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

Agro-ecological region : Region A- (up to 1000); Region B (1000-1500); Region C (1500-2400);Region D (>2400)

A. General information about Agroeco-region

District : Tehri Garhwal

Agro-ecological region :

Region A (up to 1000 m)
Region B (1000-1500)
Region C (1500-2400)
Region D (>2400)

Main Blocks in Region :

Pratapnagar
Narendranagar
Kirtinagar
Chamba
Thauldhar
Jakhnidhar
Bhilangana
Jaunpur
Devprayag

Main village cluster in blocks:

Dharkot, Okhalakhal, Rajakhet, Kathuli
Bhoniyada, Madan Negi Roniya
Salamkhet, Maun, Guriyali Kuri, Khathyar, Nala, Pali, Jajal
Sabli, Dargi, Weed, Jagdhar, Chamni, Nakot,
Kanda, Lamkot,
Kot, Kot Kulogi, Dadur,
Baur, Dabri, Kaleth, Aleru
Jhaknidhar, Anjanisain

Irrigated Clusters : Weed, Dadur, Mudiya Gaon, Kot, Kot Kulogi, Kaleth, Nala, Pali
Rampur, Tipli, Jardhargaon, Nagni, Jajal

Rainfed Clusters : Sabli, Dargi, Jagdhar, Salamkhet, Maun, Guriyali, Kuri, Khathyar, Nala, Pali, Ramgarh, Baur, Dabri, Aleru

Existing rain water management facilities:

1. Very less facilities and rain water harvesting units are available in the district.
2. Diversion of perennial springs and streams through guhls
3. Storage tanks (Hauj)
4. Village pond (Taal and Chaal)
5. Collection from hill slope (Khaal)
6. Hydrum as lift device
7. 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. Construction of small sized rain water harvesting with LDPE/HDPE tanks, making bunds, trenches and check dams.

2. Low cost lining material to check seepage
3. Efficient water application systems (sprinkler and drip)
4. Rejuvenation and popularisation of traditional water harvesting systems
5. Cost effective lifting devices
6. Roof top water harvesting system

2. Existing practices for soil health improvement

1. Adequate soil testing facilities are not available.
2. Use of FYM, Vermi-compost.
3. Meagre/ no use of biofertilizers
4. Imbalanced/ insufficient nutrient use
5. Use of raw/partially decomposed FYM
6. Meagre/ no compost making/recycling of crop residue
7. Mixed cropping of cereal and legume in few pockets
8. Soil health card scheme launched in 2015

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

1. Establishment of soil testing labs at Block level and Nyaypanchayat level for soil sampling, testing and soil health card distribution.
2. Availability of nutrients/ micro-nutrients through cooperative societies.
3. Promotion for use of organic fertilizers/ Bio fertilizers and bioagents.
4. Use of recommended doses of FYM/Vermi-compost for better soil health.

Cereals and oilseeds

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

Pulses and soybean

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

Vegetables and spices

1. Seed/ nursery soil inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture (each of 200 g/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
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

1. Regular Occurrence: Frost, Drought, Cold wave.
2. Almost 90% agriculture is rainfed, which requires robust strategies of rainwater conservation and harvesting.
3. Soil erosion due to steep slopes and rainfall is quite high.
4. Field crops such as rice, wheat, mandua, jhangora are major crops of the region.
5. Vegetables and horticultural crops are being grown over very small area, except Apple, which is being grown over large area.

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

The climatic projection suggesting increasing air temperature and erratic distribution of rainfall. Therefore following strategy should be followed to increased income under changing climatic scenario.

1. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
2. The rain water should be properly stored (In polythene tank, and by making bunds) and harvested for Kharif season crops.
3. Soil erosion triggered by higher slope gradient is the major issue of Tehri Garhwal. Therefore water and soil conservation techniques like terrace farming, bunding etc should be encouraged.
4. The area of off season vegetable should be increased.
5. The frost susceptible vegetable crops should be grown on southern aspect of topography so that availability of radiation increases and the effect of frost could be minimized.
6. Crop residues should be burnt in the previous night if there is forecast of frost.
7. Organic mulch should be used in a vegetable field for enhancing energy level in field so that crop should be protected from frost.
8. The summer temperature of major part of southern part of Tehri Garhwal is suitable for cultivation of French bean, therefore French bean cultivation should be encouraged.
9. The climatic conditions, slope gradients and soils are suitable for sub tropical (in Valley region Citrus fruits, Mango) and Temperate fruits (Apple, pear, peach, Apricot, Walnut).
10. Due to increasing temperature the new orchards should be developed at higher altitudes to meet out the chilling requirement.

6A. Name of Field Crop : Wheat

i. Existing varieties being used

Region A (up to 1000 m) & Region B (1000-1500 m): VL 832, VL 738, HS 240, UP1109, VL 804, VL 802, UP 2572, VL 616, HPW 251

Region C- HPW 42, HS 365, VL 832, HPW 155

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 and UP 2572

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. Use of undecomposed FYM.

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

1. **High yielding varieties (HYV)** seed and adoption of recommended seed rate 100kg/ha, line to line distance 23cm, right time for sowing –15th October to 15th November, Fertilizer requirement- N-P-K: 60-30-20kg/ha (For rainfed) and N-P-K: 120-60-40kg/ha(For irrigated condition)
2. Sowing should be done in Ist & IInd fortnight of October to proper utilized moisture for seed germination.

3. Application of proper seeds rate to maintain optimum crop density. 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.
7. 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.
8. Promotion of Cluster based farming in integrated approach, Proper Utilization of Fallow land by planting short duration pulse, vegetable and other horticulture crops.

v. Major insect pests associated with crop

Cutworm ,Termites, Aphids

vi. IPM Module for management of insect pests

Cut worm

1. Avoid late sowing of crop to save crop from armyworm.
2. Spray in afternoon any of the following insecticides after diluting in 500 litre of water/ha when 4-5 larvae are recorded per meter row:

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

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:

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

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

vii. Major disease associated with crop

Yellow rust , loose smut Powdery mildew, Karnal bunt

viii. IPM Module for management of disease

Karnal bunt: *Tilletia indica* = *Neovossia indica*

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

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 Bio-Fungicides	(gm)/(Kg seed/lit water)	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

ix. Major weeds associated with crop

Phalaris minor, Bathua (*Chenopodium album*)

x. IPM Module for management of weeds

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. Proper adoption of package of practices after soil testing analysis
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, Cluster based farming and Inter cropping.

xii. Production constraints in agro-ecological region

1. Non-availability of good quality seeds.
2. Non adoption of package of practices.
3. Most of the area in district is under rainfed condition.
4. Wild animals damage and scattered land holding.
5. Unavailability of proper irrigation facilities.
6. Lack of quality seed, poor awareness of seed treatment, poor weed management,
7. Imbalanced use of chemical fertilizer, lack of awareness about pest and disease management among farmers, difficulties to use heavy modern agriculture implement due to hilly terrain.
8. Proper marketing of agriculture produce is not available, Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

6B. Name of Field Crop : Rice

i. Existing varieties being used

Region A (up to 1000 m): Pant dhan-11, Govind, HKR-47, Pant Dhan -6, VL-62, VL 91, VL-16, Sarju-52

Region B & Region C- VL- 81, Vl-82, Pant Dhan-10, Pant Dhan-12, VL-221, VL-206

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

(Irrigated - VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85,* Pant Dhan-19, Pusa Basmati 1509; Spring rice - VL Dhan 208 and VL Dhan 209; Jethi rice - Vivek Dhan 154 and VL Dhan 157)

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 of rice which are susceptible against various pests and diseases, farmers also not using proper compost before rice cultivation, they use imbalanced chemical fertilizers.
3. 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

Paddy under rainfed conditions

Seed rate 100kg/ha, Line to line distance 20cm, Fertilizer requirement- N-P-K: 60-30-20kg/ha, Pendimethaline @3Lit/ha before seed germination for weed management.

