 94, PRB-502, UPB-1008

iii. Existing package of practices being used:

1. Most of the farmers using their own produced seed
2. Farmers do not applied proper dose of fertilizers
3. Farmers also not adopting proper plant protection measures and effective herbicide for weed management.
4. Use of undecomposed FYM.

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

1. Sowing should be done in Ist & IInd fortnight of October to proper utilized moisture for seed germination.
2. Application of proper seeds rate to maintain optimum crop density.
3. Promotion of inter/mix cropping with other crops to minimize the loss of crop failure in case of drought.
4. Proper weed management, proper monitoring and management of insect and pest.
5. Besides the above measure need to create irrigation facilities by construction of water harvesting tank.
6. Balanced use of nutrients to be applied in the soil as per the soil testing report. Quality seed of high yielding varieties should be chosen after that seed must be treated with proper fungicide to check the various seed born disease. Promotion of cluster based farming in integrated approach.
7. Proper utilization of Fallow land by planting short duration pulse ,vegetable and other horticulture crops,

v. Major insect pests associated with crop: Aphid, white grub

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

Barley aphid: *Macrosiphum* sp.)

Name of the insecticides	(gm/ml) /ha	Waiting period (days)
Carbofuran 3 %CG	1000	33300
Phorate 10 %CG	1000	10000

For management of **white grub**, drenching of chlorpyriphos 1 ml per liter of water should be done. Light trap be used during adult emergence in the month of June-July for mass trapping.

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

viii. IPM Module for management of disease:

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

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

ix. Major weeds associated with crop: *Phalaris minor, Chenopodium*, wild oat

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

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

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

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

1. Need of agriculture diversification with horticultural crops along with live stocks management.
2. Adoption of proper cropping pattern
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,

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.

6D. Name of Field Crop: Finger millet

i. Existing varieties being used: Band muthi(Garwali 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, PRM-1, PRM-2, PES-110, PES-176, Pant Mandua-3

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- 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 practcices

v. Major insects associated with crop: stem borer

vi. IPM Module for management of insect-pests:

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: For management of blast disease, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha on need basis.

ix. Major weeds associated with crop: *Oxalis latifolia, Phylanthus niruri ,Amaranthus viridis,Uphorbia 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,
   Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
   Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
3. Timely Sowing,
4. Seed treatment,
5. Use of HYV, Gapfilling/Transplating
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. Less availability of agriculture inputs
2. Use of imbalance and un decomposed FYM
3. Climate changing
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities

6E. Name of 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.Undecomposed 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. 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
6. Use of IPM practcices

v. Major insects associated with crop: stem borer

vi. IPM Module for management of insect-pests:

vii. Major disease associated with crop: Blight

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(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. 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
2. Use of imbalance and un decomposed FYM
3. Climate changing
4. Wild animal damages
5. Migration specially from border area
6. Poor Irrigation facilities

7A. Name of the Pulse crop: Horsegram

i. Existing varieties being used: Pahari gahat

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 Gahat 10, VL Gahat 15 and VL Gahat 19

iii. Existing package of practices being used:

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

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

1. **Preparation of land**- - 2-3 ploughing followed by planking **Seed rate and seed sowing** – 30-40 kg/ha, spacing 30*10cm
2. **Sowing time-** Ist fortnight of June
3. **Manure and fertilizer**- 5 -10 tonne FYM / ha, NPK20:40 :20 along with the use of bio fertiliser
4. **Irrigation**-usually maximum area is rain fed
5. **Weed control** – Two manual weeding at 20-25 and 40-45 DAS is quite effective for weed control. Herbicides i.e. Alachlor 50 Ec 4 lt/ha at 0-3 DAS, Imazethapyr 10SL @100 gm a.i./ha At 15-20DAS.
6. Use of IPM practcices

v. Major insect pests associated with crop: -

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

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

viii.IPM Module for management of disease: -

ix. Major weeds associated with crop: *Oxalis latifolia, Phyllanthus niruri , Amaranthus viridis, Euphorbia hirata, Solanum* 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. Sowing of Baby corn and Sweet corn Shot duration hybrid Varieties .
2. Seed treatment , HYV, Inter cropping, Gap filling ,Weed Management
3. Organic cultivation,
4. Adoption of low-cost based cultivation practices,
5. Horsegram- Wheat/Lentil/Barley/oat (fodder) (rainfed),
6. Horsegram +Maize+Fingermillet - Wheat/Lentil/Barley/oat (fodder) (rainfed),
7. Timely Sowing
8. Seed treatment,

9. Use of HYV, Gapfilling
10. Contour cultivation and care soil & water conservation measures
11. Maximum use of value added compost/FYM
12. INM and soluble fertiliser
13. Integrated weed management
14. IPM
15. Good storage condition
16. 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
5. Migration
6. 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-5, 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 1.0-2.0qt./nali,
3. 1-2 inter culture

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

1. 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: For management of major insect pest application of Dichlorovos, Imidachloropid 200 ml/ha, Dimetheoate (1 liter/hac)

vii. Major disease associated with crop: Wilt ,

viii. IPM Module for management of disease (except organic areas): Seed treatment with Carbendazim 1.0 gm. + Thiram 2.0 gm./kg.

ix. Major weeds associated with crop: Bathuwa

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)
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

iii. 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, re sowing
6. Care soil & water conservation measures
7. INM (Maximum use of value added compost/FYM
8. and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

iv. 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.

7C. Name of Pulse crop: Urd

i. Existing varieties being used: Narendra Urd 1, Pan urd 19, Uttara, Pant Urd-30

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: U-31, PU-35, PU-40

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,
3. It is also observed that due to lack of knowledge,
4. 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 IInd fortnight of June to July.
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 :

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	
Phorate 10% CG	10000	

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

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

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

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.
3.Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.
4.Cluster based farming
5.Inter cropping.
6.Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed.
3. Poor awareness of seed treatment.
4. Poor weed management.
5. Imbalanced use of chemical fertilizer.
6. Lack of awareness about pest and disease management among farmers.
7. Difficulties to use heavy modern agriculture implement due to hilly terrain.
8. Proper marketing of agriculture produce is not available.
9. Crop damaged by wild animals.
10. Agriculture depends on rain.
11. Scattered agriculture land.
12. Migration and lack of interest in agriculture.

7D. Name of Pulse Crop: Moong

i. Existing varieties being used: Pant moong 2, Narendra moong-1,

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 Moong-5, Shweta

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.
3.It is also observed that due to lack of knowledge.
4.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 IInd fortnight of June to first week of July.
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. 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 :

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
Phorate 10% CG	10000

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

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

3. For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.

4. 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.
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.
4. Cluster based farming.
5. Inter cropping.
6. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed.
3. Poor awareness of seed treatment
4. Poor weed management.
5. Imbalanced use of chemical fertilizer.
6. Lack of awareness about pest and disease management among farmers.
7. Difficulties to use heavy modern agriculture implement due to hilly terrain.
8. Proper marketing of agriculture produce is not available,

9. Crop damaged by wild animals.
10. Agriculture depends on rain.
11. Scattered agriculture land.
12. Migration and lack of interest in agriculture.

7E. 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-3, Pant Arhar-291, VL Arhar 1, UPAS-120, Pusa-992

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.
3. 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 diseases.
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(except organic areas):

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. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed.
3. Poor awareness of seed treatment
4. Poor weed management
5. Imbalanced use of chemical fertilizer
6. Lack of awareness about pest and disease management among farmers.
7. Difficulties to use heavy modern agriculture implement due to hilly terrain.
8. Proper marketing of agriculture produce is not available,
9. Crop damaged by wild animals.
10. Agriculture depends on rain.
11. Scattered agriculture land.
12. Migration and lack of interest in agriculture.

7F. 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, Aman, GNG-1958, GNG-1969, Pant G-186, Pusa-256

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.
3. It is also observed that due to lack of knowledge.
4. 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. 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.
2. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
3. Sowing in line must be promoted for proper intercultural operations.
4. To minimize weed infestation proper management of weed must be done. Incidence of pests and diseases should be taken care properly.
5. Arrangement of irrigation facilities in case of drought should be available. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: Gram Pod borer

vi. IPM Module for management of insect pests :

Gram Pod Borer; *H. armigera*

1. Field sanitation and deep ploughing in the summer
2. Adopt proper crop rotation
3. Weeds like *Melilotus*, *Vicia* and *Chenopodium* should be weeded between 30-40 days after sowing of the crop
4. Intercropping/mixed cropping with coriander, linseed, etc.

5. Early planting during mid- October to mid -November
6. Growing of marigold as trap crop to attract adults for egg laying. Later the trap crop should be removed.
7. Use of light trap for destruction of adult insects.
8. Setup pheromone traps @ 5-6 traps/ha for monitoring of adult of *H. armigera*
9. Conservation of natural enemies like *Campoletis chloridae,* Chrysopid, wasp, and spider
10. Chickpea intercropping with coriander and linseed attract more number of *Campoletis chloridae*.
11. Install bird perches @ 15-20/ha for the increasing bird population like black drongo, king crow, myna, Blue jay which preys upon larvae. But these pirches should be removed from the field at maturity of the crop
12. First spray with biorational insecticides like NPV@ 250 LE/ha /NSKE 5% /B.t. @ 1 kg formulation/ha with 0.1% UV retardant such as (Tinopal and 0.5% jaggery) during initial stages of flowering/ and podding stages of the crop to conserve natural enemies followed by need based, judicious and safe application of following any insecticide viz.

Name of the insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	125	11
Emamectin benzoate 5% SG	220	14
Novaluron 10 % EC	750	7
Lambda cyhalothrin 5% EC	500	6
Deltamethrin 2.8% EC	10-12.5	400-5003
Monocrotophos 36% SL	1000	
Quinalphos 25% EC	1250	
Ethion 50% EC	1000-1500	21

Bio-insecticides

Name of the insecticides	**(gm/ml) /ha**
Bacillus thuringiensis var kurstaki 0.5% WP serotype 3a,3b,3c, Strain DOR Bt-1	2000
Beauveria bassiana 1% WP Strain no: NBRI-9947	3000
Beauveria bassiana 1% WP Strain no: SVBPU/CSP/Bb-10	3000
NPV of *Helicoverpa armigera* 2.0% AS Strain No. IBH-17268	500
NPV of *Helicoverpa armigera* 2.0% AS Strain No. BIL/HV-9 POB	250-500
NPV of *Helicoverpa armigera* 2.0% AS Strain No. IBL-17268	250-1000
NPV of *Helicoverpa armigera* 0.5% AS	250

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

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

Yellow mosaic

Control of yellow mosaic control of white fly or its vector by application of Imidacloropid 200 ml/ha, Dimetheoate 1 lit/ha, Seed treatment with Thiram+Carbendazim 2:1@3gm/kg seed.

For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per 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.
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.

4. Cluster based farming
5. Inter cropping.
6. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed.
3. Poor awareness of seed treatment.
4. Poor weed management.
5. Imbalanced use of chemical fertilizer.
6. Lack of awareness about pest and disease management among farmers
7. Difficulties to use heavy modern agriculture implement due to hilly terrain.
8. Proper marketing of agriculture produce is not available,
9. Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration.
10. Lack of interest in agriculture.

7G. Name of Pulse/oilseed Crop: Soyabean

i. Existing varieties being used: Kala bhatt(Oval), VLS-47, PS-1024, PRS-1, Shilajeet, PS-1042

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, PS-1092, PS-1241, PRS-1, PS-1347, PS-1225, PS-19, PS-21, PS-22, PS-23, PS 1347, VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65 and PS-19

iii. Existing package of practices being used:

1. Traditional seed variety
2. Undecomposed FYM 1.5-2.0qt./nail
3. 1-2 weeding
4. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
5. They also do not follow balance use of chemical fertilizers.
6. 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. Preperation of land- 1 or 2 ploughing ,
2. Seed rate and seed sowing -100-125/ha,
3. Manure and fertilizer -10 tonne FYM ,
4. NPK 20-80:40,
5. Irrigation-usually maximum area is rain fed
6. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence, Use of IPM practices
7. Timely sowing of crop in Ist fortnight of June to IInd fortnight of July.
8. 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.
9. Seed treatment with *Rhizobium* and P.S.B. Proper application of compost and farm yard manure.
10. Sowing in line must be promoted for proper intercultural operations.
11. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
12. Arrangement of irrigation facilities in case of drought should be available. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: Semilooper, Leafy catter piller, Whitefly, Girdle beetle, 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

Tobacco caterpillar: *Spodoptera litura*

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Indoxacarb 15.8% EC	333	31

Green semilooper: *Plusia orichalcea*

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	22
Indoxacarb 15.8% EC	333	31
Lambda cyhalothrin 4.9 % CS	300	31
Profenofos 50% EC	1000	40

Leaf eating caterpillar

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Dichlorvos 76% SC	225-300	282-376

White fly : *Bemisia tabaci*

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Carbofuran 3% CG	1500	50000

Jassids

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Imidacloprid 48% FS (Seed Treatment/Kg)	0.75	1.25

Girdle beetle

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	22
Thiacloprid 21.7% SC	750	17
Triazophos 40% EC	625	30
Profenofos 50% EC	1000	40
Profenofos 50% EC	1500	30

Bio-insecticides

Tobacco caterpillar (*Spodoptera litura*)

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

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

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

Semilooper (*Chrysodeixis acuta*)

Name of 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, Phyllanthus niruri ,Amaranthus viridis, Euphorbia hirata, Solanum* sp., *Tribulus* sp., *Cyperus* sp.

x. IPM module for management of weeds:

Flat sedge: *Cyperus* sp. (annual-perennial, monocot, narrow leaves, sedge)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Metalachlor 50% EC	1000	2000

Asthma weed: *Euphorbia hirta* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Imazethapyr 10% SL	1000	75
Pendimethalin 30% EC	2500-3300	110
Pendimethalin 38.7% CS	1500-1750	40
Imazamox 35% + Imazethapyr 35% WG	100	56

Stone breaker: *Phyllanthus niruri* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Chlorimuron ethyl 25% WP	36	45

Green amaranth: *Amaranthus viridis* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Alachlor 50 %EC	5000	
Metalachlor 50% EC	2000	
Pendimethalin 30% EC	2500-3300	110
Pendimethalin 38.7 CS	1500-1750	40
Pendimethalin 30% + Imazethapyr 2% EC	2500-3000	90

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 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. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing,
4. Wild animal damages
5. Migration,
6. Poor Irrigation facilities
7. Lack of ICT tools due to poor awareness and inter net connectivity

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, Bhawani, VL Toria-3, PT-507, Uttara

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:** One ploughing followed by 2-3 harrowings and planking; 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. Seed treatment: Apron 35 SD @ 5g/kg. 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:** About 20-25 days after sowing maintaining a plant to plant space of 10 cm. The thinned out plants could be used as **green forage**.
6. **Nutrient management:**
   Vermicompost: 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.
7. Excess use of nitrogenous fertilizers should be avoided.
8. **Nitrogen:** 120kg/ha
   60-80 kg/ha for *toria*
   Half of the N as basal and remaining half be top dressed about 25- 30DAS
   Phosphorus: 40 kg/ha as basal
   Potassium: 20 kg/ha as basal
   Phosphorus be applied as SSP; if SSP is not available, 20 kg/ha Sulphur shall be applied as basal.
9. **Water management:**
   Rosette (25-30 days) and pre-flowering stages are the most sensitive to water deficit. Hence, irrigations shall be made at these stages wherever possible.
10. **Harvesting and threshing:**
    The crop should be harvested when about 75 % of the siliquae turn yellowish brown. After threshing, seeds should be stored with less than 8% moisture.
    Use of IPM

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

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

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 Insecticides	(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

Hairy caterpillar

1. Mechanical destruction of egg masses and early instar larvae which feed gregariously.
2. Spray with

Emamectin Benzoate 5 SG 250ml/ha
Lufenuron 5EC 800ml/ha
Triazophos 40EC 750ml/ha
Monocrotophos 36 WSC 1250 ml/ha.

vii. Major disease associated with crop : Blight, Rust, 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: *Cyperus* 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
4. HYV
5. IPM

xii. Production constraints in agro-ecological region:

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

8A. Name of 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 June, Asariya, (Local selection) 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. 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 cause 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 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: Tafrina and Gummosis are major disease of peach

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

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: *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium,* etc.

x. IPM Module for management of weeds: Though mechanical, chemical and 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 Quality planting material
2. Need to delineate the table and canning type varieties.

8B**. Name of 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. 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 High density plantation with drip irrigation system

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. 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 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.

iv. **Major disease associated with crop:** Seasonal weeds

v. **IPM Module for management of disease (except organic areas):** Spraying of available contact /systematic insecticide if required.

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

vii. **IPM Module for management of weeds:** Though mechanical, chemical and control

viii. **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.

ix. Production constraints in agro-ecological region:

1. Availability of elite planting material
2. Lack of technical knowhow in plum cultivation

9A. Name of the vegetable crop: Cabbage

i. Existing varieties being used: Pride of India, Golden acre as open pollinated varieties and Varun, Pragati as hybrid 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: All hybrid varieties, Seeds are available in Multinational companies

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-
   (Early)-600-700g/ ha open pollinated
   (Mid and Late)- 500-550g/ha open pollinated
   (Hybrid)-350-400g/ha
7. Optimum sowing time
   Region B Aug- Sept (Irrigated condition)
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: Cabbage butterfly, Aphids, *Plutell*a and bugs

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, 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:**

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 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

xii.Production constraints in agro-ecological region:

1. Less heading in open pollinated cabbage.
2. Boron deficiency is becoming serious.

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

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** A large number of hybrids are used in the distt., There is no specific hybrid available for farmers in the state.

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. Optimum sowing time
   Region B -Early: May- June (Irrigated condition); Mid: June- july; Late: Aug – Mid Sept
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:**

14. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
15. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
16. Seed- Farmers should use improved varieties/ hybrids
17. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
18. 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.
19. 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.
20. Varieties- Farmers should select proper variety for suitable sowing time as per maturity group.
21. 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.
22. Transplanting- Farmers should transplant seedlings properly as for early (30x30cm), medium (45x30cm), and late (60 x 45 cm).
23. 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.
24. 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.
25. 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.
26. 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 :**

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

vii. Major disease associated with crop: Black rot and stalk rot are serious problem

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

***Sclerotenia* stem rot:**

4. Summer deep ploughing,
5. Burn the infected crop debris,
6. 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.

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

x. IPM Module for management of weeds:

4. Use of weedicide if required.

5. Weeding, hoeing
6. Deep ploughing.

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

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

xii.Production constraints in agro-ecological region:

4. Non availability of suitable varieties as per agro-ecological situation.
5. Buttoning and leafyness are common problem
6. Lack of technical knowledge

9C. Name of the vegetable crop: Radish

i. Existing varieties being used: Dunagiri, Chinese Pink, 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: Early Mino, Japnese white

iii. Existing package of practices being used: Mixed cropping.

1. No package of practices are adopted
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-
   Regin B: Sept- Oct
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. 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. 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.
9. 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.
10. A light irrigation may be given before harvesting to facilitate lifting of roots.
11. 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.
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 weeds

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
2. Non pithy
3. Coloured varieties for year round production.

xii. Production constraints in agro-ecological region:

Pithyness problem in low hills

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: Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852

iii.Existing package of practices being used:

1. Without soil and seed treatment
2. Poorly managed nurseries
3. Subterreaen staking
4. Non- judicious use of fertilizers.

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.
2. Special training and pruning techniques
3. Upright stacking and earthing up operation
4. With standard harevsting techniques and stages.

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:

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

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

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 alaxenderium, Cyperus rotundus, Cynodon dactylon*

x. IPM Module for management of weeds:

1. Cultural practices.
2. 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.
2. Can enhance the productivity of tomato manifold.
3. Polyhouse technogy is a boon for small and marginal farmers with fragmented holdings.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continous 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: Up-to-date, Kufri Jyoti, Kufri chandramukhi

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, Kufri Jyoti, Kufri Chandramukhi

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 maures, sowing in flat bed.
4.Sowing time is March-April. Limited or no IPM practices

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with aplication of organic manures.

v. Major insect pests associated with crop: Potato tuber moth, Epilachna beetle, Aphid, White grub

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	

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

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

Late blight of potato: ***Phytophthora infestans***

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

ix. Major weeds associated with crop: *Ranunculus*, *Cyperus* sp and *Chenopodium* etc.

x. IPM Module for management of weeds:

1. Mechanical and cultural method.
2. 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.
3. 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,

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continous cultivation.
2. Poor nursery management in the crop

3. Poor staking and pruning techniques.
Poor technical knowhow

9F. Name of the vegetable crop: Brinjal

i.Existing varieties being used: Up-to-date, Kufri Jyoti, Kufri chandramukhi

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 and Ankur etc are hybrid available in local market.

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.

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

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 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 toward 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.

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carbendazim 50% WP	150	300

ix. Major weeds associated with crop: *Euphobia hirta, Cynadon dactylon ,Cyperus* and *Oxalis*,

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

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

1. Use of hybrids can increase productivity 2to 3 times higher.
2. Use of mulch in rainy season.

xii. Production constraints in agro-ecological region:

1. Non-availability of suitable hybrids
2. Wild animals problems
3. Poor technical knowhow
4. Marketing problem in rainy season

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
2. No seed treatment
3. Poor nursery management
4. Tranplanting on or before rainy or monsoon season
5. Crop geometry knowledge is poor
6. Poor dry fruit storage.

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.

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

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: Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

ix. Major weeds associated with crop: *Euphobia hirta, Cynadon dactylon ,Cyperus* and *Oxalis* 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: Use of tall hybrids supplentation of organic packages of practices to be followe

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.

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 , Other pathenocarpic cucumber strains available in local market.

iii. For open field condition: 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

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.

v. Major insect pests associated with crop:

Leaf miner , white fly, thrips, Red pumpkin beetle

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: Wilt, Mildew, Mosaic

viii. IPM Module for management of disease:

1. Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

Powdery mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Benomil 50% WP	100	200
Carbendazim 50% WP	150	300

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:** *Trifolium alexenderium, Cyperus rotundus, Cynodon dactylon, Fagopyrum* species.

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:** Polyhouse technology and hybrid cultivars can increase productivity 3-4 times

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:** Traditional field pea , Arkel and Azad pea 3

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** PSM-3, PSM-5, Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12, Pusa Pragati

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

1. Sowing in of Autumn month
2. Broadcasting method,
3. No line sowing,
4. High seed rate,
5. Mature more than 120 days,
6. Stacking is done for tall varieties,
7. Dual purpose varieties

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.
2. Mangement of powdery mildew
3. Aschochyta blight and other diseases and Fusarium wilt in autumn season

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:** Powdery mildew in all agroecological situations
Fusarium wilt in autumn sown crop

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

1. Use of ogananic inputs only
2. Use of rust and powdery mldew resistant strains.

Powdery mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Benomil 50% WP	100	200
Carbendazim 50% WP	150	300

ix. **Major weeds associated with crop:** *Trifolium alexendrium, Cyperus rotundus, Cynodon dactylon, Fagopyrum* species.

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. September 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: Frenchbean

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 Bauni Bean 1 and VL Bean 2, Pant Anupama, Pusha, Himlata, Swarna Lata, Laxmi, Pusha Parvati, Pant bean-2, Arka Anoop, Arka Bold

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

1. Use of locally available untreated seeds
2. No proper field preparation

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

1. Use of FYM 15-20 tone /ha.
2. 3-4 irrigations
3. Proper weeding

v. **Major insect pests associated with crop:** Aphids, Pod borer, White grubs

vi. **IPM Module for management of insect pests:** Use light traps and spraying of Melathion @ 1.5 ml./litt.

vii. **Major disease associated with crop:** Damping off, Anthracnos, Powdery mildew, Leaf spots and Mosaic

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

1. Seed treatments with Bavistin 1.5 gm.+ Thiram 1.5 gm./kg.
2. Spraying of Bavistin @ 2 gm./litt.
3. Spraying of Meta systock @ 1 ml./ha.**Powdery mildew**

ix. **Major weeds associated with crop:** *Cyperus, Oxalis* sp.

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.Organic cultivation of French bean
2.Use of certified seed
3.Maize crop should be used as intercropping for doubling the income

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:** California wonder, 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 Shimla Mirch 3, Yellow Wonder, Pusha Dipti, Bharat, Indira, Aasha, Orobelle, Natasha, Swarna

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

1. Without soil and seed treatment
2. Poorly managed nurseries
3. Non- judicious use of fertilizers

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Use of improved varieties and growing nursery on raised and treated beds

v. **Major insect pests associated with crop:** Thrips, Aphids and Nematodes

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

1. Use of improved varieties
2. Use of systemic pesticides to manage insects
3. Use of plastic mulch
4. Use of Avant or systemic insecticides for management of insect/ pest.

vii. **Major disease associated with crop:** Anthracnose, Powdery mildew, Leaf spots and wilt

viii. **IPM Module for management of disease:**
Seed treatment with bavistin @ 2.5 gm./kg. And spray of crops with Streptocyclim @ 150 mg./litt. Dead crop residues should be burnt

ix. **Major weeds associated with crop:** *Cyperus, Oxalis* sp.

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.Use of high yielding varieties grown under ventillated polyhouse using standardized technology with fertigation in capsicum can enhance the productivity manifold.

2.Polyhouse technology is a boon for small and marginal farmers with fragmented holdings.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continous cultivation.
2. Poor nursery management in the crop
3. Poor staking and pruning techniques.
4. Poor technical knowhow

9K. Name of the vegetable crop: Coriander

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: Pant Haritima, Hisar Sugandh, Hisar Aanand, CS-287, Rajendra Sonia CS-287

iii. Existing package of practices being used:

1. Use of locally available untreated seeds
2. No selection of disease free bits

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

1. Use of FYM 10-15 tone /ha.
2. 3-4 irrigations
3. Proper weeding
4. For weed control Flue cloralin @ 1 kg./ha. In 600 litt. Water before sowing in field.

v. Major insect pests associated with crop: Aphids, Leaf cutting catter pillars

vi. IPM Module for management of insect pests: Spraying of melathion @ 2 ml./litt. water

vii. Major disease associated with crop: Wilt, powdery mildew, Stem galls, Blights

viii. IPM Module for management of disease:

1. Seed treatments with Bavistin 1.5 gm.+ Thiram 1.5 gm./kg.
2. Spraying of Bavistin @ 2 gm./litt.

ix. Major weeds associated with crop: *Cyperus, Oxalis* sp.

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. Organic cultivation of Corainder
2. Use of true to the type of seed
3. Radish crop should be used as intercropping for doubling the income

xii. Production constraints in agro-ecological region:

Poor technical knowhow

9L. Name of the vegetable crop: Ginger

i. Existing varieties being used: Local (Mixer of different varieties) Rio-de-jenerio

1. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Suprabh, Varda, Himgiri, Rio-de-jenerio, Suruchi

ii. Existing package of practices being used:

1. Use of locally available untreated seeds
2. No selection of disease free bits
3. No use of proper mulching

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

1. Use of disease free Rhizomes (bits size in wait 2-5 cm. Long and 15-20 gm.)
2. Rhizome should be treated 10-15 minuts with 2 gm. Carbendazim or 3 gm. Copper Oxicloride/lit. of water

3. Planting of Rhizomes at 30-40 cm. In to 30 cm. Distance and 5-10 cm. Depth.
4. FYM 25-30 tone/ha., 100-120 kg. Nitrogen, 75-80 kg. Phosphors, 100-120 kg. Potash/ha. Should be used.
5. Half dose of Nitrogen and full dose of phosphors and potash should be used at the time of land preparation and reaming nitrogen should be used as top dressing in to equal doses after 45 days and 90 days of planting.
6. Inter cropping of Maize is advisable for high yield.
7. Bio mulching is also recommended for good yield.
8. 2-3 intercultural operations should be done at 30 days, 45 days and 65 days after planting.

iv. Major insect pests associated with crop: Termites, shoot borer, rhizome scale

v. IPM Module for management of insect pests:

1. Seed treatment with qunolphos @ 2ml/lit.
2. Water solution for 5 minutes.

vi. Major disease associated with crop: Bacterial rot, wilt, rhizome rot

vii. IPM Module for management of disease: Seed treatment with copper oxycloride @ 3 gm/lit. Water for 5-10 minutes before sowing

viii. Major weeds associated with crop: *Cyperus, Oxalis* sp.

ix. IPM Module for management of weeds:

Use pendimethaline @ 1kg ai/ha as pre-emergence and one hoeing 25-30 days after sowing.

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

1. Organic cultivation of Ginger
2. Use of true to the type of planting material
3. Maize crop should be used as intercropping for dabbling the income

xi. Production constraints in agro-ecological region:

Poor technical knowhow

10 A.Name of the fodder crop: Berseem

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:** Vardan

iii. Existing package of practices being used:

1. Traditional seeds
2. No use of fertilizer
3. Non availability of variety of seeds

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

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

b. Dry method: Without puddled.