Paddy under irrigated conditions

Seed rate 40kg/ha, Line to line distance 20cm, nursery sowing –First fortnight of May, Fertilizer requirement- N-P-K @100-60-40kg/ha, use Butachlore @1.5kg/ha after 2-3days of transplanting of nursery for weed control.

v. Major insect pests associated with crop

Rice Stem borer, Brown plant hopper and white grub

vi. IPM Module for management of insect pests

Stem borer:

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

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

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

50 Days within transplating (2 inch water in field)

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

50 Days after tranplanting

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

Bio-insecticides

Name of the 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	

Brown plant hopper: *Nilaparvata lugens*

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

Buprofezin 25% SC	800	20
Clothianidin 50% WDG	20-24	12
Dinotefuran 20% SG	150-200	10
Flonicamid 50% WG	150	36
Pymetrozin 50% WG	300	19
Imidacloprid 17.8% SL	100-150	40
Imidacloprid 30.5 %SC	60-75	37
Imidaclorpid 70% WG	30-35	7
Acetamiprid 20 %SP	50-100	7
Acephate 75% SP	666-1000	15
Acephate 95 % SG	592	30
Thiamethoxam 25 %WSG	100	14
Monocrotophos 36 %SL	1400	
Fipronil 5 %SC	1000-1500	32
Ethiprole 40%+ Imidacloprid 40% WG	125	15
Chlorpyriphos 20%+ Acetamiprid 0.4%EC	2500	10
Buprofezin 15% + Acephate 35 WP	1250	20
Flubendamide 4%+ Buprofezin 20 SC	175+700	30

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 5% (Neem extract concentrate containing)	375	5
Metarhizium anisopliae 1.15% WP	2500	

vii. Major disease associated with crop

Rice blast, bacterial leaf blight, brown spot, sheath 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

Sheath blight: *Rhizoctonia solani*

Drain of water to check spread of sheath blight.

Name of the Fungicides	**(gm/ml)/ha**	**Waiting period (days)**
Carbendazim 50 %WP (Seed Treatment)	2	
Carbendazim 50 %WP	250-500	
Propiconazole 25% EC	500	30
Hexaconazole 5% EC	1000	40
Hexaconazole 5% SC	1000	40
Difenoconazole 25% EC	0.05%	25

Flusilazole 40% EC	300	24
Tebuconazole 250% EC (25.9%)	750	10
Validamycin 3% L	2000	14
Iprodione 50% WP	2250	35
Pencycuron 22.9% SC	150-188	600-750
Thifluzamide 24% SC	375	28
Cresoczim-methyl 44.3 %SC	500	30
Tebuconazole 50% +Trifloxystrobin 25% WG	200	21
Carbendazim 12%+Flusilazole 12.5 %SE	800-960	54
Iprodione 25% + Carbendazim 25% WP	500	
Propiconazole 13.9%+ Difenoconazole 13.9% EC	0.07-0.1%	46
Tebuconazole 50% +Trifloxystrobin 25% WGs	200	31

Biofungicides:

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

Brown leaf spot: *Cochiobolus miyabianus*

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

Biofungicides

Name of the Bio-Fungicides	**Kg/ha**	**Treatment**
Pseudomonas fluorescens 1.5% WP (BIL-331 Accession No. MTCC 5866)	2.5 Kg/hectare	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

Echinochloa, Ageratum conyzoids, Phyllanthus urinaria, Saccharum spontaneum L. laptocloa, sedges

x. IPM Module for management of weeds

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	

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

1. Proper adoption of package of practices with suitable information bridging can intensify the Rice production in the district.
2. Application of fertilizers should done after proper nutrient analysis.

xii. Production constraints in agro-ecological region

1. Farmers don't follow proper package of practices, Proper market linkage is not available, improper use of irrigation facilities, lack of quality input.
2. Region B & Region C: Unavailability of proper irrigation facilities.
3. Lack of quality seed, poor awareness of seed treatment, poor weed management, imbalanced use of chemical fertilizer, lack of awareness about pest and disease management among farmers, difficulties to use heavy modern agriculture implement due to hilly terrain.
4. Proper marketing of agriculture produce is not available, Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

6C. Name of Field Crop : Barley

i. Existing varieties being used

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : 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

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : (VL Jau 118 and VLB 94)

iii. Existing package of practices being used

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

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

Region A, Region B, Region C:

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. Promotion of inter/mix cropping

with other crops to minimize the loss of crop failure in case of drought.

3. Proper weed management, proper monitoring and management of insect and pest.
4. Besides the above measure need to create irrigation facilities by construction of water harvesting tank.
5. Balanced use of nutrients to be applied in the soil as per the soil testing report.
6. 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.
7. Promotion of Cluster based farming in integrated approach, Proper Utilization of Fallow land by planting short duration pulse ,vegetable and other horticulture crops.

v. Major insect pests associated with crop

Region A, Region B, Region C: Aphid, white grub

vi. IPM Module for management of insect pests

Wheat aphid: *Macrosiphum (Sitobion) avenae* or *Macrosiphum miscanthi*)

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

Barley aphid: *Macrosiphum* sp.)

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

White grub:

Light trap be used during adult emergence in the month of June-July for mass trapping.

vii. Major disease associated with crop

Region A, Region B, Region C: Yellow rust, Powdery mildew, Karnal bunt

viii. IPM Module for management of disease

Karnal bunt: *Tilletia indica* = *Neovossia indica*

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

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 Bio-Fungicides	**(g)/(Kg/lit.**	**Waiting period (days)**

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

ix. Major weeds associated with crop

Region A, Region B, Region C: *Phalaris minor, Chenopodium album*, wild oat

x. IPM Module for management of weeds

1. Summer ploughing, Isoproturon 1.0 KG ai/ ha.
2. Removal of weed by intercultural operation and by application of 2,4-D, Met sulfuron methyl, isoproturon (1to 1.25 liter/ha) + clodinofob 60 gm ai per ha after Ist irrigation.

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

Jangli Chaulai: Green Amaranth: *Amaranthus viridis, A.spinosus* (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

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

Region A, Region B, Region C:

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, Cluster based farming, Inter cropping.

xii. Production constraints in agro-ecological region

Region A:

Farmers don't follow proper package of practices, Proper market linkage is not available, improper use of irrigation facilities, lack of quality input.

Region B & Region C:

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

6D. Name of Field Crop : Ragi

i. Existing varieties being used

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : 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

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : VL 324, VL352, VL347, PRM 1, VL 348

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, they use imbalanced chemical fertilizers.
4. 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. Use of HYV seed with seed rate 10kg/ha, Line to line distance 20cm,
2. Fertilizer requirement- N-P-K: 40-20-20kg/ Application of Isoproturon @0.75 kg/ha after 30-35 days after sowing for weed control
3. Proper application of compost and farm yard manure and Green manuring must be followed before two months of planting.
4. Moong can be grown during summer season to improve the soil health.
5. Line planting must be done in area were irrigation facilities available, to minimize weed infestation proper management of weed must be done,
6. Incidence of pests and diseases should be taken care properly.
7. Water harvesting tank need to be created in rain fed areas to provide timely irrigation.
8. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.
9. 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 insect pests associated with crop

White grub, Stem borer

vi. IPM Module for management of insect pests

1. Use of kurmula trap and entomopathogenic fungi formulations for control of white grub

White grub: *Holotrichia* sp.

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Phorate 10 %CG	2500	25000

vii. Major disease associated with crop

Blast

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Oxalis latifolia, Phylanthus niruri, Amaranthus viridis, Uphorbia hirata, solanum sp, Tribulus sp, Cypurus sp.

x. IPM Module for management of weeds

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

1. Adoption of package of practices after proper soil nutrient analysis.
2. Maximum use of value added compost/FYM
3. INM and soluble fertiliser
4. Integrated weed management
5. IPM
6. Good storage condition
7. Sale of value added products
8. Sowing of crop in suitable cropping pattern under irrigated condition.

9. Need of agriculture diversification with horticultural crops along with live stocks management.
10. Adoption of proper cropping pattern, Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop, Cluster based farming, Inter cropping.
11. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region

1. Non adoption of package of practices
2. Most of the areas in the district are under rainfed condition.
3. Wild animals and scattered land holding

Region A:

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

Region B & Region C:

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

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

iii. Existing package of practices being used

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

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

1. 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 practices

v. Major insect pests associated with crop

Stem borer

vi. IPM Module for management of insect pests

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vii. Major disease associated with crop

Blight, smut

viii. IPM Module for management of disease

Smut

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

ix. Major weeds associated with crop

Oxalis latifolia, Phylanthus niruri ,Amaranthus viridis,euphorbia hirata,solanum sp*,Tribulus* sp*,Cypurus* sp

x. IPM Module for management of weeds

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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

6F. Name of Field Crop : Maize

i. Existing varieties being used

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

(Vivek QPM 9, Vivek Maize Hybrid 45, Vivek Maize Hybrid 53,CMVL Sweet Corn 1, CMVL Baby Corn 2)

iii. Existing package of practices being used

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. They also do not follow balance use of chemical fertilizers. It is also observed that due to lack of knowledge,
3. 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. Adoption of recommended package of practices.
2. Green manuring must be followed before two months of sowing.
3. Moong can be grown during summer season to improve the soil health.
4. Line planting be done to minimize weed infestation, incidence of pests and diseases and for ideal vegetative growth of the plants.
5. Sowing should be done in Ist fortnight of June in plains and hills of state.
6. Water harvesting tank need to be created in rain fed areas to provide timely irrigation.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.
8. Quality seed of high yielding varieties should be preferred after that seed must be treated with carbendazim 2 g per kg of seed before sowing.
9. In order to avoid lodging problem in hilly areas, hybrids such as 9164 having dwarf in nature and provide yield up to 25 Q per acre should be preferred for commercial cultivation.

v. Major insect pests associated with crop

stem borer, white grub, shoot fly, cut worm and blister beetle

vi. IPM Module for management of insect pests

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

Shoot fly: *Atherigona soccata*

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Phorate 10 %CG	3000	30000
Dimethoate 30% EC	350	1155
Monocrotophos 36% SL	250	625
Oxydemeton methyl 25% EC	250	1000

vii. Major disease associated with crop

leaf blight, leaf blast and common rust

viii. IPM Module for management of disease

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

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

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

ix. Major weeds associated with crop

Cyanodon dactylon and *Chloris barbata*

x. IPM Module for management of weeds

1. Use of recommended weedicides
2. Apply Atrazine 50%WP @ 1.0 kg a.i/ha or Alachlor 50%EC @ 2.5 kg a.i/ha or Diuron @ 0.8 kg a.i/ha within 3 days after sowing followed by one hand weeding at 25-30 days after sowing.
3. Apply 2, 4-D Dimethyl Amine Salt 58%SL @ 0.5 kg a.i/ha or 2,4-D Ethyl Ester 38%EC @ 0.9 kg a.i/ha at 25 days after sowing to control broad leaf weeds.

4. Apply Tembotrine @ 120 g a.i/ha at 15-20 days after sowing to control grassy and non grassy weeds.
5. Minimum two hand weeding at 20& 35 DAS are required

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

1. Proper adoption of package of practices with soil nutrient analysis.
2. Use of HYV, Gapfilling/Transplating
3. Contour cultivation and care soil & water conservation measures
4. Maximum use of value added compost/FYM
5. INM and soluble fertiliser
6. Integrated weed management
7. IPM
8. Good storage condition
9. Sale of value added products

xii. Production constraints in agro-ecological region

Region A:

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.

Region B & Region C:

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment, poor weed management, imbalanced use of chemical fertilizer, lack of awareness about pest and disease management among farmers, difficulties to use heavy modern agriculture implement due to hilly terrain.
3. Proper marketing of agriculture produce is not available; Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

7A. Name of the Pulse Crop : Pigeon pea

i. Existing varieties being used

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : 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

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : VL *Arhar* 1

iii. Existing package of practices being used

Region A, Region B & Region C:

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

Region A, Region B & Region C:

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, pod fly, bugs

vi. IPM Module for management of insect pests

1. Deep ploughing in summer
2. Intercrop with sorghum for reducing *Helicoverpa armigera*.
3. Early planting (mid- June) for avoiding peak infestation period of *H. armigera* on short duration crop
4. Planting of tall sorghum /maize varieties on borders for conserving natural enemies. These plants also function as live perches for predatory bird.
5. First spray of *Ha* NPV@ 500 LE per ha or *B.t.* 1 kg/ha followed by second spray of NSKE5% .

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	

Red gram podfly: *Melagromyza obtusa*

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Monocrotophos 36% SL	625	
Carbaryl 10% DP	20000	
Lambda cyhalothrin 5% EC	400-500	15
Lufenuron 5.4% EC	600	65
Quinalphos 25% EC	1400	

vii. Major disease associated with crop

Wilt, Yellow Mosaic, Blast

viii. IPM Module for management of disease

Blast disease

For management of, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha

Yellow mosaic disease:

For the control of white fly or its vector by application of Imidachlorpid 200 ml/ha

Wilt of pigeon pea: *Fusarium oxysporum* f.sp. *ciceris, Gibberella indica*

Name of the Fungicides	(gm/ml)/ha	Waiting period (days)
Carboxin 37.5%+ Thiram 37.5% DS	4/Kg	Seed Treatment

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 a.i. 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 and Inter cropping.
5. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region

Region A:

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

Region B & Region C:

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,
5. Difficulties to use heavy modern agriculture implement due to hilly terrain.
6. Proper marketing of agriculture produce is not available, Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

7B. Name of the Pulse Crop : Chick pea

i. Existing varieties being used

Region A, B & C: 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

Region A, B & C: Pant Kabli chana-1, GNG-1969, Aman, GNG-1958

iii. Existing package of practices being used

Region A, Region B & Region C:

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

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

Region A, Region B & Region C:

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

v. Major insect pests associated with crop

Region A, Region B & Region C: White fly, Pod borer, Thrips

vi. IPM Module for management of insect pests

G**ram 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.

Gram pod borer: *Helicoverpa armigera*

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

Region A, Region B & Region C: Yellow Mosaic, Blast

viii. IPM Module for management of disease

Blast disease:

Apply tricyclozole 400-500 g in 500-600 litre of water per ha.

Yellow mosaic disease

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

Region A, Region B & Region C: 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 to grow as main crop during rabi in line of wheat
2. Inter cropping
3. Judicious application of fertilizers
4. Proper insect-pest and weed management

xii. Production constraints in agro-ecological region

Region A:

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

Region B & Region C:

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

7C. Name of the Pulse Crop : Urd

i. Existing varieties being used

Narendra Urd 1, Pant 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-31, 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

Blister beetle, white grub, thrips and pod fly

vi. IPM Module for management of insect pests

1. Collect and destroy affected plants with egg masses and gregariously feeding larvae of hairy caterpillar and tobacco caterpillar.
2. Spray NSKE 5% or monocrotophos36EC @ 437 ml/ha or for controlling defoliators, tobacco

caterpillar and bugs

3. Seed treatment with imidacloprid (5 g/kg seed) followed by foliar application of thiamethoxam (150 g/ha) / at flowering and indoxacarb (500 ml/ha) at podding stages of crop (as per AICRP recommendation).

vii. Major disease associated with crop

Yellow mosaic disease, rust, powdery mildew and leaf blight

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Amaranthus viridis& Echinochloa

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. Proper adoption of package of practices with suitable information bridging can intensify the urd production in the district.
2. Sowing of crop in suitable cropping pattern under irrigated condition.
3. Need of agriculture diversification with horticultural crops along with live stocks management,
4. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables,
5. Oilseeds and pulse crop, Cluster based farming, Inter cropping. Needs to promote local germplasm.

xii. Production constraints in agro-ecological region

Region A:

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

Region B & Region C:

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, lack of awareness about pest and disease management among farmers, Difficulties to use heavy modern agriculture implement due to hilly terrain.
4. Proper marketing of agriculture produce is not available, Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land,
5. Migration and lack of interest in agriculture. Non-availability of good quality plants on time.
6. Non adoption of package of practices.
7. Wild animal damage and scattered land holdings.

7D. Name of the Pulse Crop : Mung

i. Existing varieties being used

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : 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

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : Pant moong-5, IPM-02-03, Shweta.

iii. Existing package of practices being used

Region A, Region B & Region C:

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

Region A, Region B & Region C:

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

Region A, Region B & Region C: 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`

Region A, Region B & Region C: Yellow Mosaic, Blast

viii. IPM Module for management of disease

Region A, Region B & Region C:

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

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

Region A, Region B & Region C: Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Region A, Region B & Region C:

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

Region A:

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.