6. Sowing time: First an week of October
7. Fertilizer: 30:60:70:: N:P_2O_5 K_2O kg/ha
8. Irrigation: Field should remain at field capacity throughout the crop period after germination.
9. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.
10. Cutting management: First cut -45-50 DAS
11. Other cutting at 25-30 days interval- total 5-6 cutting are taken
12. Yield: 800-1000g/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:**
xii. **Production constraints in agro-ecological region:** Lack of knowledge

10B.Name of the fodder crop: Lobia

i. **Existing varieties being used:** UPC-5286
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** EC-4216
iii. **Existing package of practices being used:** Traditonal methods
1. Traditional seeds
2. No use of fertilizer
3. Non availability of variety of seeds

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
1. Preparation of land
2. 1 or 2 ploughing with mould plough.
3. Timely sowing of June-July.
4. Proper seed rate 40 kg/ha.
5. Apply 2-3 irrigation

v. **Major insect pests associated with crop:** Aphids, Jassids
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:** Chepa
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. Apply low cost based cultivation practices.
2. Timely sowing.
3. Use of high yielding variety.
4. Use of fertilizer in time.
5. Timely irrigation.
6. Cutting at the time of maximum foliage.

xii. **Production constraints in agro-ecological region:** Lack of knowlegde

10C.Name of the fodder crop: Oat

i. **Existing varieties being used:** 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:** UPO212
iii. **Existing package of practices being used:**
1. No use of FYM
2. Use of local available seed
3. No seed treatment.
4. Less availability of inputs

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
1. Use of proper amount of seed rate @ 60 kg./ha.
2. 3-4 irrigation should be apply
3. Timely sowing i.e. 60-62 kg./ha.
4. Proper use of fertilizer as per recommended dose of fertilizer i.e. 100 kg. Urea of to split doses
5. Soil : Loam soils
6. Field preparation : 2-3 Harrowing + leveling
7. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
8. Seed rate: 100 kg/ha

9. Spacing : 30cm line to line distance
10. Sowing time: first week of October to last October

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. Preparation of land 1-2 of ploughing
2. Timely sowing
3. 3-4 Irrigation should be applied
4. Timely cutting

xii. Production constraints in agro-ecological region: Lack of knowledge

11A.Name of the ornamental crop: Rose

i. **Existing varieties being used:** Commercial varieties available with private companies

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Commercial varieties available with private company's varieties to meet the demand of market (may be procured from Sakata seeds)

iii. Existing package of practices being used: Raising crop in poly house with package of practice provided by private firm who supply plant material

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

1. Plant density 6-9 plants per square meter area in polyhouse.
2. Soil test based micronutrient application
3. Soil sterilization with formaldehyde (2%), ensure regular de-suckering
4. Drip system of 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:** 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. Clubbing of 4-5 different coloured varieties
2. Drip irrigation
3. Soil test based fertilizer application.
4. Important colours are Red, yellow, Pink, Orange and white.

xii. Production constraints in agro-ecological region:

1. High cost of plating material and high initial cost of poly house
2. Heavy feeder and labour intensive crop
3. Problem of thrips and powdery mildew bother the farmers

C. Livestock: Livestock: Gotatory/Fisheries/Poultry

1.A Existing breeds available:

1. **Cattle:** Badri, Crossbred (Sahiwal, Red Sindhi,HF, Jersey) and Native cattle non descript
1. **Buffalo:** Upgraded Murrah, Upgraded Nili Ravi, and Native buffalo
2. **Goats:** Chaugarkha, Black Bengal, Beetal, Barbari
3. **Poultry:** Hybrid Breeds in broiler, and croilers

1.B Specific breeds to be introduced:

1. **Cattle:** Sahiwal, Red Sindhi, Jersey
2. **Buffalo:** Murrah, Nili Ravi, Bhadwari

3. **Goats:** Jamunapari
4. **Poultry:** Hybrid Breeds

2.A Existing feeds being used:

1. Oak tree leaves and grasses without chaffing
2. Wheat straw
3. Salt and Mineral Mixture in very less amount
4. Concentrates home made Leaves of bhemal, Mulberry and other wild grasses

2.B Specific feeds to be introduced / advised:

Concentrates for hilly areas of:

1. Barley
2. Oats
3. Napier grass

3.A Existing health services:

1. State animal husbandry department
2. Vet. Hospital (28)
3. LEO Centers (98) BAIF
4. mobile hospital and KVK

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

1. Doing first aid and vaccination at village level animal hospital
2. Advanced polyclinics with ultrasound and Xray facilities,
3. Provision for small portable ultrasound units which can be used at field level.

4.A Existing management practices:

1. Animal houses lack proper ventilation and hygiene
2. Weaning is not practiced
3. Administration of dewormers and mineral mixtures' is inadequate.
4. Concentrate mixtures is given in small amounts without considering lactation and pregnancy status.
5. Reducing calf mortality
6. No balance feed should be provided
7. Less management
8. In adequate feeding practices
9. No use of vaccination

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

1. Scientific housing management
2. Balance feed should be provided to the animal
3. Timely provided to Vaccination, Deworming, and breeding practices
4. Hygienic housing
5. Weaning
6. Timely administration of dewormers and mineral mixtrures.
7. Concentrate mixtures' to be administered as per lactation and pregnancy status
8. Reducing calf mortality
9. Improving awareness for vaccination

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

1. Poor breeds
2. Poor housing management
3. More no. of unproductive animals

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

PPR (Pest of Petits Ruminants)

A.Livestock

1. Deficiency of quality feed and foods.
2. Prolonged age of first calving

3. Unhygienic housing
4. Little knowledge about vaccination.
5. Prolonged intercalving period.

B.Goats

1. Difficulty in Nutritional Improvement.
2. Lack of systematic effort for breed upgradation.
3. Selective breeding is a long term process and investment required are high.
4. Intensification of production is difficult in goats as farmers prefer to send animals for open grazing.

D. Integrating Farming system

1.A Existing farming system: Cattle+Crop/Vegetable

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

1. Protected cultivation + Composting + Goatry/ backyard poultry
2. Fodder production + Mini dairy + Composting+ Protected cultivation
3. Seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea)+ Planting material supply + Mushroom

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: Mannual

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

A.For grains:

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

B.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: Few units available in fruits

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

A.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

B.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.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

B.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: Use of tradicitional bins only

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

A.For grain:

1. Multipurpose 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

B.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: A few check dams/ trenches are constructed.

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

Adoption of practices developed by institutes like IISWC,

2.A Existing plantation: Plantation on eroded/waste lands, and check dams for gully control.

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. Plantation of suitable trees/brushes in waterlogged and eroded areas;
2. Rejuvenation/repair of faulty/abandoned terraces;
3. Stabilization of eroded land using biological/engineering measures;
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: Berseem, Maize, oat

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:

Plantation of fodders like berseem, napier etc. needed

A.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

B.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.

C.Timothi grass

1. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
2. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal)
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.

D.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.

E.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.

Waste Land Development

1. Rejuvenation/repair of faulty/abandoned terraces;
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).

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. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
2. Industrial wastewater should not be used for irrigation directly
3. 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:

A.Rice-wheat,Maize-Sugarcane/Lentil/ Soybean / Urd bean

1. Annexure–II is enclosed for N,P and K.
2. 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
3. Foliar spray of 1% $FeSO_4$ in rice nursery, maize and sugarcane ratoon.
4. 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 .
5. In deficient soils, application of 215 kg gypsum/ha, if S deficiency exist in field.

1.B Soil test based inputs to be suggested in the specific agro-ecological region of district:

If required then deficit fertilizers and micronutrients may be provided

2.A Existing mechanization:

A.Paddy

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Conventional nursery raising.
3. Puddling by *damala* / peg type wooden puddler.
4. Manual transplanting.
5. Manual weed control.
6. Manual fertilizer application.
7. Manual harvesting.
8. Manual threshing.
9. Hand operated paddy thresher –cum-winnower.
10. Cleaning by winnowing fan.

B. Wheat

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting.
3. Manual weed control.

4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

C. Pulses

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.

D. 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.

E.Soybean

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 harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

2.B Mechanization required for reducing cost of cultivation in the specific agro-ecological region of district:

I.Sugarcane :

A. Paddy

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. Puddling by light weight power tiller / animal drawn improved Pant *damala*.
3. Weed control by conoweeder.
4. Manual harvesting / harvesting by power cutter / power tiller front mounted vertical conveyor reaper.
5. Threshing by Pant axial flow power hill thresher / hand operated paddy thresher-cum-winnower.

B.Wheat

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by single or double row Pant zero-till drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe.
4. Plant protection by manually operated sprayers.
5. Manual harvesting / harvesting by power cutter / power tiller front mounted vertical conveyor reaper.
6. Threshing by Pant wheat thresher for hills.

C.Pulses

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by single or double row Pant zero-till drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe.
4. Plant protection by manually operated sprayers.

5. Manual harvesting using improved sickles.
6. Pant axial flow power hill thresher.

D. 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.

E. Soybean

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by Pant zero-till single / double row seed drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.
6. Light weight soybean thresher / Pant multi-crop hill thresher.

1. **3.A Existing collective inputs:** Chemical Fertilizers, Insecticides, Pesticides, Farm Yard Manure, Poultry Manure, Seed, Water and Tillage Machinery

3.B Collective inputs suggested for reducing cost of cultivation in the specific agro-ecological region of district:

Bhabhar and Lower Hills

1. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
2. Avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
3. Encourage use of organic manures and biofertilizers.
4. Need based application of insecticides and pesticides, preferably enhanced the use of bioagents.
5. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons.
6. Use optimum and recommended seed rate at optimum spacing and depth.
7. Encourage water harvest technology for irrigation.
8. Use sprinkler and drip method for irrigation should be encouraged.
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:

1. Heterogeneous soils – soils of each situation differ widely in their physical, physio-chemical characteristics as are developed from a variety of rocks and minerals under joint influence of vegetation, physiography and clim
2. Sloping lands with high rate of removal of soil and nutrients from surface through erosion resulting to depleti soil fertility.
3. Scattered holding and marginal land size.
4. 90 % of area 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 know-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 reaction depending upon elevation, vegetation and developme soil from rocks and minerals causing nutrient imbalance in soil and impose hidden nutrient toxicity and defic symptoms in crops retard growth and yield.

11. Minimum use of fertilizers: farmers are mostly small and marginal economically backward, not able to 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 input are costly and therefore, the small and marginal farmers are not able to adopt the improved technol
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 right Sowing are done more than once either because of insufficient moisture mostly in rabi crops or due to formation in kharif.
16. Farmers follow practice of dry sowing. In such situation the seeds are eaten by birds and grubs resulti inadequate plant population.
17. Due to limited moisture and nutrient supply the growth of crops is not proper and vegetative phase of gr (flowering and fruiting) are advanced.
18. Improper/Inadequate seed bed preparation: in order to utilize moisture, the farmers do not wait for fine prepar 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 plant reduce plant population up to 70-80 %. Due to non availability of suitable plant protection chemicals as w high cost they are beyond the reach of farmers. Beside, non availability of water for solution also pose probler
20. Weeds; common weeds of the upland rainfed areas are Tipatiya (*Oxalis latifolia*), Parde *Galensojaparviflora*), Gajar grass (*Parthenium Sp.)*Kuni(*Lantena camera*) Kala bansa (*Eupatorium sp.).* loss in general in food crops are 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 models for crop production technologies under hill agricultural system for the state.

H. off-farm income

1A. Existing SHGS operative in specific agro-ecological region of district:

1. Department of Agriculture, Horticulture
2. ATMA
3. Watershed Management
4. Central Himalayan rural Action Group (CHIRAG) Shitla
5. UPASAK (NGO) Uttarakhand Parvateya Ajeevika samvardhan company Almora
6. Himani Bhimtal
7. CCF & Chestha Jeolikote
8. NABARD
9. VPKAS Almora
10. IFFCO Haldwani
11. National fertilizers Limited
12. Suchetana
13. Shivansh
14. Chetna (chopra)
15. Vridhi devi(Jyolikot)
16. Durga(Sariyataal)
17. Saraswati (Sariyataal)

18. Laxmi(Bhagtyura)
19. Unnati(Bhagtyura)
20. Jai Ma Kali (Paniyali)
21. Jaimata di(Jaipur padli)
22. Prerna(Jaipur padli)
23. Jai Santoshi(Paniyali)
24. Ekta(Bithorria No-1)
25. Navjeevan (Bithorria No-1)
26. Vanshita(Bithorria No-1)
27. Bhomiya Golu(Bamoritalli)
28. Santoshi (Belparao)
29. Bhumiya (Khempur)
30. Ekta (Berajhal)
31. Ujala(Berajhal)
32. Kadri (Berajhal)
33. Van devi(Gabua)
34. Vaibhav (Gabura khas)
35. Shanti (Tear)
36. Shiv(Madanpur)
37. Khusboo(Tera)
38. Jai durga(Kheempur)
39. Bhagwati(Madanpur)
40. Shivaji(Choti haldwani)
41. Santoshi(Choti haldwani)
42. Himani(Devirampur)
43. Navjyoti(Mayarampur)
44. Ekta (Avalakot)
45. Shanti(Pataliya),

1.B SHGS to be created/ encouraged in the specific agro-ecological region of district for doubling agricultural income:

1. Technology backstopping to existing SHG.
2. Creation of new SHG of Commodity wise
3. 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.
4. 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.
5. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
6. 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.
7. 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.
8. Loan procedure should be made more flexible with less interest rate.
9. 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.
10. 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.