Region B & Region C:

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

7E. 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

Pant Lentil -8, VL Masoor 125, VL *Masoor* 126, VL *Masoor* 507 and VL *Masoor* 514

iii. Existing package of practices being used

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

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

1. Preparation of land- 1 or 2 ploughing
2. Seed rate and seed sowing – 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)
6. Rainfed- pre emergence
7. Use of IPM practices

v. Major insect pests associated with crop

Pod borer

vi. IPM Module for management of insect pests

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vii. Major disease associated with crop

Wilt

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

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x. IPM Module for management of weeds

-

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

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

xii. Production constraints in agro-ecological region

1. Farmers don't follow proper package of practices
2. Proper market linkage is not available

7 F. Name of the Pulse/oilseed Crop : Soyabean

i. Existing varieties being used

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : 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

Region A (up to 1000 m) Region B (1000-1500) : Region C (1500-2400) : (Pant Soaybean 1092, Pant Soaybean 1225, VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65)

iii. Existing package of practices being used

1. **POP**- seed rate 75kg/ha, Line to line distance 45x7.5cm, right time for sowing –First fort night of June.
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. 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. **POP**- seed rate 75kg/ha, Line to line distance 45x7.5cm, right time for sowing –First fort night of June, Fertilizer requirement- N-P-K: 20-80-40kg/ha. For weed control use Alachlore@2kg/ha before seed germination.
2. Timely sowing of crop in Ist fortnight of June to IInd fortnight of July.
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, leaf miner, jassid, stem fly, pod borer, defoliators etc.

vi. IPM Module for management of insect pests

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:

1. Reduction of insect pest population by means of manual devices or labour is called mechanical control.
2. The following measures are recommended for mechanical practices for soybean insect pests.
3. Collection and destruction of girdle beetle infested plant parts, egg masses and gregariously feeding larvae of Bihar hairy caterpillar and tobacco caterpillar.
4. Hand picking and mechanical destruction of matured pod borer larvae.
5. Erection of bird perches @ 10-12/ha to attract predatory birds for preying on defoliator larvae.

Physical control:

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

Biological Control:

1. The successful management of a pest by means of another living organism (parasitoids, predators and pathogens) is called biological control.
2. The following biological control agents are used in IPM of soybean.
3. Release of *Tricogramma chilonis* @ 50,000/ ha four times at weekly interval against *S. litura*.
4. Spraying of *Bacillus thuringiensis* var. kurstaki @ 0.75 to 1.0 kg/ha for the management of defoliators.
5. Foliar application of HaNPV (*Helicoverpa armigera* Nuclear Polyhedrosis Virus) for *H. armigera* @

250 LE/ha.

6. 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 and Jassids	Lady bird beetles: *Coccinella septumpunctata* *Coccinella transversalis*
Lepidopterous caterpillars	Pentatomid bug *Eocanthecona furcellata*
Lepidopterous caterpillars, Whiteflies and Jassids	Spiders: *Lynx* spider and Orb weaver spider

Chemical Control:

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

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

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

Table 4: List of insecticides recommended for soybean insect pests

Insect pest	**Insecticide**	**Dosage**
Sucking pests, stem fly	Thiamethoxam 30 FS (Seed treatment)	10ml/kg seed
Sucking pests	Acetamiprid 20 SP	100 ml/ha
Sucking pests	Spiromesifen 22.9 SC	600ml/ha
Sucking pests	Imidacloprid 17.8 SL	500 ml//ha
Sucking pests and girdle beetle	Triazophos 40 EC	800ml/ha
Defoliators	Dichlorovos 76EC	500 ml/ha
Defoliators and pod borer	Quinalphos 25 EC	1500 ml/ha
Sucking pests and defoliators	Monocrotophos 36 SL	800 ml/ha
Pod borer	Indoxacarb 15.8EC	333 ml/ha
Defoliators, stem fly and girdle beetle	Chlorantraniliprole 18.5 SC	150 ml/ha
Leaf miner	Carbaryl 50WP	2.0 kg/ha
Leaf miner and sucking pests	Oxydemeton methyl 25EC	350 ml/ha
Girdle beetle	Phorate 10 G	10 kg/ha
Stemfly and girdle beetle	Carbofuran 3 G	30 kg/ha

vii. Major disease associated with crop

Frog eye leaf disease

viii. IPM Module for management of disease

Use of resistant varieties and recommended dose of fungicides

ix. Major weeds associated with crop

Setaria, Cyprus, Galinsoga parviflora etc.

x. IPM Module for management of weeds

For weed control use Alachlore @2kg/ha before seed germination.

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

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

xii. Production constraints in agro-ecological region

Region A:

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.

Region B & Region C:

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, lack of awareness about pest and disease management among farmers, Difficulties to use heavy modern agriculture implement due to hilly terrain.
4. Proper marketing of agriculture produce is not available, Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

7G. Name of the Oilseed Crop : Toria/ Sarson

i. Existing varieties being used

Rara,Gharia

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

PT-303,507,Uttara, PPS-1

iii. Existing package of practices being used

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

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

1. Deep ploughing during summer months
2. **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.
3. **Sowing time to improve productivity and income:**
   Toria: Last week of September.
   Yellow *sarson* & *rai* (Mustard): First fortnight of October.
4. **Seed treatment**
   Seed treatment: Apron 35 SD @ 5g/kg. Only certified seeds should be used.
5. **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.
6. **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**.
7. **Nutrient management:**
   i. Vermicompost: 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.
   ii. Excess use of nitrogenous fertilizers should be avoided.
   iii. **Nitrogen:** 120kg/ha **;** 60-80 kg/ha for *toria* **;** Half of the N as basal and remaining half be top dressed about 25- 30DAS
   iv. **Phosphorus**: 40 kg/ha as basal; Phosphorus be applied as SSP; if SSP is not available, 20 kg/ha

Sulphur shall be applied as basal.

v. **Potassium**: 20 kg/ha as basal

8. **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.
9. **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

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, Downy Mildew

viii. IPM Module for management of disease

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 Insecticides	(gm/ml)/ha	Waiting period (days)
Iprodione 50% WP	2250-3000	50

White rust : *Albugo candida*

Name of the Insecticides	(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 Insecticides	(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

About 20-25 days after sowing a hand weeding be done along with the thinning operation to take out the emerged weeds

Umbrella plant: *Cyperus* sp.(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 un decomposed FYM
3. Climate changing, Wild animal damages
4. Migration specially from border area

Poor Irrigation facilities

8A. Name of the Fruit Crop : Mango

i. Existing varieties being used

Seedling origin and Local variety

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

Amrapali, Dashehari, Bombay Green

iii. Existing package of practices being used

1. Non adoption of package of practices.
2. Only FYM manuring and occasional pesticide application.

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

1. Adoption of recommended package and practices.
2. Basin preparation.
3. Use of balanced fertilization.

v. Major insect pests associated with crop

Mango shoot caterpillar, leaf hopper and fruit fly, stem borer, mealy bug

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, anthracnose, die back

viii. IPM Module for management of disease

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

Powdery mildew: *Oidium mangiferae*

Name of the Fungicides	**(gm/ml)/ha**	**Waiting period (days)**
Azoxystrobin 23% SC	0.1%	5
Carbendazim 50% WP	0.1%	15
Penconazole 10% EC	0.05%	30
Hexaconazole 5% EC	0.1%	30
Hexaconazole 5% SC	0.2%	27
Sulphur 80% WDG	1875-2500	
Sulphur 80% WP	3130	
Dinocap 48% EC (per tree)	5	

Anthracnose: *Colletotrichum gloeosporioids*

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

ix. Major weeds associated with crop

Chenopodium album, Cyperus rotundus, Cynadon dactylon, Parthenium, etc.

x. IPM Module for management of weeds

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

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

***Cynodon dactylon* (perennial, dicot, narrow leaves, grass)**

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

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

Name of the Herbicides	(gm/ml)/ha	Waiting period (days)
Carfentrazone ethyl 40% DF	50	80
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38% EC	1320-2200	
Methabenzthiazuron 70 %WP (POE: 30DAS)	2000-2500	100
Methabenzthiazuron 70 %WP (POE: 16-18 DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20%WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Heavy soil)	4200	
Sulfosulfuran 75% WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

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

Adoption of package of practices after proper soil analysis and intercropping with ginger and turmeric.

xii. Production constraints in agro-ecological region

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices.
3. Most of the area is under rainfed condition.
4. Wild animals damage, scattered land holding.

8B. Name of the Fruit Crop : Citrus

i. Existing varieties being used

Seedling other local lime

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

Blood red malta, Pant lemon-1

iii. Existing package of practices being used

1. Rainfed farming mostly.
2. Lack of irrigation facilities.
3. Least emphasis on cultural operations.
4. Less awareness of IPM and INM.
5. FYM manuring.

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

1. Adoption of recommended package of practices
2. Irrigation Facilities
3. Canopy Management.
4. Integrated nutrient management is required.
5. Introduction of Quality planting material.
6. Cultural practices.

v. Major insect pests associated with crop

Lemon butterfly, Psylla, Black fly, Scale insects

vi. IPM Module for management of insect pests

Citrus psylla

1. Collect and destroy the infested plant parts.
2. Conserve parasitoids such as *Tamarixia radiata, Diaphorencyrtus aligarhensis* and predators *Chrysoperla zastrowi sillemi*, coccinellids, syrphids.

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Imidacloprid 17.8% SL	50	15
Thiamethoxam 25% WSG	100	20

Lemon butterfly:

1. Hand picking of all stages and destroy.
2. Grow attractant plants: Carrot family, sunfl ower family, buckwheat, alfalfa, corn, shrubs for lacewing attraction.
3. Nectar rich plants with small flowers i.e. anise, caraway, parsley, mustard, sunflower, buckwheat and cowpea for attraction Braconid wasp.
4. Conserve the parasitoids such as *Trichogramma evanescens*, *Telenomus* spp on eggs *Brachymeria* spp*, Cotesia* on larvae and *Pterolus* sp. on pupae.
5. Spraying of entomogenous - fungus, *Bacillus thuringiensis* Berliner, nematode DD-136 strain or neem seed extract (3%) also gives quite high mortality of caterpillars.

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Quinalphos 25% EC	0.025%	1500-2000

Citrus white flies:

1. Close planting, dense canopy structure and water stress should be avoided.
2. In case of localized infestation, affected shoots should be clipped off and destroyed.
3. Excessive irrigation and application of nitrogenous fertilizers shall be avoided to reduce off season flushes.
4. Indigenous natural enemies can be conserved and augmented by avoiding excessive pesticide application.
5. External Parasite *Tamarixia radiata, Encarsia divergens* and *Tetrastichus radiatus.*

6. Dimethoate (0.03%) or phosphamidon (0.03%) or acephate (0.05%) or neem seed pesticide application. new flush and repeated at 10 days interval once or twice.

Scale insects:

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

Citrus leaf miner: *Phyllocnistis citrella*

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Phorate 10% CG	15000	
Carbofuron 3% CG	50000	
Imidacloprid 17.8% SL	50	15

vii. Major disease associated with crop

Die back, Citrus canker

viii. IPM Module for management of disease

Citrus canker: *Xanthomonas campestris* pv.*citri*

Name of the Fungicides	(gm/ml)/ha
Copper oxychloride 50% WG (per lit)	2.50
Streptocyclin (Spray)	50-100 ppm

ix. Major weeds associated with crop

Chenopodium album, Cyperus rotundus, Cynadon dactylon, Parthenium, etc.

x. IPM Module for management of weeds

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

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

***Cynodon dactylon* (perennial, dicot, narrow leaves, grass)**

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

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

Name of the Herbicides	(gm/ml)/ha	Waiting period (days)
Carfentrazone ethyl 40% DF	50	80
2,4 D Dimethyl amine salt 58% SL	860-1290	
2,4 D ethyl ester 38% EC	1320-2200	
Methabenzthiazuron 70 %WP (POE: 30DAS)	2000-2500	100
Methabenzthiazuron 70 %WP (POE: 16-18 DAS)	1000-1250	100
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20%WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Heavy soil)	4200	

Sulfosulfuran 75% WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

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

1. Adoption of package of practices after proper soil nutrient analysis
2. Proper Canopy Management (Training and Pruning)
3. Spraying schedule is required to avoid the diseases and pest in orchard.
4. INM modules to overcome the early senility of plants.
5. PHM & marketing to be enhanced.

xii. Production constraints in agro-ecological region

1. Non adoption of package of practices
2. Most of the areas are under rainfed condition.
3. Wild animals like monkeys
4. In hilly terrain due to sloppy surface, nutrient loss is more as compared to plains.
5. In rainy season, water logging resulted the canker
6. Early degradation of plant (dieback& physiological disorder) health due to lack of proper nutrient management.

8C. Name of the Fruit Crop : Guava

i. Existing varieties being used

Local varities

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

Alahabad Safeda, L 49, Pant Prabhat

iii. Existing package of practices being used

1. Cultural practise
2. Traditional farming of guava in hills.
3. Scientific cultivation of guava in Haridwar and US Nagar districts.
4. Application of FYM and fertilizers traditionally.

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

1. Adoption of recommended Package of practice**s.**
2. Establishment of high density and meadow orchard.
3. Advance training and pruning is required.
4. Canopy Management.
5. Rejuvenation of Senile orchard.
6. IPM and INM approach to be emphasised.
7. Intervention of Mulching.

v. Major insect pests associated with crop

Fruit fly, fruit borer, white fly and aphids

vi. IPM Module for management of insect pests

Guava fruit borer/ castor capsule borer:

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

Guava butterfly:

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

vii. Major disease associated with crop

Wilt, canker, hyaloderma leaf spot and sooty mould

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Cynadon dactylon and *Cyperus rotundus*

x. IPM Module for management of weeds

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

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

***Cynodon dactylon* (perennial, dicot, narrow leaves, grass)**

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

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

1. Proper adoption of package of practices after soil nutrient analysis
2. Enhancing the productivity by cultivating the filler and other vegetables and legumes crop as inter cropping.
3. HDD to be adopted by all farmers.

xii. Production constraints in agro-ecological region

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices.
3. Wild animal damage, scattered land holdings.

8D. Name of the Fruit Crop : Apple

i. Existing varieties being used

Red delicious, Golden Delicious

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

Royal delicious, Golden Delicious and spur varieties

iii. Existing package of practices being used

1. Only FYM
2. Manual training and pruning
3. Use of traditional measures for applying the nutrients.
4. Nutrient application without proper soil testing.

5. Lesser adaptation of scientific approach for digging the pit for new orchard establishment.
6. Rainfed farming of apple.

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

1. Adoption of recommended Package of practices
2. Adaptation of advance technology for training and pruning.
3. Training of farmers regarding holistic approach of apple cultivation.
4. Moisture conservation through poly mulching sheets.
5. Creation of water bodies for irrigation means.
6. Adequate use of available water through micro irrigation systems.
7. Plantation of adequate no. of pollinizing variety.
8. Beekeeping for enhancing the pollination.
9. Use of anti hail/ anti bird net.
10. High density and ultra high density plantation of new varieties with clonal root strock with treliis system with micro irrigation.
11. Promotion of organic apple cultivation.

v. Major insect pests associated with crop

Wooly apple aphid, Scale, tent caterpillar, codling moth

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
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

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.

Apple wooly aphid: *Eriosoma lanigerum*

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Phorate 10% CG (per tree)	10-15	100-150

Carbosulfon CG (per tree)	5	166
Chlorpyriphos 20% EC	0.05%	3750-5000
Oxydemetonmethyl 25% EC	0.025%	1500-2000
Quinalphos 25% EC	0.05%	3000-4000

San jose scale: *Diaspidiotus perniciosus= Aspidiotus perniciosus*

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

vii. Major disease associated with crop

Powdery mildew, scab and canker

viii. IPM Module for management of disease

Powdery mildew of Apple: *Podosphaera leucotricha*

Name of the Fungicides	**(gm/ml)/ha**	**Waiting period (days)**
Dinocap 48% EC (per tree)	3	21
Sulphur 80% WP	2500-5000	
Lime sulphur 22% SC	1%	

Apple scab: *Venturia inaequalis*

Name of the Fungicides	**(gm/ml)/ha**	**Waiting period (days)**
Penconazole 10% EC	0.05%	30
Difenoconazole 25% EC	0.015%	14
Hexaconazole 5% EC	0.05%	30
Fenarimol 12% EC	0.04%	30
Dodin 65% WP	0.075%	21
Dithianon 75% WP	1800	14-21
Thiophanate methyl 70% WP	715	3
Myclobutanil 10% WP	0.04%	21
Propineb 70% WP	0.30%	30
Sulphur 80% WG	1875-2500	
Mancozeb 75% WP (per tree)	30	
Carbendazim 50% WP (per tree)	2.50	
Captan 50% WP	2500	
Ziram 80% WP	1500-2000	21

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. Adoption of package of practices after proper soil nutrient analysis.
2. Intercropping of leguminous crops like rajma, bhat and gahat etc.
3. Cultivation of potato as inter crop during the period of beginning of orchard of normal spacing.
4. Cultivation of some vegetable crop as a intercrops i.e. cabbage, cauliflower , French bean etc in normal spacing.

xii. Production constraints in agro-ecological region

1. Non adoption of package of practices
2. Most of the areas are under rainfed condition.
3. Wild animals like monkeys
4. 90% orchard in rainfed areas.
5. Most of the orchards on south and east slopes where soil is poor.