11. 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.
12. Enterprises need to be identified depending upon local resources- human and material.
13. Market linkages need to be developed so that people can sell their produce gainfully.
14. To encourage SHG's better planning, training and sustained efforts on long term basis are required.
15. Target should not be only to form large number of SHGs but care should be taken that formed SHG may be in less number are functioning properly

1. SHG already formed and need to be encouraged:
2. Chetna(chopra)
3. Durga(Sariyataal)
4. Saraswati(Sariyataal)
5. Unnati (Bhagtyura)
6. Jai Ma Kali(Paniyali)
7. Jaimata di(Jaipurpadli)
8. Jai Santoshi(Paniyali)
9. Ekta(Bithorria No-1)
10. Navjeevan (Bithorria No-1)
11. Vanshita (Bithorria No-1)
12. Bhomiya Golu (Bamoritalli)
13. Santoshi (Belparao)
14. Bhumiya (Khempur)
15. Ekta (Berajhal)
16. Ujala (Berajhal)
17. Van devi(Gabua)
18. Vaibhav(Gabura khas)
19. Shanti(Tear)
20. Shiv (Madanpur)
21. Khusboo(Tera)
22. Jai durga(Khempur)
23. Bhagwati (Madanpur)
24. Shivaji(Choti haldwani)
25. Santoshi(Choti haldwani)
26. Himani(Devirampur)
27. Navjyoti(Mayarampur)
28. Ekta(Avalakot)

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:

1. Dairy

2. Aipan designing
3. Handloom weaving
4. Candle making

2.B Micro-entrepreneur employment to be generated in the specific agro-ecological region of district for doubling agricultural income:

1. Tie and die technique
2. Candle making
3. Mushroom cultivation
4. Beekiping.
5. Survey need to be conducted regarding locally available crops, fruits, vegetables and other things.
6. On the basis of these enterprise can be generated.
7. Aipan designing can be promoted in cloth, paper in the form of greeting cards, envelops, calenders etc.
8. That has market value at national and international level.

3.A Existing skill development facilities:

1. Skill development facilities are available at (1) KVK
2. Dairy
3. Aipan designing
4. Handloom weaving
5. Candle making \

3.B Skill development facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Vocational training courses should be organised
2. Training centre
3. Processing and packaging units as per the locally available resources

4.A Existing women skilling facilities: ITI

4.B Women skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

Local, traditional skill like Aipan (iM+) should be improved and proper marketing linkage should be provided to women SHG's

5.A Existing youth skilling facilities: Zila udyog Kendra, Educational institute and NGOs.

5.B Youth skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

Vocational training course should be started

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
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.

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: 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°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°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°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°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: Promote agriculture & animal husbandry in the state for better income of farmer community.

1.B Policies to be suggested for doubling income in the specific agro-ecological region:

1.Expand application scientific methods and mechanized cultivation

2.Promotion of secondary agriculture

2.A Existing Institutions:

1. ICAR Institutes
2. Department of Agriculture, Horticulture, Animal Husbandry, Fisheries,
3. Dairy Development Board
4. KVK
5. NGOs

2.B Institutions to be suggested for doubling income in the specific agro-ecological region of district:

1. ICAR Institutes
2. Department of Agriculture, Horticulture, Animal Husbandry, Fisheries,
3. Dairy Development Board,
4. KVK, NGOs

3.A Existing Incentives: Subsidies on almost all the inputs are available in the state

3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district:

Transport facilities in remote areas stretching of local mandi

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. Minimum support price for major fruits and vegetable crop should be declared
2. During failure of the main crop, provision and availability of improved seeds of short duration crops should be ensured.

J. Marketing and value addition in specific agro-ecological region

1.A Existing marketing facilities: Local market

1.B Marketing facilities to be suggested for doubling income in the specific agro-ecological region: Value addition of turmeric

2.A Existing grading facilities:

2.B Grading facilities to be suggested for doubling income in the specific agro-ecological region:

A.For grains:

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

B.For horticultural crops:

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

Colour grader for particular commodity

2.C Processing facilities to be created for better marketing and value addition in the district:

A.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

B.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 :

A.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

B.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. Existing marketing and value addition problems in the specific agro-ecological region:

1. Transportation problem during rainy season.
2. No value addition plants of crops are available

K. Online Management and Evaluation

1.A: Existing online management structure available:

1. Internet etc. is available at cities.
2. Internet literacy at village level is also a challenge.

1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district: Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.

2.A: Existing evaluation procedure: Manual

2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online evaluation.

3.A: Existing monitoring system: Physical

3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online monitoring.

4.A: Existing feedback system: Manually

4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online feedback.

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: Reading manuals may be developed/ published for easy operation of Mobile apps/ software developed for online management and evaluation for farmers as we well as concerned experts linked with it.

Specific action plan for doubling agricultural income in agro-ecological region

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of wheat (UP 2526, UP 2554, UP-2572, UP 2628, VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349, HS-277, HS-295, HS-420)
2. Promotion of high yielding varieties of Paddy (Pant Sankar Dhan-3, Pant Dhan-12, Pant Dhan-23, Pant Dhan-26, PR-113, Pant Basmati-1, Pant Basmati-2, Pant Sugandh Dhan-26, Pant Sugandh Dhan-27, Irrigated 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), Pant Dhan-11, PB-1509)
3. Promotion of high yielding varieties of Barley (VL Jau 118 and VLB 94, PRB-502, UPB-1008)
4. Promotion of high yielding varieties of Finger millet (Ragi/mandua) (, VL Mandua 324, and VL Mandua 352, PRM-1, PRM-2, PES-110, PES-176, Pant Mandua-3)

5. Promotion of high yielding varieties of specialty corn (CMVL Sweet Corn 1, CMVL Baby Corn 2)Promotion of high yielding varieties of Barnyard Millet (PRJ-1, VL Madira 172 and VL Madira 207)
6. Promotion of high yielding varieties of Horsegram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19)
7. Promotion of high yielding varieties of Lentil (PL-4, PL-5, PL-7, PL-8, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL Masoor 514)
8. Promotion of high yielding varieties of Toria/Sarson (PT-303, Bhawani, VL Toria-3, PT-507, Uttara)
9. Promotion of high yielding varieties of Urd (U-31, PU-35, PU-40)
10. Promotion of high yielding varieties of Moong (Pant Moong-5,Shweta)
11. Promotion of high yielding varieties of Arhar (Pant Arhar-3, Pant Arhar-291, VL Arhar 1, UPAS-120, Pusa-992)
12. Promotion of high yielding varieties of Chickpea (Pant Kabli Chana-1, Aman, GNG-1958, GNG-1969, Pant G-186, Pusa-256)
13. Promotion of high yielding varieties of Tomato (VL Tamatar 4, Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852)
14. Promotion of high yielding varieties of Potato (Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3, Kufri Jyoti, Kufri Chandramukhi)
15. Promotion of high yielding varieties of Pea (PSM-3, PSM-5, Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12, Pusa Pragati)
16. Promotion of high yielding varieties of French bean (VL Bauni Bean 1 and VL Bean 2, Pant Anupama, Pusha, Himlata, Swarna Lata, Laxmi, Pusha Parvati, Pant bean-2, Arka Anoop, Arka Bold)
17. Promotion of high yielding varieties of Capsicum (VL Shimla Mirch 3, Yellow Wonder, Pusha Dipti, Bharat, Indira, Aasha, Orobelle, Natasha, Swarna)
18. Promotion of high yielding varieties of Garlic (VL Garlic 1 and VL Lahsun 2); Onion (VL Piaz 3)
19. Promotion of high yielding varieties of Coriander (Pant Haritima, Hisar Sugandh, Hisar Aanand, CS-287, Rajendra Sonia)
20. Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
2. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
3. Creation of trenches for high percolation of water in *Betalghat, Dhari and Okhalkanda* block of this region.
4. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in all the blocks of this region.

Adoption of cluster approach for holistic development

1. Rejuvenation of existing senile orchards of peach, plum in *Bhimtal, Betalghat and Okhalkanda* blocks of this region.
2. Rejuvenation of senile orchards of Gola pear with improved varieties like Wartlet, Max Wartlet etc. in the region of *Bhimtal, Ramgarh, Okhalkanda and Dhari* block of this region.
3. Establishment of high density orchards of mango, guava, litchi, aonla and jackfruit in *valley area of Bhimtal, Betalghat, Dhari and Okhalkanda* blocks of this region.
4. Cultivation of Cinnemon (Tejpatta) plants at low hills in *Bhimtal* block.
5. Promotion of ginger cultivation in all *blocks of the region*.
6. Promotion of organic cultivation of turmeric in *Bhimtal* block.
7. Promotion of onion and garlic cultivation in *Bhimtal* belt.
8. Promotion of cultivation of kiwi in all blocks of this region.
9. Promotion of off season vegetables cultivation in *Bhimtal, Ramgarh, Dhari, Betalghat and Okhalkanda* block of this region.
10. Promotion of off season vegetables cultivation in Bhimtal, Dhari, Betalghat and Ramgarh block.
11. Promotion of protected cultivation at Nyay Panchayat level of Bhimtal, Dhari, Betalghat and Ramgarh block of this region.
12. Encouragement of plantation of forest plants like Bhimal, Khadik, Mulberry, Kachnar at the ridges of field

for fodder purpose in Betalghat, Dhari and Ramgarh block of this region.

13. Organic cultivation of chilli and ginger in *Bhimtal and Betalghat* block of this region
14. Promotion of production of vegetable pea in rainfed area of *Ramgarh and Dhari* block of this region.

Management of wild animal problem

1. Promotion of live fencing of Karonda surrounding the field in all blocks of this region.
2. Promotion of protected cultivation of flowers in Bhimtal block.
3. Promotion of protected cultivation of vegetables in Bhimtal, Dhari, Betalghat and Ramgarh blocks of this region.
4. Promotion of cultivation of lime/lemon at larger scale in Bhimtal, Dhari, Betalghat and Ramgarh block of this region.
5. Promotion of cultivation of garlic, ginger and turmeric in Bhimtal, Dhari, Betalghat and Ramgarh blocks of this region.
6. Promotion of cultivation of Kafal, Mango, Hishalu and other wild fruits in different pockets in forest areas for wild animals
7. Enacting legislative measures for protection of crop from wild animals.
8. Adoption of Farm mechanisation (Power tiller, thresher etc)
9. Promotion of serrated sickle, maize sheller, Vivek Millet thresher cum pearler, VL Paddy thresher and Vivek small tool kit for reduction in drudgery of hill farmers.
10. Popularization of multi crop thresher and Power Tiller/ Mini Tractor at Nyay Panchayat level in all the blocks.

Adoption of efficient irrigation techniques

1 Micro Irrigation (Drip and Sprinkler Irrigation) where water is available, etc.

2 Drip Irrigation in integration with water harvesting structure where water for irrigation is limited

3. Green House Cultivation for Vegetables with drip irrigation

Management of soil health in low or valley areas

1. Promotion of vermi compost unit and green manuring in all the villages
2. Promotion of cultivation of green manuring crops like Sesbania, Sunhemp, and lobia in different blocks.
3. Organic cultivation of local grain and millets in all the blocks of this region.

Others

1. Cluster approach for holistic development.
2. Adoption of Soil health improvement practices.
3. Selection of right crop & variety.
4. Adoption of only well decomposed FYM/ value added compost.
5. Promotion on seed treatment through bio agent/ chemical means strictly in the cluster.
6. Judicious use of fertiliser.
7. Improvement in moisture conservation practices.
8. Promotion to focus on timely weed management
9. Promotion and Adoption of IPM techniques
10. Adoption of Farm mechanisation(Power tiller, thresher etc)

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of high milk breeds of cows, buffaloes and goats in all the blocks.
2. Establishment of Fodder Bank in *Bhimtal, Dhari, Betalghat and Okhalkanda* to meet fodder requirement of area.
3. Establishment of milk chilling plant at Chafi in Bhimtal block
4. Promotion of Urea, Molasses, Multinutrient Blocks at *Nyaypanchayat* level.
5. Establishment of hatcheries for need of broilor or croilor at block level at *Bhimtal*, *Ramgarh, Dhari and Betalghat, Okhalkanda.*
6. Introduction and promotion of cross Heiffer for increasing income of marginal farmer in *Ramgarh, Dhari, Betalghat, Okhalkanda* block of this region.
8. Strengthening of traditional water bodies/ rivulets with Mahaseer or carps at Bhimtal.

Strategy 3 : Integrating Farming system

Promotion of different Integrated Farming System modules such as :

1. Protected cultivation + Composting + Goatry/ backyard poultry
2. Fodder production + Mini dairy + Composting+ Protected cultivation
3. Seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea)+ Planting material supply + Mushroom

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of mini fruit grading plant for malta and pear at Bhimtal, Ramgarh, Dhari and Betalghat area.
2. Establishment of Food Processing Units at *Bhimtal, Betalghat, Ramgarh and Dhari*
3. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in areas.
4. Promotion of common resources on custom hire basis viz. Power tiller, Mini Thresher and other equipments at Nyay Panchayat level of blocks of *Ramgarh, Dhari, Betalghat, Okhalkanda* of this region.
5. Establishment of small processing units for tertiary and value addition of mango, malta, citrus, pear in *Ramgarh, Dhari, Betalghat, Okhalkanda* blocks.

Strategy 5 : Waste land development and waste water

1. Contour making for arable purpose in waste land in Bhimtal, Betalghat, Dhari and Okhalkanda.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in *Ramgarh, Dhari, Betalghat, Okhalkanda block of this region.*
3. Promotion of plantation of mulberry (*Morus*), wild fruit plants and fodder trees (*Grewia*, *Alnus*, Celtis,Quercus) in *Ramgarh, Dhari, Betalghat, Okhalkanda* block of this region.
4. Plantation of perennial grasses like *Bromus*, fasku, chari (*Sorghum*), guinni, gunara, para, rahad, Balauk and siteriya in area of Betalghat, Dhari and Okhalkanda block.
5. Popularization of soil bunds to save excessive loss of nutrients in wasteland in area of Betalghat, Dhari and Okhalkanda block..
6. Popularization of trenches for percolation of water to avoid surface run off in all the blocks of this region.
7. Construction of check dam and artificial structure in all the blocks of this region to maximize water percolation rate.
8. Construction of tank for storage of water for lean season at Nyay Panchayat area of all the blocks of this region.
9. Creation of rain water harvesting structure in all the blocks of this region.
10. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in all the blocks of this region.
2. Promotion of line sowing and fertilizers application in crops of *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
3. Promotion of recommended seed rate, spacing and depth.
4. Promotion of need based application of pesticides and other agricultural inputs in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
5. Promotion of hand tools in agricultural and horticultural operations in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
6. Adoption of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers
7. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost in different blocks of this region.
8. Promotion of pressurized irrigation techniques in horticultural crops in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
9. Promotion of tillers and other garden tools for reduction of drudgery in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.

Strategy 7 : Off-farm income

1. Promotion of subsidiary occupations like goatry, poultry, fish farming and mushroom production in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
2. Promotion of apiculture for small and landless farmers in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of

this region.
3. Promotion of sericulture in low hills or valley areas in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
4. Promotion of cultivation and collection of medicinal plants in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
5. Promotion of skill development in women and youth in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
6. Strengthening of existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. may be provided for better performance in *Ramgarh, Dhari, Betalghat, Okhalkanda blocks* of this region.
7. Creation of new SHGs in other villages in the blocks of *Ramgarh, Dhari, Betalghat, Okhalkanda* of this region.

Strategy 8 : Enabling Policies

1. Increasing institutional support by providing subsidises and incentives to small and marginal farmers.
2. Labelling of organic inputs and certification mechanism for various crops.
3. Popularization of Udhyan and KCC for widespread use of government incentives/subsidies to farmers.
4. Establishment of wood bank at Bhimtal, Ramgarh to meet the present and future demand of germplasm in horticultural crops.
5. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
6. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
7. Implementation of Soil Health Card Scheme in each block.

Strategy 9 :Marketing and value addition in specific agro-ecological region

1. Creation of better transportation facilities with Refrigerated Van at Block level.
2. Creation of direct linkages with food processing industries for better prices.
3. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
4. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
5. Installation of mini grading machines at village level.
6. Establishment of cold room in different clusters.

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.
5. Promotion of use of radio, TV talks and Whatsapp etc. for effective implementation of program.

Agro-ecological region: Region C (1500 m-2400m)

A.General information about Agroeco-region
District: Nainital
Agro-ecological region: Region C (1500 m-2400m)
Main Blocks in Region: Dhari, Ramgarh, Okhalkanda
Main village cluster in blocks: Aghariya, Jarapani, Rata, Paharpani
Irrigated Clusters:
Rainfed Clusters:
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. Roof water harvesting system
7. Poly tank for water storage for scattered fields

2. Existing practices for soil health improvement

1. Use of unrecompensed farmyard mannure/compost
2. Meagre use of biofertilizers
3. Imbalanced/ insufficient nutrient use
4. Use of raw/partially decomposed FYM
5. Meagre compost making/recycling of crop residue
6. Mixed cropping of cereal and legume in few pockets
7. Soil health card scheme launched in 2015

3. Specific Action / Interventions recommended to improve soil health in specific agro-ecological region

1. Bio-fertiliser/soluble fertiliser based farming
2. Soil test based fertilizer application
3. Promotion of pulse based crop rotation
4. Integrated fertilizer application
5. Maximum use of value added compost/FYM

i) 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. Green manuring with Sesbania in low land paddy
4. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
5. Use of FYM @4-5t/ha or application of vermicompost @2.5-3.0t/ha

(ii) 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

(iii) Vegetables and spices

1. Seed/ nursery soil inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture (each of 200 g/m^2 for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with *Azotobacter/ 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

(iv) Sugarcane

1. Set inoculation with *Acetobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture.
2. Recycling of sugarcane trash through windrow composting
3. Soil test based use of balanced fertilizers; INM shall be preferred
4. Use of FYM @8-10t/ha or application of vermicompost @2.5-3.0t/ha
5. Distribution of soil health cards to each and every farmer along with nutrient recommendation for different crops
6. Establishing soil testing labs for major and micro plant nutrients at Block level
7. Capacity building for scientific use of organic manures, Integrated Nutrient Management, use of biofertilizers, different soil amendments, vermicomposting, etc.
8. Organization of camps for general awareness regarding harmful effect of burning crop residues
9. Popularization of legume-cereal rotation for improving the soil fertility in the region
10. Availability of all inputs viz., fertilizers, micro nutrient, biofertilizers, etc. at Nyay Panchayat Level

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

No contingencies plan is used by farmers

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

1. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
2. In event of decreased water arability (Approximately 1500mm rainfall) in rainy season (June-September) the rain water should be properly stored (In polythene, to make bund) and harvested for Kharif season crops.
3. Short duration variety should be grown show that at least two crops in a year could be taken
4. Growing of Cheti/spring rice variety viz., (VL 206, VL 207, VL 208, VL 209).
5. Organic mulch should be used to reduce the adverse impact of frost attack.
6. The area of off season vegetable should be increased at least by double by the year 2022.
7. The area having slope 10-30% should be used for growing of horticultural crop viz, Apple, pear, peach, plum, Apricot, walnut should be grown in temperate regions and Mango, Litchi, Guava in Sub-tropical regions.
8. The wheat sowing in plain region of Nainital (Haldwani) should be advanced by approximately one week in tarai and bhabhar region for nullifying the adverse effect of increasing temperature and terminal rains.
9. Micro irrigation technique should be popularized in tarai and bhabhar region.
10. Upland rice should be replaced by horse gram and buck wheat.
11. According to the frost forecast the crop residue should be burnt in the tomato field (open area) to increase energy level and to create a layer of smog for retardation of outgoing radiation.

12. In rain-fed lower hills Rice, Wheat, Soybean, Maize, in Rain fed mid hill, Rice, Wheat, French bean, and in Rain fed higher hills Finger millet, Wheat and Potato should be grown.
13. In order to minimize the impact of hail storms in mango and litchi the canopy geometry should be managed in a way that upper portion of tree should bear least fruit and bottom and middle portion should bear maximum fruits.Use fodder crop i.e Sorghum, Lobia as supplementary crop
14. Transplanting of finger millet
15. Late sowing of horse gram
16. Sowing of radish /leafy vegetables as cash crop
17. Plantation of citrus / pome granate
18. Sowing late sown varieties of wheat
19. Cultivation of off season vegetable

6 A. Name of Field Crop: Wheat

i. Existing varieties being used: VL-738, VL-616, 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: UP 2554, UP-2572, UP 2628, 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), HS-277, HS-295, HS-420

iii. Existing package of practices being used:

1. Preparation of land- 1 or 2 ploughing with local plough no definit depth
2. Seed rate and seed sowing -150-175 kg/ha, Broad casting
3. Manure and fertilizer- use of un decomposed FYM (rainfed) and un decomposed FYM with small doses of chemical fertiliser by some progreesive farmers (in irrigated conditions)as per availability
4. 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*)

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

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

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

Jassids:

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Carbofuran 3% CG	1250	41600

vii. Major disease associated with crop Rust, Loose smut, Leaf blight

viii. IPM Module for management of disease:

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

Sticker @ 1 ml per liter of water must be applied along with chemical pesticides to improve the effectiveness of chemical. For control of loose smut seed treatment with fungicide.

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

Biofungicides

Name of the Herbicides	(gm/Kg) /ha	Treatment
Pseudomonas fluorescens 1.75% WP (In house isolated Strain Accession no. MTCC 5176)	5 g/Kg seed 5 g/lit. water	**Seed Treatment:** Mix the required quantity of seeds with the required quantity of *Pseudomonas fluorescens* 1.75% WP formulations and ensure uniform coating. Shade dry and sow the seeds. **Foliar spray:** Dissolve 5 Kg of *Pseudomonas fluorescens* 1.75% WP in 1000 litres of water and spray.

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

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

Leaf blight of wheat: *Alternaria triticina*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Mancozeb 75% WP	1125-1500	1500-2000
Zineb 75% WP	1125-1500	1500-2000

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

Mexican prickly poppy: *Argemone mexicana* (annual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4-D Sodium salt Technical (80WP)	625-1000	90
MCPA Amine salt 40% WSC	2500	

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	

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. Adption of low-cost based cultivation practices:
3. Wheat-Horse gram/Soybean(rainfed),
4. Wheat-Rice(irrigated),
5. Timely Sowing, Seed treatment, Use of HYV
6. FIRB
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 storages conditions
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,
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities
7. SAAR practice(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:** Pant Sankar Dhan-3, Pant Dhan-12, Pant Dhan-23, Pant Dhan-26, PR-113, VL Dhan–86, Pant Dhan-11, Pant Dhan-11, PB-1509

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(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,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 practcices

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

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

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%	175+700	30

SC		
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 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	1500	

Z-52		
Beauveria bassiana 1.15%WP Strain BB-ICAR-RJP	2500	
Beauveria bassiana 1.15%WP Strain ICAR	2500	

Thrips

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

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

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

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*

3. 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	**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 latifolia, Cyperus* sp.*, Echinocloa* sp.*, Cynodon* sp.*, Digitaria sanguinales, Eclipta* sp.**,** *Eleusine* sp, *Chenopodium album, Commalina bengalensis*

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

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	

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

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

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

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

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 (Transplanted rice)	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
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 %WDG (Transplanted rice)	83.3-100	110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
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
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)

Umbrella plant: *Cyperus rotundus* (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)

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 raising practice 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
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities

6C. Name of Field Crop: Finger millet

i. Existing varieties being used: Band muthi(Garwali 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 352 upto 2000m amsl, PRM-1, PRM-2, PES-110, PES-176, Pant Mandua-3

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- 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 practcices

v. Major insects associated with crop: stem borer

vi. IPM Module for management of insect-pests: For management of stem borer, cartap 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: For management of blast disease, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha on need basis.

ix. Major weeds associated with crop: *Oxalis latifolia, Phylanthus niruri ,Amaranthus viridis,Uphorbia 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,
   Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
   Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
3. Timely Sowing, Seed treatment,
4. Use of HYV, Gapfilling/Transplating
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
3. Climate changing
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities

6D. Name of 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 upto 2000m amsl

iii. Existing package of practices being used:

1. Traditional seed variety
2. Undecomposed 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. 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
6. Use of IPM practcices

v. Major insects associated with crop: stem borer

vi. IPM Module for management of insect-pests:

vii. Major disease associated with crop: Blight

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(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. 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
2. Use of imbalance and un decomposed FYM
3. Climate changing
4. Wild animal damages
5. Migration specially from border area
6. Poor Irrigation facilities

7A. Name of the Pulse crop: Horsegram

i. Existing varieties being used: Pahari gahat

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./nali,
3. Broad casting 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 practcices

v. Major insect pests associated with crop: -

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

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

viii.IPM Module for management of disease: -

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

Horsegram- Wheat/Lentil/Barley/oat (fodder) (rainfed),

Horsegram +Maize+Fingermillet - Wheat/Lentil/Barley/oat (fodder) (rainfed),

4. Timely Sowing
5. Seed treatment,
6. Use of HYV
7. 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
3. Climate changing
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities

7B. Name of the Pulse crop: Lentil

i. Existing varieties being used: Chota masur , Lal masur, VL-125, PM-4, PM-5, VL-103, PL-406

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-5, PL-7, PL-8

iii. Existing package of practices being used:

1. Traditional seed variety , un decomposed FYM 1.5-2.0qt./nail, 1-2 inter culture
2. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
3. They also do not follow balance use of chemical fertilizers.
4. 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. 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 practcices

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

vi. IPM Module for management of insect pests: For management of major insect pest application of Dichlorovos, Imidachloropid 200 ml/ha, Dimetheoate (1 liter/hac)

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

viii. IPM Module for management of disease (except organic areas): For management of blast disease, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha on need basis 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: Bathua

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)

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

v. 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, re sowing
6. Care soil & water conservation measures
7. INM (Maximum use of value added compost/FYM
8. and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

vi. Production constraints in agro-ecological region:

1. Lack of quality seed
2. Poor awareness of seed treatment
3. Poor weed management
4. Imbalanced use of chemical fertilizer
5. Lack of awareness about pest and disease management among farmers.
6. Difficulties to use heavy modern agriculture implement due to hilly terrain. Proper marketing of agriculture produce is not available.

7C. Name of Pulse crop: Urd

i. Existing varieties being used: Narendra Urd 1, Pan urd 19, Uttara, Pant Urd-30

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: U-31, PU-35, PU-40

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,
3. It is also observed that due to lack of knowledge,
4. 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 IInd fortnight of may to first week of July.
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. 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 :

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	
Phorate 10% CG	10000	

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

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

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

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.
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.
4. Cluster based farming
5. Inter cropping.

6. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed.
3. Poor awareness of seed treatment.
4. Poor weed management.
5. Imbalanced use of chemical fertilizer.
6. Lack of awareness about pest and disease management among farmers.
7. Difficulties to use heavy modern agriculture implement due to hilly terrain.
8. Proper marketing of agriculture produce is not available.
9. Crop damaged by wild animals.
10. Agriculture depends on rain.
11. Scattered agriculture land.
12. Migration and lack of interest in agriculture.

7D. Name of Pulse Crop: Moong

i. Existing varieties being used: Pant moong 2, Narendra moong-1,

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 Moong-5, Shweta

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.
3. It is also observed that due to lack of knowledge.
4. 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 IInd fortnight of June to first week of July.
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 : For management of major insect pest application of Dichlorovos, Imidachloropid 200 ml/ha, Dimetheoate (1 liter/ha)

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

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

1. **Blast disease** For management of, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha on need basis
2. **Yellow mosaic** For the control 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.
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.
4. Cluster based farming
5. Inter cropping.
6. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment, poor weed management.
3. Imbalanced use of chemical fertilizer
4. Lack of awareness about pest and disease management among farmers, Difficulties to use heavy modern agriculture implement due to hilly terrain. Proper marketing of agriculture produce is not available.
5. Crop damaged by wild animals.
6. Agriculture depends on rain.
7. Scattered agriculture land.
8. Migration and lack of interest in agriculture.

7E. 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-3, Pant Arhar-291, VL Arhar 1, UPAS-120, Pusa-992

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.
3. It is also observed that due to lack of knowledge
4. 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. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: 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(except organic areas):

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.
5. Inter cropping.
6. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment.
3. Poor weed management.
4. Imbalanced use of chemical fertilizer.
5. Lack of awareness about pest and disease management among farmers. Difficulties to use heavy modern agriculture implement due to hilly terrain. Proper marketing of agriculture produce is not available,
6. Crop damaged by wild animals.
7. Agriculture depends on rain scattered agriculture land, migration and lack of interest in agriculture.

7F. 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, Aman, GNG-1958, GNG-1969, Pant G-186, Pusa-256

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.
3. It is also observed that due to lack of knowledge.
4. 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. 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.
2. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
3. Sowing in line must be promoted for proper intercultural operations.
4. To minimize weed infestation proper management of weed must be done.
5. Incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop: Gram Pod borer

vi. IPM Module for management of insect pests :

Gram Pod Borer; *H. armigera*

1. Field sanitation and deep ploughing in the summer
2. Adopt proper crop rotation
3. Weeds like *Melilotus*, *Vicia* and *Chenopodium* should be weeded between 30-40 days after sowing of the crop
4. Intercropping/mixed cropping with coriander, linseed, etc.
5. Early planting during mid- October to mid -November
6. Growing of marigold as trap crop to attract adults for egg laying. Later the trap crop should be removed.
7. Use of light trap for destruction of adult insects.
8. Setup pheromone traps @ 5-6 traps/ha for monitoring of adult of *H. armigera*
9. Conservation of natural enemies like *Campoletis chloridae,* Chrysopid, wasp, and spider
10. Chickpea intercropping with coriander and linseed attract more number of *Campoletis chloridae*.
11. Install bird perches @ 15-20/ha for the increasing bird population like black drongo, king crow, myna, Blue jay which preys upon larvae. But these pirches should be removed from the field at maturity of the crop
12. First spray with biorational insecticides like NPV@ 250 LE/ha /NSKE 5% /B.t. @ 1 kg formulation/ha with 0.1% UV retardant such as (Tinopal and 0.5% jaggery) during initial stages of flowering/ and podding stages of the crop to conserve natural enemies followed by need based, judicious and safe application of following any insecticide viz.