6. Adverse weather during season hits the spraying schedule of pesticides in apple.
7. Negligence of drainage causes the root rot disease.
8. Lesser attention on sanitation of orchard which leads the infection of diseases.
9. Lesser adoption of proper technical know-how during training and pruning in high /ultra high density orchard

8E. Name of the Fruit Crop : Peach

i. Existing varieties being used

Traditional plants are used

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

Florda Sun, Saharanpuri No. 1 & No. 2, Florda Prince

iii. Existing package of practices being used

No package of practice are used

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

Adoption of recommended package of practices developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

v. Major insect pests associated with crop

Aphid, tree borer, twig borer, Leaf miner, Hairy Caterpillar, shot borer, stem borer, chaffer beetles, mites, thrips, scale, tent caterpillar, codling moth, aphid, frui 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 .
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%.
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.

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. Use Methyl eugenol trap
4. 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.
5. Bury the infested fruits at 60 cm deep in the soil.

vii. Major disease associated with crop

Leaf curl, Blight, Shot hole

viii. IPM Module for management of disease

Adoption of recommended IPM module developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

ix. Major weeds associated with crop

Common weeds

x. IPM Module for management of weeds

Adoption of recommended IPM module developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

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

Proper adoption of package of practices with after soil nutrient analysis.

xii. Production constraints in agro-ecological region

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices
3. Wild animal damage and scattered land holdings

8F. Name of the Fruit Crop : Pear

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

Bartlet, Max Red Bartlet, Victoria

iii. Existing package of practices being used

No package of practices are used

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

Adoption of recommended Package of practices

v. Major insect pests associated with crop

shoot borer, scale, tent caterpillar, codling moth, aphid, 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
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, viruses 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.

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. Use Methyl eugenol trap
4. 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.
5. Bury the infested fruits at 60 cm deep in the soil.

vii. Major disease associated with crop

Scab, leaf spots

viii. IPM Module for management of disease

Adoption of recommended IPM modules

ix. Major weeds associated with crop

Chenopodium album, Cyperous rotundus, Cynodum dactylon, Parthenium, etc.

x. IPM Module for management of weeds

Mechanical control

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

1. Adoption of package of practices after proper soil nutrient analysis.
2. Drip irrigation.

xii. Production constraints in agro-ecological region

1. Non adoption of package of practices
2. Most of the areas are under rainfed condition.
3. Wild animals like monkeys, scattered land holdings.

8G. Name of the Fruit Crop : Plum

i. Existing varieties being used

Traditional varieties are used

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

Kieffer, New Pear, William, Jargonelle, Kieffer, New Pear, William and Jargonelle

iii. Existing package of practices being used

1. No package of practices are used
2. Manual training and pruning
3. Use of traditional measures for applying the nutrients.
4. Nutrient application without proper soil testing.
5. No scientific approach for digging the pit for new orchard establishment.
6. Rainfed farming of apple.

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

1. Adoption of recommended package of practices**.**
2. Adaptation of advance technology for training and pruning. Training of farmers regarding holistic approach of apple cultivation.
3. Moisture conservation through poly mulching sheets.
4. Creation of water sources for irrigational mean.
5. Adequate use of available water through micro irrigation system.
6. Plantation of adequate no. of plants pollinizing variety during layout of orchard.
7. Promotion of other means of pollinating agent to enhance the yield.
8. Use of anti hail net.
9. High density and ultra high density plantation is required.
10. Promotion of organic apple cultivation.

v. Major insect pests associated with crop

San jose scale, tent caterpillar, codling moth, aphid, 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

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

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. Use Methyl eugenol trap
4. 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.
5. Bury the infested fruits at 60 cm deep in the soil.

vii. Major disease associated with crop

Corynium Blight

viii. IPM Module for management of disease

Adoption of recommended IPM modules

ix. Major weeds associated with crop

Chenopodium album, Cyperous rotundus, Cynodum dactylon, Parthenium, etc.

x. IPM Module for management of weeds

Mechanical control

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

Proper adoption of package of practices with after soil nutrient analysis.

xii. Production constraints in agro-ecological region

1. Non adoption of package of practices
2. Most of the areas are under rainfed condition.
3. Wild animals like monkeys, scattered land holdings.

9A. Name of the Vegetable Crop : Cabbage

i. Existing varieties being used

Region A Golden acre or mix of varieties
Region B Golden acre or mix of varieties
Region C Golden acre or mix of varieties

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

Region A, T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole Green star, Pride of India
Region B T-621, Pragati, Indica,, Pusa Mukta , Sri Ganesh Gole
Region C T-621, Pragati, Indica,, Pusa Mukta , Sri Ganesh Gole

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 A- Mid Sept- Oct
   Region B Aug- Sept (Irrigated condition)
   Region C June, July (Rainfed)
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

Diamondback Moth, Leaf Webbers, Aphids

vi. IPM Module for management of insect pests

Before Planting

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

DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

After Planting

1. Regular Monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Hook out the head borer and destroy mechanically. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT . Spray Dipel 8 SP (Bt var. kurstaki) @ 0.2% at 15 days interval after 22-25 DAT to manage DBM.
5. If still the population of larva appears spray cartap hydrochloride 0.5% at 10, 20 and 30 DAS (nursery) and primordial stage against DBM.

Dimond back moth: *Plutella Xyllostella*

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

Bioinsecticides

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

vii. Major disease associated with crop

Downy Mildew, Alternaria Leaf Spot, White Rot, Bacterial Black Rot

viii. IPM Module for management of disease`

Adoption of recommended IPM modules

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.

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 adoption of package of practices
2. Most of the areas are under rainfed condition.
3. Wild animals and scattered land holdings
4. Less availability of high quality seeds
5. High prices of hybrid seeds
6. Post-harvest losses are more due to non availability of
7. storage facility
8. High prices of fertilizers
9. Low prices of farm produce
10. Lack of knowledge about the cultivation practices
11. Lack of processing facilities
12. So far no minimum support price is fixed for the crop.

9B. Name of the Vegetable Crop : Cauliflower

i. Existing varieties being used

Unknown varieties available in the mandi

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

Region A- Early- Early Kunwari, Pusa Kartiki, Pusa Early Synthetic
Mid- Pusa Shubhra, Pant Shubhra, Hisar No.1, Snow crown
Late- Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2.
Region B-(Partial irrigated)
Mid- Snow crown
Late- Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2.
Region C- (Rainfed or partially irrigated) Snow crown

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 A- Early: May- June; Mid: July – Aug;Late: Oct
Region B -Early: May- June (Irrigated condition); Mid: June- july; Late: Aug – Mid Sept
Region C -June-July (Rainfed)

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

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, Aphid

vi. IPM Module for management of insect pests

Before Planting

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

After Planting

1. Regular Monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Destroy the larval stage of insects mechanically.
4. 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.
5. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT. Spray Dipel 8 SP (Bt var. kurstaki) @ 0.2% at 15 days interval after 22-25 DAT to manage DBM.
6. If still the population of larva appears spray following insecticides against DBM.

Dimond back moth: *Plutella Xyllostella*

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

Bioinsecticides

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

vii. Major disease associated with crop

Stem rot, Black rot and Downy Mildew

viii. IPM Module for management of disease

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

Downy Mildew:

1. Burn the infected crop debris,

Spray of mancozeb @ 2.5 gm/litre at initial stage of disease appearance.

ix. Major weeds associated with crop

Parthenium, Chenopodium album, Krishnil, Teepatiya

x. IPM Module for management of weeds

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

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

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

Adoption of package of practices after proper soil nutrient analysis.

xii. Production constraints in agro-ecological region

1. Non adoption of package of practices
2. Most of the areas are under rainfed condition.
3. Wild animals and scattered land holdings
4. Less availability of high quality seeds
5. High prices of hybrid seeds
6. Post-harvest losses are more due to non availability of
7. storage facility
8. High prices of fertilizers

9. Low prices of farm produce
10. Lack of knowledge about the cultivation practices
11. Lack of processing facilities
12. So far no minimum support price is fixed for the crop.