Name of the insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	125	11
Emamectin benzoate 5% SG	220	14
Novaluron 10 % EC	750	7
Lambda cyhalothrin 5% EC	500	6
Deltamethrin 2.8% EC	10-12.5	400-5003
Monocrotophos 36% SL	1000	
Quinalphos 25% EC	1250	
Ethion 50% EC	1000-1500	21

Bio-insecticides

Name of the insecticides	**(gm/ml) /ha**

Bacillus thuringiensis var kurstaki 0.5% WP serotype 3a,3b,3c, Strain DOR Bt-1	2000
Beauveria bassiana 1% WP Strain no: NBRI-9947	3000
Beauveria bassiana 1% WP Strain no: SVBPU/CSP/Bb-10	3000
NPV of *Helicoverpa armigera* 2.0% AS Strain No. IBH-17268	500
NPV of *Helicoverpa armigera* 2.0% AS Strain No. BIL/HV-9 POB	250-500
NPV of *Helicoverpa armigera* 2.0% AS Strain No. IBL-17268	250-1000
NPV of *Helicoverpa armigera* 0.5% AS	250

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

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

Yellow mosaic

For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha on need basis.

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.
3.Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop.
4.Cluster based farming
5.Inter cropping.
6.Needs to promote local germplasm.

xii. Production constraints in agro-ecological region:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed.
3. Poor awareness of seed treatment.
4. Poor weed management.
5. Imbalanced use of chemical fertilizer.
6. Lack of awareness about pest and disease management among farmers. Difficulties to use heavy modern agriculture implement due to hilly terrain. Proper marketing of agriculture produce is not available,
7. Crop damaged by wild animals.
8. Agriculture depends on rain.
9. Scattered agriculture land.
10. Migration and lack of interest in agriculture.

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, Bhawani, PT-507, Uttara

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:

One ploughing followed by 2-3 harrowings and planking

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:

Toria: Last week of September.

Yellow *sarson & rai* (Mustard): First fortnight of October.

3. Seed treatment

Apron 35 SD @ 5g/kg.

Only certified seeds should be used.

4. Seed rate and spacing:

***Toria*:** 4kg/ha about 3-4 cm deep in 30 cm apart rows

Yellow *sarson & rai* (Mustard): 5 kg/ha with a row spacing of 30-45 cm.

5. **Thinning:**

About 20-25 days after sowing maintaining a plant to plant space of 10 cm.

The thinned out plants could be used as **green forage**.

6. Nutrient management:

Vermicompost: 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.

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.

Phosphorus: 40 kg/ha as basal, be applied as SSP

Potassium: 20 kg/ha as basal

Sulphur: if SSP is not available, 20 kg/ha Sulphur shall be applied as basal.

7. Water management:

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

8. Harvesting and threshing:

The crop should be harvested when about 75 % of the siliquae turn yellowish brown.

After threshing, seeds should be stored with less than 8% moisture.

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

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

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 Insecticides	**(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, 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: *Cyperus* sp.

x. IPM Module for management of weeds:

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

Name of the Weedicides	(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
4. HYV
5. IPM

xii. Production constraints in agro-ecological region:

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

8A. Name of 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. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:

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. Major insect pests associated with crop: San jose scale, tent caterpillar, coddling moth

v. IPM Module for management of insect pests :

San Jose Scale:

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
5. Spray trees with Thiamethoxam (0.05%) or melathion (0.05%) or oxy demeton methyl (0.07%) and use Imidacloprid (0.007%) or Chlorpyriphos (0.05%) or around tree basin

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.

vi. Major disease associated with crop: Canker, collar rot, Powdery mildew, apple scab, leaf fall disease.

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

viii. 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:** Though mechanical, chemical and 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 Quality planting material
2. Need to delineate the table and canning type varieties.

8B. Name of 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 June, Asariya, (Local selection) 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. 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. Use parasitoid Tachnid fly, virus also cause 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%.
6. Codling Moth/ Fruit borer:
7. Thorough clean up of orchard.

8. Scrapping lose bark from old trees.
9. Collection and destruction of fallen fruits.
10. Mating disruption dispenser, moth pheromone trap can be used
11. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
12. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
13. Spray of Carpovirusine (GV of moth) at fortnightly interval.
14. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
15. 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.
16. In case of high abundance, tree should be banded with chemically treated bands.

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 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.
6. Bury the infested fruits at 60 cm deep in the soil.

vii. Major disease associated with crop: Tafrina and Gummosis are major disease of peach

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

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: *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium,* etc.

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

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.

xi. Production constraints in agro-ecological region:

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

8C. Name of 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: 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. 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

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 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(except organic areas): 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: Though mechanical 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:
Availability of Quality planting material

8D**. Name of 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 for mid and high hills.

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 for plum

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: 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. 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 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: -

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

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

dactylon, Parthenium etc.

x. IPM Module for management of weeds: Though mechanical, chemical and 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

9A. Name of the vegetable crop: Cabbage

i. Existing varieties being used: Pride of India, Golden acre as open pollinated varieties and Varun, Pragati as hybrid 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: All hybrid varieties, Seeds are available in Multinational companies

iii. Existing package of practices being used:

1. Use of organic manures
2. No knowledge of crop geometry
3. Use of hybrid varieties only
4. Serious weed management problem

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

1. Promotion of high yielding
2. Round shaped
3. 100% heading percentage mature within 90 days.

v. Major insect pests associated with crop: Aphids, *Plutell*a and bugs

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, 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:**

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 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

xii. Production constraints in agro-ecological region:

1. Less heading in open pollinated cabbage.
2. Boron deficiency is becoming serious.

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

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: A large number of hybrids are used in the distt., There is no specific hybrid available for farmers in the state.

iii. Existing package of practices being used:

1. Traditional cultural practices
2. Line spacing is not done
3. Poor crop geometry

4. Use of organic manure
5. Less or no used of organic pesticides.
6. High incidence of insect and diseases.

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

1. Selection of hybrids as per maturity group of crop
2. Need to develop seed production program in cauliflower.
3. Use of micronutrients especially borax

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

vi. IPM Module for management of insect pests :

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	2500-5000	7

based)		

vii. Major disease associated with crop: Black rot and stalk rot are serious problem

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.

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.

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

Name of the Weedicides	(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. 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. 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.

9C. Name of the vegetable crop: Radish

i. **Existing varieties being used:** Dunagiri, Chinese Pink, 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:** Early Mino, Japnese white

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

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 weeds

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 short duration
2. Non pithy
3. Coloured varieties for year round production.

xii. **Production constraints in agro-ecological region:**

Pithyness problem in low hills

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:** VL Tamatar 4 upto 1800m amsl, Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852

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

1. Without soil and seed treatment
2. Poorly managed nurseries
3. Subterreaen staking
4. Non- judicious use of fertilizers.

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.
2. Use of organic manures.
3. Special training and pruning techniques
4. Upright stacking and earthing up operation
5. With standard harevsting techniques and stages.

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:**

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

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

vii. Major disease associated with crop: Bacterial wilt, buck eye rot, damping off.

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 alaxenderium, Cyperus rotundus, Cynodon dactylon*

x. IPM Module for management of weeds:

1. Cultural practices.
2. 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.
2. Can enhance the productivity of tomato manifold.
3. Polyhouse technogy is a boon for small and marginal farmers with fragmented holdings.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continous 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: Up-to-date, Kufri Jyoti, Kufri chandramukhi

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, Kufri Jyoti, Kufri Chandramukhi

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 maures, sowing in flat bed.
4. Sowing time is March-April.
5. Limited or no IPM practices

iii. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with aplication of organic manures.

iv. Major insect pests associated with crop: Potato tuber moth, Epilachna beetle, Aphid,

White grub is a serious and wide spread problem

v. 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	

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

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

Late blight of potato: *Phytophthora infestans*

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

viii. Major weeds associated with crop: *Ranunculus*, *Cyperus* sp and *Chenopodium* etc.

ix. IPM Module for management of weeds:

Rice flat sedge: *Cyperus iria* (annual-perennial, monocot, narrow leaves, sedge)

2,4 D Dimethyl amine salt 58% SL	2000	3440
Oxyflourfen 23.5% EC	100-200	425-850

Cyperus* sp and *Chinopodium

1. 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.
2. Apply Paraquat dichloride 24% SL @ 0.5 kg a.i/ha at 5% germination of potato.

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

3. Early mature varieties.
4. Use of Kufri Girriraj and Kufri Jyoti varieties supplementation with use of optimal tuber size,

xi. Production constraints in agro-ecological region:

1. Timely and adequate seed supply.
2. Facility of poor seed storage in the distt.

9F. Name of the vegetable crop: Brinjal

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

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 and Ankur etc are hybrid available in local market.

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.

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

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 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 toward 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.

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Carbendazim 50% WP	150	300

ix. Major weeds associated with crop: *Euphobia hirta, Cynadon dactylon ,Cyperus* and *Oxalis*,

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

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

1. Use of hybrids can increase productivity 2to 3 times higher.
2. Use of mulch in rainy season.

xii. Production constraints in agro-ecological region:

1. Non-availability of suitable hybrids
2. Wild animals problems
3. Poor technical knowhow
4. Marketing problem in rainy season

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
2. No seed treatment
3. Poor nursery management
4. Tranplanting on or before rainy or monsoon season
5. Crop geometry knowledge is poor
6. Poor dry fruit storage.

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.

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

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: Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

ix. Major weeds associated with crop: *Euphobia hirta, Cynadon dactylon ,Cyperus* and *Oxalis* 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: Use of tall hybrids supplentation of organic packages of practices to be followe

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.

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 , Other pathenocarpic cucumber strains available in local market.

iii. For open field condition: 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

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.

v. Major insect pests associated with crop:

Leaf miner , white fly, thrips, leaf eating caterpillar, fruit fly, cut worm, Red pumpkin beetle

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: Wilt, Mildew, Mosaic

viii. IPM Module for management of disease:

Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

Powdery mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Benomil 50% WP	100	200
Carbendazim 50% WP	150	300

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%	800-1000	3

SC		

ix. Major weeds associated with crop: *Trifolium alexenderium, Cyperus rotundus, Cynodon dactylon, Fagopyrum* species.

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: Polyhouse technology and hybrid cultivars can increase productivity 3-4 times

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: Traditional field pea , Arkel and Azad pea 3

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PSM-3, PSM-5, Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12, Pusa Pragati

iii. Existing package of practices being used:

1. Sowing in of Autumn month
2. Broadcasting method,
3. No line sowing,
4. High seed rate,
5. Mature more than 120 days,
6. Stacking is done for tall varieties,
7. Dual purpose varieties

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.
2. Mangement of powdery mildew
3. Aschochyta blight and other diseases and Fusarium wilt in autumn season

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: Powdery mildew in all agroecological situations
Fusarium wilt in autumn sown crop

viii. IPM Module for management of disease:

1. Use of oganani c inputs only
2. Use of rust and powdery mldew resistant strains.

Powdery mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Benomil 50% WP	100	200
Carbendazim 50% WP	150	300

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. Increasing crop intensity
2. Line spacing
3. Use of tall cultivars in cropping system
4. Standardization of time for seed sowing in pea viz. September 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: Frenchbean

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 Bean 2, Pant Anupama, Pusha, Himlata, Swarna Lata, Laxmi, Pusha Parvati, Pant bean-2, Arka Anoop, Arka Bold

iii. Existing package of practices being used:

1. Use of locally available untreated seeds
2. No proper field preparation

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

1. Use of FYM 15-20 tone /ha.
2. 3-4 irrigations
3. Proper weeding

v. Major insect pests associated with crop: Aphids, Pod borer, White grubs

vi. IPM Module for management of insect pests: Use light traps and spraying of Melathion @ 1.5 ml./litt.

vii. Major disease associated with crop: Damping off, Anthracnose, Powdery mildew, Leaf spots and Mosaic

viii. IPM Module for management of disease:

1. Seed treatments with Bavistin 1.5 gm.+ Thiram 1.5 gm./kg.
2. Spraying of Bavistin @ 2 gm./litt.
3. Spraying of Meta systock @ 1 ml./ha.**Powdery mildew**

ix. **Major weeds associated with crop:** *Cyperus, Oxalis* 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 of French bean
2. Use of certified seed
3. Maize crop should be used as intercropping for doubling the income

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: California Wonder, 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 Shimla Mirch 3, Yellow Wonder, Pusha Dipti, Bharat, Indira, Aasha, Orobelle, Natasha, Swarna

iii. Existing package of practices being used:

1. Without soil and seed treatment
2. Poorly managed nurseries
3. Non- judicious use of fertilizers

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Use of improved varieties and growing nursery on raised and treated beds

v. Major insect pests associated with crop: Thrips, Aphids and Nematodes

vi. IPM Module for management of insect pests:

1. Use of improved varieties
2. Use of systemic pesticides to manage insects
3. Use of plastic mulch
4. Use of Avant or systemic insecticides for management of insect/ pest.

vii. Major disease associated with crop: Anthracnose, Wilt, Leaf sopts

viii. IPM Module for management of disease:

1. Seed treatment with bavistin @ 2.5 gm./kg. And spray of crops with Streptocyclim @ 150 mg./litt.
2. Dead crop residues should be burnt

ix. Major weeds associated with crop: *Cyperus, Oxalis* sp.

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 high yielding varieties grown under ventillated polyhouse using standardized technology with fertigation in capsicum

2.It can enhance the productivity of capsicum manifold.

3. Polyhouse technology is a boon for small and marginal farmers with fragmented holdings.

xii. Production constraints in agro-ecological region:

1. Non-availability of reliable hybrid cultivars for continous cultivation.
2. Poor nursery management in the crop
3. Poor staking and pruning techniques.
4. Poor technical knowhow

9K. Name of the vegetable crop: Coriander

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: Pant Haritima, Hisar Sugandh, Hisar Aanand, CS-287, Rajendra Sonia

iii. Existing package of practices being used:

1. Use of locally available untreated seeds
2. No selection of disease free bits

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

1. Use of FYM 10-15 tone /ha.
2. 3-4 irrigations
3. Proper weeding
4. For weed control Flue cloralin @ 1 kg./ha. In 600 litt. Water before sowing in field.

v. Major insect pests associated with crop: Aphids, Leaf cutting catter pillars

vi. IPM Module for management of insect pests: Spraying of melathion @ 2 ml./litt. water

vii. Major disease associated with crop: Wilt, powdery mildew, Stem galls, Blights

viii. IPM Module for management of disease:

3. Seed treatments with Bavistin 1.5 gm.+ Thiram 1.5 gm./kg.
4. Spraying of Bavistin @ 2 gm./litt.

ix. Major weeds associated with crop: *Cyperus, Oxalis* 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 of Corainder
2. Use of true to the type of seed
3. Radish crop should be used as intercropping for doubling the income

xii. Production constraints in agro-ecological region:

Poor technical knowhow

9L. Name of the vegetable crop: Ginger

i. Existing varieties being used: Local (Mixer of different varieties) Rio-de-jenerio

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

jenerio, Suruchi

iii. Existing package of practices being used:

1. Use of locally available untreated seeds
2. No selection of disease free bits
3. No use of proper mulching

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

1. Use of disease free Rhizomes (bits size in wait 2-5 cm. Long and 15-20 gm.)
2. Rhizome should be treated 10-15 minuts with 2 gm. Carbendazim or 3 gm. Copper Oxicloride/lit. of water
3. Planting of Rhizomes at 30-40 cm. In to 30 cm. Distance and 5-10 cm. Depth.
4. FYM 25-30 tone/ha., 100-120 kg. Nitrogen, 75-80 kg. Phosphors, 100-120 kg. Potash/ha. Should be used.
5. Half dose of Nitrogen and full dose of phosphors and potash should be used at the time of land preparation and reaming nitrogen should be used as top dressing in to equal doses after 45 days and 90 days of planting.
6. Inter cropping of Maize is advisable for high yield.
7. Bio mulching is also recommended for good yield.
8. 2-3 intercultural operations should be done at 30 days, 45 days and 65 days after planting.

v. Major insect pests associated with crop: Termites, shoot borer, Rhizome scale

vi. IPM Module for management of insect pests:

1. Seed treatment with qunolphos @ 2ml/lit.
2. Water solution for 5 minutes.

vii. Major disease associated with crop: Bacterial wilt, rhizome rot

viii. IPM Module for management of disease: Seed treatment with copper oxycloride @ 3 gm/lit. Water for 5-10 minutes before sowing

ix. Major weeds associated with crop:

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. Organic cultivation of Ginger
2. Use of true to the type of planting material
3. Maize crop should be used as intercropping for dabbling the income

xii. Production constraints in agro-ecological region:

Poor technical knowhow

10 A. Name of the fodder crop: Berseem

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:** Vardan

iii. Existing package of practices being used:

1. Traditional seeds
2. No use of fertilizer
3. Non availability of variety of seeds

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

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:
c. Wet method-like rice in puddled field
d. Dry method: Without puddled.
6. Sowing time: First an week of October
7. Fertilizer: 30:60:70:: N:P_2O_5 K_2O kg/ha
8. Irrigation: Field should remain at field capacity throughout the crop period after germination.
9. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.
10. Cutting management: First cut -45-50 DAS
11. Other cutting at 25-30 days interval- total 5-6 cutting are taken
12. Yield: 800-1000g/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:
xii. Production constraints in agro-ecological region: Lack of knowledge

10B.Name of the fodder crop: Maize

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:
iii. Existing package of practices being used:

1.Traditional seeds
2.No use of fertilizer
3.Non availability of variety of seeds

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

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

10C.Name of the fodder crop: Lobia

i. **Existing varieties being used:** UPC-5286
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** EC-4216
iii. **Existing package of practices being used:**

1.Traditional seeds
2. No use of fertilizer
3. Non availability of variety of seeds

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

1.Preparation of land
2. 1 or 2 ploughing with mould plough.
3. Timely sowing of June-July.
4. Proper seed rate 40 kg/ha.
5. Apply 2-3 irrigation

v. **Major insect pests associated with crop:** Aphids, Jassids
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:** Chepa
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. Apply low cost based cultivation practices.
2. Timely sowing.
3. Use of high yielding variety.
4. Use of fertilizer in time.
5. Timely irrigation.
6. Cutting at the time of maximum foliage.

xii. **Production constraints in agro-ecological region:** lack of knowledge

10D.Name of the fodder crop: Oat

i. **Existing varieties being used:** 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:** UPO212
iii. **Existing package of practices being used:**

1. No use of FYM
2. Use of local available seed
3. No seed treatment.
4. Less availability of inputs

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

1. Use of proper amount of seed rate @ 60 kg./ha.
2. 3-4 irrigation should be apply
3. Timely sowing i.e. 60-62 kg./ha.
4. Proper use of fertilizer as per recommended dose of fertilizer i.e. 100 kg. Urea of to split doses
5. Soil : Loam soils

6. Field preparation : 2-3 Harrowing + leveling
7. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
8. Seed rate: 100 kg/ha
9. Spacing : 30cm line to line distance
10. Sowing time: first week of October to last October

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. Preparation of land 1-2 of ploughing
2. Timely sowing
3. 3-4 Irrigation should be applied
4. Timely cutting

xii. Production constraints in agro-ecological region: Lack of knowledge

11A.Name of the ornamental crop: Rose

i. **Existing varieties being used:** Commercial varieties available with private companies

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Commercial varieties available with private company's varieties to meet the demand of market (may be procured from Sakata seeds)

iii. Existing package of practices being used: Raising crop in poly house with package of practice provided by private firm who supply plant material

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

1. Plant density 6-9 plants per square meter area in polyhouse.
2. Soil test based micronutrient application
3. Soil sterilization with formaldehyde (2%), ensure regular de-suckering
4. Drip system of 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:

x. IPM Module for management of weeds:

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

1. Clubbing of 4-5 different coloured varieties
2. Drip irrigation
3. Soil test based fertilizer application.
4. Important colours are Red, yellow, Pink, Orange and white.

xii. Production constraints in agro-ecological region:

1. High cost of plating material and high initial cost of poly house
2. Heavy feeder and labour intensive crop
3. Problem of thrips and powdery mildew bother the farmers

C. Livestock: Livestock: Gotatory/Fisheries/Poultry

1.A Existing breeds available:

1. **Cattle:** Badri, Crossbred (Sahiwal, Red Sindhi,HF, Jersey) and Native cattle non descript

2. **Buffalo:** Upgraded Murrah, Upgraded Nili Ravi, and Native buffalo
3. **Goats:** Chaugarkha, Black Bengal, Beetal, Barbari
4. **Poultry:** Hybrid Breeds in broiler, and croilers

1.B Specific breeds to be introduced:

1. **Cattle:** Sahiwal, Red Sindhi, Jersey
2. **Buffalo:** Murrah, Nili Ravi, Bhadwari
3. **Goats:** Jamunapari
4. **Poultry:** Hybrid Breeds

2.A Existing feeds being used:

1.Leaves of trees such as bhemal, Mulberry
2.other wild grasses

2.B Specific feeds to be introduced / advised:

3.A Existing health services:

1.State animal husbandry department [Vet. Hospital (28)
2.LEO Centers (98)
3.BAIF
4.1 mobile hospital and KVK

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

Doing first aid and vaccination at village level animal hospital

4.A Existing management practices:

1. No balance feed should be provided
2. Less management
3. In adequate feeding practices
4. No use of vaccination

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

1. Scientific housing management
2. Balance feed should be provided to the animal
3. Timely provided to Vaccination
4. Deworming,and breeding practices

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

1. Poor breeds
2. Poor housing management
3. More no. of unproductive animals

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

1. PPR (Pest of Petits Ruminants)
2. Lack of local available good quality grains as concentrate feed reduce the health condition of the goat,
3. Due to inbreeding and anorexia the morbidity and mortality is very high.

D. Integrating Farming system

1.A Existing farming system: Cattle+Crop/Vegetable

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

Promotion of different Integrated Farming System modules such as :

1. Protected cultivation+ Composting+Goatry/backyard poultry
2. Fodder production+ Mini dairy+Composting+ Protected cultivation
3. Seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea)+ Planting material supply+Mushroom

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: Mannual

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

region of district:

A.For grains:

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

B.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: Few units available in fruits

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

A.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

B.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.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.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

B.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: Use of tradicitional bins only

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

A.For grain:

1. Multipurpose 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

B.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
8. Jaggery storage bin

F. Waste land development and waste water

1.A Existing practices of soil water conservation: A few check dams/ trenches are constructed.

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

Adoption of practices developed by institutes like IISWC, Dehradun

2.A Existing plantation: Plantation on eroded/waste lands, and check dams for gully control.

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. Plantation of suitable trees/brushes in waterlogged and eroded areas;
2. Rejuvenation/repair of faulty/abandoned terraces;
3. Stabilization of eroded land using biological/engineering measures;
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: Berseem, Maize, oat

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:

Plantation of fodders like berseem, napier etc. needed

Plantation of fodders like berseem, napier etc. needed

A.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

B.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.

C.Timothi grass

1. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
2. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal)
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.

D.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.

E.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

Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

Waste Land Development

1. Rejuvenation/repair of faulty/abandoned terraces;
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).

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. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
2. Industrial wastewater should not be used for irrigation directly
3. Must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.

5.Sewage water from cities should be treated by municipal corporations or other agencies.

G. Reduced cultivation cost

1.A Existing inputs being given:

Rice-wheat,Maize-Sugarcane/Lentil/ Soybean / Urd bean

1. Annexure–II is enclosed for N,P and K.
2. 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
3. Foliar spray of 1% $FeSO_4$ in rice nursery, maize and sugarcane ratoon.
4. 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 .

In deficient soils, application of 215 kg gypsum/ha, if S deficiency exist in field.

1.B Soil test based inputs to be suggested in the specific agro-ecological region of district:

If required then deficit fertilizers and micronutrients may be provided

2.A Existing mechanization:

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.

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:

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: Chemical Fertilizers, Insecticides, Pesticides, Farm Yard Manure, Poultry Manure, Seed, Water and Tillage Machinery

3.B Collective inputs suggested for reducing cost of cultivation in the specific agro-ecological region of district:

Bhabhar and Lower Hills

1. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
2. Avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
3. Encourage use of organic manures and biofertilizers.
4. Need based application of insecticides and pesticides, preferably enhanced the use of bioagents.
5. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons.
6. Use optimum and recommended seed rate at optimum spacing and depth.
7. Encourage water harvest technology for irrigation.
8. Use sprinkler and drip method for irrigation should be encouraged.
9. Use of mulches and available composts/organic manures
10. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
12. Promote reduced tillage operations.

Factors responsible for increasing cost of cultivation in the specific agro-ecological region of district:

1. Heterogeneous soils – soils of each situation differ widely in their physical, physio-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 area 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 know-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 reaction 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 input 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 right 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/Inadequate 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 reach of farmers. Beside, 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 are 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 models for crop production technologies under hill agricultural system for the state.

H. off-farm income

1A. Existing SHGS operative in specific agro-ecological region of district:

1. Department of Agriculture, Horticulture
2. ATMA
3. Watershed Management
4. Central Himalayan rural Action Group (CHIRAG) Shitla
5. UPASAK (NGO) Uttarakhand Parvateya Ajeevika samvardhan company Almora
6. Himani Bhimtal
7. CCF & Chestha Jeolikote
8. NABARD
9. VPKAS Almora
10. IFFCO Haldwani
11. National fertilizers Limited
12. Suchetana
13. Shivansh

14. Chetna (chopra)
15. Vridhi devi(Jyolikot)
16. Durga(Sariyataal)
17. Saraswati (Sariyataal)
18. Laxmi(Bhagtyura)
19. Unnati(Bhagtyura)
20. Jai Ma Kali (Paniyali)
21. Jaimata di(Jaipur padli)
22. Prerna(Jaipur padli)
23. Jai Santoshi(Paniyali)
24. Ekta(Bithorria No-1)
25. Navjeevan (Bithorria No-1)
26. Vanshita(Bithorria No-1)
27. Bhomiya Golu(Bamoritalli)
28. Santoshi (Belparao)
29. Bhumiya (Khempur)
30. Ekta (Berajhal)
31. Ujala(Berajhal)
32. Kadri (Berajhal)
33. Van devi(Gabua)
34. Vaibhav (Gabura khas)
35. Shanti (Tear)
36. Shiv(Madanpur)
37. Khusboo(Tera)
38. Jai durga(Kheempur)
39. Bhagwati(Madanpur)
40. Shivaji(Choti haldwani)
41. Santoshi(Choti haldwani)
42. Himani(Devirampur)
43. Navjyoti(Mayarampur)
44. Ekta (Avalakot)
45. Shanti(Pataliya),

1.B SHGS to be created/ encouraged in the specific agro-ecological region of district for doubling agricultural income:

1. Technology backstopping to existing SHG.
2. Creation of new SHG of Commodity wise
3. 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.
4. 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.
5. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
6. 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.)
7. So there is need of encouragement, motivation along with imparting knowledge, skills and linking them to market.
8. 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.

9. Loan procedure should be made more flexible with less interest rate.
10. 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.
11. 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.
12. 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.
13. Enterprises need to be identified depending upon local resources- human and material.
14. Market linkages need to be developed so that people can sell their produce gainfully.
15. To encourage SHG's better planning, training and sustained efforts on long term basis are required.
16. Target should not be only to form large number of SHGs but care should be taken that formed SHG may be in less number are functioning properly.
17. SHG already formed and need to be encouraged:

1. Chetna(chopra)
2. Durga(Sariyataal)
3. Saraswati(Sariyataal)
4. Unnati (Bhagtyura)
5. Jai Ma Kali(Paniyali)
6. Jaimata di(Jaipurpadli)
7. Jai Santoshi(Paniyali)
8. Ekta(Bithorria No-1)
9. Navjeevan (Bithorria No-1)
10. Vanshita (Bithorria No-1)
11. Bhomiya Golu (Bamoritalli)
12. Santoshi (Belparao)
13. Bhumiya (Khempur)
14. Ekta (Berajhal)
15. Ujala (Berajhal)
16. Van devi(Gabua)
17. Vaibhav(Gabura khas)
18. Shanti(Tear)
19. Shiv (Madanpur)
20. Khusboo(Tera)
21. Jai durga(Khempur)
22. Bhagwati (Madanpur)
23. Shivaji(Choti haldwani)
24. Santoshi(Choti haldwani)
25. Himani(Devirampur)
26. Navjyoti(Mayarampur)
27. Ekta(Avalakot)

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:

1. Dairy
2. Aipan designing
3. Handloom weaving
4. Candle making

2.B Micro-entrepreneur employment to be generated in the specific agro-ecological region of district for doubling agricultural income:

1. Tie and die technique
2. Candle making
3. Mushroom cultivation
4. Beekiping.
5. Survey need to be conducted regarding locally available crops, fruits, vegetables and other things.
6. On the basis of these enterprise can be generated.
7. Aipan designing can be promoted in cloth, paper in the form of greeting cards, envelops, calenders etc.
8. That has market value at national and international level.