9C. Name of the Vegetable Crop : Radish

i. Existing varieties being used

Local varieties, Dunagiri

Mixture of varieties from unknown source

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

Region A- Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant, Punjab Pasand

Region B- (Partially irrigated) Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant, Punjab Pasand

Region C: (rainfed) Japanese White, Pusa Himani, Mino early, Ankur Naveen, Century -11

iii. Existing package of practices being used

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-
   Region A: Sept- Dec
   Regin B: Sept- Oct
   Region C: June-Aug
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, flea beetles and mustard saw fly

vi. IPM Module for management of insect pests

Aphid *Aphis gossypii* Glover and *Myzus persicae* (Sulzer) (Aphididae: Homoptera)

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.

vii. Major disease associated with crop

White rust

viii. IPM Module for management of disease

Adoption of recommended of IPM Modules

ix. Major weeds associated with crop

Common weeds

x. IPM Module for management of weeds

Adoption of recommended IPM Modules

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

1. Proper adoption of package of practices with suitable information bridging can intensify the Radish production in the district.
2. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Cauliflower early- Radish- Bottlegourd
   Brinjal-Radish –Chilli
   Bottle bourd-radish-French bean

xii. Production constraints in agro-ecological region

1. Non-availability of good quality seeds on time.
2. Non adoption of package of practices
3. Wild animal damage and scattered land holdings
4. Less availability of high quality seeds
5. High prices of hybrid seeds
6. Post-harvest losses are more due to non availability of storage facility
7. High prices of fertilizers
8. Low prices of farm produce
9. Lack of knowledge about the cultivation practices
10. Lack of processing facilities

9D. Name of the Vegetable Crop : Tomato

i. Existing varieties being used

Private company varieties like Himsona, Rakshhak etc.in all zones

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

Heemsona, Arka Rakshak, Naveen 2000+ and VL Tamatar 4

iii. Existing package of practices being used

1. Generally crop grown in open field condition
2. Sowing time- Oct-Nov. And Jan-Feb
3. Sowing space-75x60 cm and 75x45 cm

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

1. Use Inderminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition. Use Zn in deficient soil.
2. Use micronutrient including Ca, B and Mo
3. Crop rotation Tomato-cowpea-Early cauliflower.
4. Use of hybrid seeds.
5. Availability of area specific hybrid varieties.
6. Promotion of poly house cultivation.
7. Promotion of organic fertilizer and organic pesticides.
8. Advance INM and IPM technology is required.
9. Replacement of wooden staking, which can save the forest.
10. Marketing facilities.
11. Installation of sprinkler with facilities of liquid fertilizers.

v. Major insect pests associated with crop

Fruit Borer, Serpentine Leaf Miner, Whiteflies, Tobacco Caterpillar, Red Spider Mites, Root-knot Nematodes

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

Leaf miner, *Liriomyza trifoli*

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

Aphid, *Aphis gossypii*

Name of the Insecticides	**(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 Insecticides	**(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

Alternaria Blight, Late Blight, Collar Rot, Pseudocercospora Leaf Blight, White Rot, Fruit Rots, Grey Leaf Spot, Bacterial Spot, Bacterial Speck, Leaf Curl Complex

viii. IPM Module for management of disease

In Nursery

1. Soil Solarization of nursery bed by covering with polythene sheet (25 – 50mm) for 45 to 60 days

during April-June.
2. Use TH/PsF colonized compost
3. Seed biopriming with TH / PsF or TH + PsF (10 g/kg seed).
4. Use resistant cultivars like Arka Rakshak, Arka Samrat, Ramya etc., if possible
5. Grow the nursery under tunnel of poly net of 50 mesh.

On Crop

4. Use TH/PsF colonized compost.
5. Use of healthy seedling.
6. Root dipping of seedlings in TH/PsF suspension (10 g/l water).
7. Roguing of virus infected plants and destruction of weeds followed by need based spraying of systemic insecticides for vector management
8. Remove all previous season tomato plants
9. Need based spraying of PsF + mancozeb (2 + 2 kg/ha) at 15 days interval.
10. For the management of soil borne diseases follow crop rotation and rotate crop with maize, rice, wheat, okra or cowpea.
11. In case of bacterial wilt at the time of planting apply bleaching powder@ 20 kg/ha.

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. Proper adoption of package of practices with suitable soil nutrient analysis.
2. Reduce number of spray of pesticides.
3. Raise nursery on treated soil.
4. Treat seed with fungicide before sowing.
5. Manage fog during fruiting period.

xii. Production constraints in agro-ecological region

1. Non-availability of good quality seeds on time.
2. Non adoption of package of practices
3. Wild animal damage
4. Imbalance use of fertilizes.
5. More numbers of pesticides' spay
6. Increase incidences of Bacterial wilt.
7. Intestine raising of tomato crop which leads inefficient management of nutrition in the soil.

9E. Name of the Vegetable Crop : Potato

i. Existing varieties being used

Region A (up to 1000 m): K. Bahar, K Badshah,
and Kufri Jyoti
Region B (1000-1500) : Tumari Local and Kufri Jyoti
Region C (1500-2400): Tumari Local and Kufri Jyoti

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

Region A (up to 1000 m): K. Khyati, K. Pukhraj K . Ashok, K. Sadabahar, K. Anand, etc
Region B (1000-1500): K Jyoti, K. Ashok , K. Himsona
Region C (1500-2400): K Girdhari, K Himalini and K.
Shailja
The seed of above listed varieties are not available or available in less quantity in different zones

iii. Existing package of practices being used

1. Planting time:
   Region A (up to 1000 m): October
   Region B (1000-1500) : Feb-March
   Region C (1500-2400): March-April
2. Spacing: 50-60 x 15-20 cm
3. Seed rate: 25-30 qtl/ha
4. Farmers are only using FYM along with urea at hills but the farmers in plains are using FYM + 160:100:120kg/ha NPK

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

1. Region C: Late blight resistant variety such as K Girdhari, K.Himalini and K. Shailja should be selected for planting. Fertilizer should be used on soil test basis. Dehaulming practise should be adopted for long duration storage of tubers.
2. Suitable fungicides should be used for control of Late blight disease e.g. mancozeb, cardendazim alone and in combination.
3. High quality disease resistant varieties of potatoes as area specific.
4. Irrigation facility is required.
5. Advanced technique of INM/IPM is required.
6. Establishment of weather forecasting stations.
7. Interventions of human resource development.
8. Installation of drip irrigation system.

v. Major insect pests associated with crop

Epilachna beetle, Cutworm, Potato aphids, Potato leaf hopper, Hadda Beetle, Potato tuber moth, Root knot nematode.

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.

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

Early blight, Late blight, leaf roll and mosaic

viii. IPM Module for management of disease

1. Select fields having bacterial wilt incidence during previous years and two - three years crop rotation should be followed. Green manuring +15 t/ha FYM prioer colonized with Pseuodomonas fluorescence helps in minimizing the disease incidence.
2. Use CERTIFIED SEED / disease free seed.
3. If using own seed, treat the whole seed tubers (If not treated before cold storage) with Boric Acid @ 3% for 20 minutes for scab.
4. Plant imroved/ resistant cultivars like Kufri giriraj, K. Himalini, K. Girdhari, K. Himgiri and K. Himsona.
5. Regularly monitor the field and rouge the virus affected plants. Need based spraying of systemic insecticides shuld be done to check the vector population.

Early blight of potato: *Alternaria solani*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorothaonil 75% WP (per lit. water)	0.875-1.250	14
Kitazin 48% EC	0.20%	48
Hexaconazole 2% SC	3000	21
Mancozeb 75% WP	1500-2000	
Propineb 70% WP	0.30%	15
Zineb 75% WP	1500-2000	
Captan 50% WP	2500	
Ziram 80% WP	1500-2000	3
Copperoxychloride 50% WP	1250	
Captan 70%+Hexaconazole 5% WP	500-1000	21

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

Grassy weeds & non grassy weeds

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

x. IPM Module for management of weeds

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

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

1. Proper adoption of package of practices with suitable information bridging can intensify the Potato production in the district.
2. Selection of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja.
3. Seed treatment should be followed.
4. Planting of pre-sprouted tubers should be done.
5. Proper crop rotation to should be followed.
6. Winter/ summer ploughing of fields.
7. Use of organic mulching material in appropriate thickness especially under rain fed mid hills agro climatic conditions.
8. Dehaulming practise should be adopted by the farmers for long duration storage of tubers.
9. Medium size whole tuber should be used as planting material.

xii. Production constraints in agro-ecological region

1. Non-availability of good quality seeds on time.
2. Non adoption of package of practices
3. Wild animals damage
4. The seed of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja is not available in sufficient quantity.

9F. Name of the Vegetable Crop : Brinjal

i. Existing varieties being used

Locally available varieties

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

Navkiran, Brinjal 704 (SunGro Seed), Navina, VNR212 (VNR Seed), Indame Supriya (Indo-American), Pant Rituraj, Pant Samrat (Pantnagar), Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Nursery- Nursery soil generally not sterilize by the farmers.
4. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
5. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
6. Sowing time:
7. Region A: Dec-Jan, June-July
8. Region B: Jan- Feb
9. Region C: Feb- March
10. Transplanting- Farmers practices improper planting distance.
11. Manures- Farmers incorporated cow dung in undecomposed stages in the field.