3.A Existing skill development facilities:

1. Skill development facilities are available at (1) KVK
2. Office of Development commissioner (handicrafts)
3. Handicraft marketing
4. Service and extension centre

3.B Skill development facilities to be created in the specific agro-ecological region for doubling agricultural income:

1. Vocational training courses should be organised
2. Training centre
3. Processing and packaging units as per the locally available resources

4.A Existing women skilling facilities: ITI

4.B Women skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

Local, traditional skill like Aipan (iM+) should be improved and proper marketing linkage should be provided to women SHG's

5.A Existing youth skilling facilities: Zila udyog Kendra, Educational institute and NGOs.

5.B Youth skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:

Vocational training course should be started

III. Enabling Policies

1.A Existing policies related with agriculture and animal husbandry: Promote agriculture & animal husbandry in the state for better income of farmer community.

1.B Policies to be suggested for doubling income in the specific agro-ecological region:

1. Expand application scientific methods and mechanized cultivation

2.Promotion of secondary agriculture

2.A Existing Institutions:

1. ICAR Institutes
2. Department of Agriculture, Horticulture, Animal Husbandry, Fisheries,

3. Dairy Development Board
4. KVK
5. NGOs

2.B Institutions to be suggested for doubling income in the specific agro-ecological region of district:

1. ICAR Institutes
2. Department of Agriculture, Horticulture, Animal Husbandry, Fisheries,
3. Dairy Development Board,
4. KVK, NGOs

3.A Existing Incentives: Subsidies on almost all the inputs are available in the state

3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district: Transport facilities in remote areas stretching of local mandi

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. Minimum support price for major fruits and vegetable crop should be declared
2. During failure of the main crop, provision and availability of improved seeds of short duration crops should be ensured.

J. Marketing and value addition in specific agro-ecological region

1.A Existing marketing facilities: Local market

1.B Marketing facilities to be suggested for doubling income in the specific agro-ecological region: Value addition of turmeric

2.A Existing grading facilities:

2.B Grading facilities to be suggested for doubling income in the specific agro-ecological region:

A.For grains:

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

B. 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:

A.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

B.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 :

A.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

B.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

5. Existing marketing and value addition problems in the specific agro-ecological region:

1. Transportation problem during rainy season.
2. No value addition plants of crops are available

K. Online Management and Evaluation

1.A: Existing online management structure available:

1. Internet etc. is available at cities.
2. Internet literacy at village level is also a challenge.

1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district: Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.

2.A: Existing evaluation procedure: Manual

2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online evaluation.

3.A: Existing monitoring system: Physical

3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online monitoring.

4.A: Existing feedback system: Manually

4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district:

1. Mobile apps/ software for online management and evaluation may be developed and

farmers as we well as concerned experts may be linked with it.

2. District level committees of State line departments with KVK experts may be formed for field and as well as online feedback.

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: Reading manuals may be developed/ published for easy operation of Mobile apps/ software developed for online management and evaluation for farmers as we well as concerned experts linked with it.

Specific action plan for doubling agricultural income in agro-ecological region

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of wheat (UP 2554, UP-2572, UP 2628, 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), HS-277, HS-295, HS-420)
2. Promotion of high yielding varieties of Paddy (Pant Sankar Dhan-3, Pant Dhan-12, Pant Dhan-23, Pant Dhan-26, PR-113, VL Dhan–86, Pant Dhan-11, Pant Dhan-11, PB-1509)
3. Promotion of high yielding varieties of Finger millet (Ragi/mandua) (and VL Mandua 352 upto 2000m amsl, PRM-1, PRM-2, PES-110, PES-176, Pant Mandua-3)
4. Promotion of high yielding varieties of Barnyard Millet (PRJ-1, VL Madira 172 and VL Madira 207 upto 2000m amsl)
5. Promotion of high yielding varieties of Rajmash (VL Rajma 63, VL Rajma 125)
6. Promotion of high yielding varieties of Lentil (PL-4, PL-5, PL-7, PL-8)
7. Promotion of high yielding varieties of Urd (U-31, PU-35, PU-40)
8. Promotion of high yielding varieties of Moong (Pant Moong-5,Shweta)
9. Promotion of high yielding varieties of Arhar (Pant Arhar-3, Pant Arhar-291, UPAS-120, Pusa-992)
10. Promotion of high yielding varieties of Chickpea (Pant Kabli Chana-1, Aman, GNG-1958, GNG-1969, Pant G-186, Pusa-256)
11. Promotion of high yielding varieties of Toria/Sarson (PT-303, Bhawani, PT-507, Uttara)
12. Promotion of high yielding varieties of Apple (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.)
13. Promotion of high yielding varieties of Tomato (VL Tamatar 4 upto 1800m amsl, Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852)
14. Promotion of high yielding varieties of Potato (Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3, Kufri Jyoti, Kufri Chandramukhi)
15. Promotion of high yielding varieties of Pea (PSM-3, PSM-5, Vivek Matar 11 for main season & VL Ageti Matar 7 for August sown , Pusa Pragati)
16. Promotion of high yielding varieties of French bean (VL Bean 2, Pant Anupama, Pusha, Himlata, Swarna Lata, Laxmi, Pusha Parvati, Pant bean-2, Arka Anoop, Arka Bold)
17. Promotion of high yielding varieties of Capsicum (VL Shimla Mirch 3 (upto 1800m amsl), Yellow Wonder, Pusha Dipti, Bharat, Indira, Aasha, Orobelle, Natasha, Swarna)
18. Promotion of high yielding varieties of Coriander (Pant Haritima, Hisar Sugandh, Hisar Aanand, CS-287, Rajendra Sonia)
19. Promotion of high yielding varieties Onion (VL Piaz 3 upto 2000m amsl); Garlic (VL Lahsun 2)
20. Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.

2. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
3. Creation of trenches for high percolation of water in most of the area of *Ramgarh, Okhalkanda and Dhari* block.
4. 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 senile orchards of peach, plum, pear, apricot and apple in *Ramgarh, Okhalkanda, Dhari* and *Mukteshwar* blocks of this region.
2. Establishment of high density orchards of peach, nectrin, plum, pear, apricot and apple in *Ramgarh, Okhalkanda, Dhari* and *Mukteshwar* blocks of this region.
3. Promotion of organic ginger cultivation in all *blocks of the region*.
4. Promotion of onion and garlic cultivation in *Ramgarh, Okhalkanda, Dhari* and *Mukteshwar* blocks of this region.
5. Promotion of cultivation of kiwi in all blocks of this region.
6. Promotion of off season vegetables cultivation in *Ramgarh, Okhalkanda, Dhari* and *Mukteshwar* blocks of this region.
7. Promotion of protected cultivation at Nyay Panchayat level of *Ramgarh, Dhari* and *Mukteshwar* blocks of this region.
8. Encouragement of plantation of forest plants like Bhimal, Khadik, Mulberry, Kachnar at the ridges of field for fodder purpose in Betalghat, Dhari and Ramgarh block of this region.
9. Promotion of production of vegetable pea in rainfed area of *Ramgarh, Mukteshwar and Dhari* block of this region.
10. Promotion of Ginger, turmeric and garlic cultivation in *Okhalkanda, Dhari and Ramgarh* belt.

Management of wild animal problem

1. Promotion of live fencing of Karonda surrounding the field in all blocks of this region.
2. Promotion of protected cultivation of flowers in Bhimtal, Ramgarh and Mukteshwar block.
3. Promotion of protected cultivation of vegetables in Ramgarh, Okhalkanda, Dhari and Mukteshwar blocks of this region.
4. Promotion of cultivation of lime/lemon at larger scale in Ramgarh, Okhalkanda, Dhari and Mukteshwar blocks of this region.
5. Promotion of cultivation of garlic, ginger and turmeric in Ramgarh, Okhalkanda, Dhari and Mukteshwar blocks of this region.
6. Promotion of cultivation of Kafal, Mango, Hishalu and other wild fruits in different pockets in forest areas for wild animals
7. Enacting legislative measures for protection of crop from wild animals.
8. Promotion of live fencing of Karonda surrounding the field.

Adoption of Farm mechanisation (Power tiller, thresher etc)

Promotion of serrated sickle, Vivek Millet thresher cum pearler, VL Paddy thresher and Vivek small tool kit for reduction in drudgery of hill farmers.

Popularization of multi crop thresher and Power Tiller/ Mini Tractor at Nyay Panchayat level in all the blocks.

Adoption of efficient irrigation techniques

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available, etc.
2. Drip Irrigation in integration with water harvesting structure where water for irrigation is limited
3. Green House Cultivation for Vegetables with drip irrigation

Management of soil health in low or valley areas

Promotion of vermi compost unit and green manuring in all the villages of *Ramgarh, Okhalkanda, Dhari* and *Mukteshwar blocks of this region.*

Organic cultivation of local grain and millets in different blocks of this region.

Others

1. Cluster approach for holistic development.
2. Adoption of soil health improvement practices.
3. Selection of right crop & variety.
4. Adopt of only well decomposed FYM/ value added compost.
5. Promotion on seed treatment through bio- agent/ chemical means strictly in the cluster.
6. Judicious use of fertiliser.
7. Improvement of moisture conservation practices.
8. Promotion of focus on timely weed management.
9. Promotion and Adoption of IPM techniques.

Adoption of Farm mechanization (Power tiller, thresher etc).

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of high milk breeds of cows, buffaloes and goats in all the blocks.
2. Establishment of Fodder Bank in Ramgarh, Okhalkanda, Dhari and Mukteshwar block of this area to meet fodder requirement.
3. Establishment of milk chilling plant at Ramgarh and Okhalkanda block of this region.
4. Promotion of Urea, Molasses, Multinutrient Blocks at *Nyaypanchayat* level.
5. Establishment of hatcheries for need of broilor or croilor at block level at *Bhimtal*, *Dhari, Betalghat, Okhalkanda*
6. Introduction and promotion of cross Heiffer for increasing income of marginal farmer in *Ramgarh, Dhari, Betalghat, Okhalkanda* block of this region.
7. Strengthening of traditional water bodies/rivulets with Mahaseer or carps at Ramgarh and Mukteshwar.

Strategy 3 : Integrating Farming system

Promotion of different Integrated Farming System modules such as :

1. Protected cultivation + Composting + Goatry/ backyard poultry
2. Fodder production + Mini dairy + Composting+ Protected cultivation
3. Seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea)+ Planting material supply + Mushroom

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of mini fruit grading plant for peach, plum, pear and apple at Ramgarh and Mukteshwar block of this region.
2. Establishment of Food Processing Units at *Ramgarh, Dhari, Mukteshwar and Okhalkanda.*
3. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in this region.
4. Promotion of common resources on custom hire basis viz. Power tiller, Mini Thresher and other equipments at Nyay Panchayat level.
5. Establishment of small processing units for tertiary and value addition of citrus fruits, apricot, plum, kiwi and Rhododendron in Ramgarh, Mukteshwar, Okhalkanda and Dhari blocks.

Strategy 5 : Waste land development and waste water

1. Contour making for arable purpose in waste land in Ramgarh, Mukteshwar, Okhalkanda and Dhari blocks and other area.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope.
3. Promotion of plantation of mulberry, wild fruit plants and fodder trees (*Bheemal, Alnus, Celtis, Oak*).
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland.
5. Popularization of trenches or silages for percolation of water to avoid surface run off.
6. Construction of check dam and artificial structure in all the blocks of this region to maximize water percolation rate.
7. Construction of tank for storage of water for lean season at Nyay Panchayat area of all the blocks of this region.

8. Creation of rain water harvesting structure in all the blocks of this region.
9. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers.
2. Promotion of line sowing and fertilizers application in crops.
3. Promotion of recommended seed rate, spacing and depth.
4. Promotion of need based application of pesticides and other agricultural inputs.
5. Promotion of hand tools in agricultural and horticultural operations.
6. Adoption of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers
7. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
8. Promotion of pressurized irrigation techniques in horticultural crops.
9. Promotion of tillers and other garden tools for reduction of drudgery.

Strategy 7 : Off-farm income

1. Promotion of subsidiary occupations like poultry, goatry, fish farming and mushroom production in blocks Ramgarh, Mukteshwar, Okhalkanda and Dhari of this region.
2. Promotion of apiculture for small and landless farmers in blocks Ramgarh, Mukteshwar, Okhalkanda and Dhari of this region.
3. Promotion of sericulture in low hills or valley areas in blocks Ramgarh, Mukteshwar, Okhalkanda and Dhari of this region.
4. Promotion of cultivation and collection of medicinal plants in blocks Ramgarh, Mukteshwar, Okhalkanda and Dhari of this region.
5. Promotion of skill development in women and youth in all blocks of this region.
6. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. for better performance.
7. Creation of new SHGs other villages of the district.
8. Creation of new SHGs may in other villages of Ramgarh, Mukteshwar, Okhalkanda and Dhari blocks of this region.

Strategy 8 : Enabling Policies

1. Increasing institutional support by providing subsidises and incentives to small and marginal farmers.
2. Labelling of organic inputs and certification mechanism for various crops.
3. Popularization of Udhyan and KCC for widespread use of government incentives/subsidies to farmers.
4. Establishment of wood bank at Ramgarh and Mukteshwar to meet the present and future demand of germplasm in horticultural crops.
5. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
6. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
7. Implementation of Soil Health Card Scheme in each block.

Strategy 9 :Marketing and value addition in specific agro-ecological region

7. Creation of better transportation facilities with Refrigerated Van at Block level.
8. Creation of direct linkages with food processing industries for better prices.
9. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
10. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural

surplus with proper labelling.

11. Installation of mini grading machines at village level.
12. Establishment of cold room in different clusters.

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 radio, TV talks and Whatsapp etc. for effective implementation of program.