12. Fertilizers: Farmer use imbalance fertilizer
13. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method..
14. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
15. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

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

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

v. Major insect pests associated with crop

Shoot and Fruit Borer, Nematode

vi. IPM Module for management of insect pests

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, Little leaf

viii. IPM Module for management of disease

Adoption of recommended IPM modules

Blight

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

ix. Major weeds associated with crop

Cyprus rotundus, Panicum repens, Cynodon dactylon, Amaranthus virdis, Parthenium hystrophorus

x. IPM Module for management of weeds

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

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

1. Adoption of package of practices after proper soil nutrient analysis.
2. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Brinjal- Radish-Bottle gourd, Brinjal- spinach-cowpea, Brinjal- Turnip-Amaranthus, Brinjal- Spinach-Bitter gourd etc.

xii. Production constraints in agro-ecological region

1. Non adoption of package of practices
2. Most of the areas are under rainfed condition.
3. Wild animals
4. Less availability of high quality seeds
5. High prices of hybrid seeds
6. Post-harvest losses are more due to non availability of storage facility
7. High prices of fertilizers
8. Low prices of farm produce
9. Lack of knowledge about the cultivation practices
10. Lack of processing facilities
11. So far no minimum support price is fixed for the crop.

9G. Name of the Vegetable Crop : Chilli

i. Existing varieties being used

Local, Andhara Jyoti, LCA-206

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

Kashi Anmol, Pant C-1, Tajwasni, Pusa Sadabhar, Punjab Lal, Panjab Surkh, CH-1 and CH-3

iii. Existing package of practices being used

1. FYM manuring and improper fertilizer application.
2. Growing local varieties.
3. No line transplanting.
4. Generally they plant two over aged seedling at one place.
5. No or very less use of fertilizer.
6. Sowing of untreated seed.

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

1. Adoption of recommended Package of practices
2. Grow high yielding varieties.
3. Treat the seed with copper containing fungicides before sowing.
4. Adopt soil testing.
5. Transplant one seedling at one place.
6. Transplant the seedlings when they attain 5-6 leaf stage.
7. Transplant the seedlings at proper spacing-
8. Dwarf varieties like Kashi Anmol at 45 x 30 cm
9. Tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm.
10. Apply recommended dose of fertilizer (15-20 t FYM + 120: 60:60NPK/ha) after soil test in irrigated condition, whereas under unirrigated condition apply half dose of recommended NPK.

v. Major insect pests associated with crop

Thrips, Yellow/White mite, Root Knot Nematodes, Aphids

vi. IPM Module for management of insect pests

Management strategies sucking pests

A. Crop Hygiene

1. 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.
2. These practices will help reduce the onset of the initial infestation of whitefly, regardless of biotype, and lower the initial infestation level during the cropping period.

B. Other Cultural Control Practices

Use proper pre-planting practices.

1. Vegetative propagated ornamental plants (i.e. *Hibiscus, Poinsettia*, etc.) should not be grown at the same location, especially if bringing in plant materials from other areas.
2. Avoid yellow clothing or utensils as these attract whitefly adults. Delay planting new fall crops as long as possible.
3. Do not plant new crops near or adjacent to old, infested crops.

Use proper post-planting practices.

1. Apply an effective insecticide to kill whitefly adults prior to cultural manipulations such as pruning, tying, etc.
2. Plants should be treated for whitefly adults prior to rouging and, if nymphs are present, should be removed from the field, preferably in plastic bags, and disposed of as far from production fields as possible.
3. Manage weeds within crops to minimize interference with spraying and to eliminate alternative whitefly and virus host plants.

4. Destroy old crops within 5 days after harvest, destroy whitefly infested abandoned crops.

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

Aphid

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Imidacloprid 70% WS (Seed Treatment)	10-15/Kg	
Cyantraniliprole 10.26% OD -	600	3
Fipronil 5% SC	800-1000	7
Carbosulphon 25% EC	800-1000	8
Imidacloprid 17.8% SL	125-250	40
Oxydemetonmethyl 25% EC	1600	
Quinalphos 25% EC	1200	

White fly

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Fanpropathrin 30% EC	250-340	7
Pyriproxyfen5%+ Fanpropathrin 15% EC	750	7

vii. Major disease associated with crop

Die-back, Anthracnose, leaf blight, leaf spot

viii. IPM Module for management of disease

Bacterial leaf spot

Name of the Fungicides	(gm/ml) /ha
Streptocyclin (Spray)	40-100 ppm

Leaf spot: *Cercospora capsici*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Benomil 50% WP	200	
Copperoxychloride 50% WP	1250	
Mancozeb 75% WP	1500-2000	
Myclobutanil 10% WP	0.04%	21
Zineb 75% WP	1500-2000	

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

1. Proper adoption of package of practices with suitable information bridging can intensify the Chilli production in the district.
2. Grow high yielding varieties.
3. Treat the seed with copper containing fungicides before sowing.
4. Adopt soil testing.
5. Transplant one seedling at one place.
6. Transplant the seedlings when they attain 5-6 leaf stage.
7. Transplant the seedlings at proper spacing.

xii. Production constraints in agro-ecological region

1. Non-availability of good quality seeds on time.
2. Non adoption of package of practices
3. Non availability of quality seed.
4. Less irrigation facilities.
5. High cost of hybrid seeds.
6. Unaware about the insect-pest management.

9H. Name of the Vegetable Crop : Cucumber

i. Existing varieties being used

Kalyanpur Green, Japanese Long Green, Poona Khira, Pant Khira-1, Poinsette, Japanese Long Green, Straight Eight, Swarna Sheetal, Swarna Poorna, Swarna Ageti etc.

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

Japanese Long green, Straight Eight, Malini, Pant parthenocarpic kheera 1,2,

1. **For open field condition:** Pusa Udhay, Pusa Barkha,Shubhangi, Himangi, Punjab Naveen, Tasty, Ruchi, Mandakini, Kumud, Noori, Alamgir, Rani, Don etc,
2. **For protected condition:** Pant Parthenocarpic Cucumber-2 & 3, Hilton, Kian, Isatis, Malini etc.

iii. Existing package of practices being used

1. No package and practice is being followed
2. Absence of crop rotation.
3. Random selection of variety (May or may not be suited to Agroeco-region).
4. Untimely sowing / planting of crop.
5. Use of untreated seed.
6. Unbalanced use of fertilizers.
7. Use of plant protection chemicals having long wetting period.
8. Use of traditional irrigation system.
9. No soil solarisation/ treatment during lean period.

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

1. Adoption of recommended Package of practices
2. Use of protected cultivation.
3. Adoption of crop/ soil health related crop rotations.
4. Recommended/suitable variety for Agroeco-region.
5. Use recommended spacing eg. 60-200 × 50-100 cm
6. Treating seed before sowing.
7. Balanced use of fertilizers (125: 155: 125 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).

8. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
9. Selection of optimum planting period.
   Region A: (Protected cultivation) : Sept
   Region B: (Protected cultivation): Feb to June
   Region C: (Protected cultivation): Feb- March
10. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
11. Adoption of micro irrigation technologies for efficient use of available water.
12. Adoption of fertigation system for efficient use of fertilizers

v. Major insect pests associated with crop

Leaf miner, fruit fly.

vi. IPM Module for management of insect pests

Adoption of recommended IPM modules

vii. Major disease associated with crop

Downey Mildew, Powdery Mildew

viii. IPM Module for management of disease

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

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

Annual grasses and broad leaves weeds

x. IPM Module for management of weeds

Adoption of recommended IPM modules

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

1. Adoption of package of practices after proper soil nutrient analysis.
2. Use of well designed and recommended protected technology suited to area i. e poly houses, net house, insect proof net house, shed net house, poly tunnels with the use of mulches & micro irrigation structures.
3. To follow proper crop rotation.
4. Selection of varieties suited to Agroeco-region.
5. Use recommended spacing eg. 60-200 × 50-100 cm
6. To use sufficient quantity of fully decomposed Farm Yard Manure (two year old)/ vermi compost.
7. Balanced use of fertilizers through fertigation.
8. To use technology such as soil solarisation/ chemical treatments for effective control of pests.
9. Timely sowing/ transplanting of crop.
10. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
11. Use bio pesticides/ plant protection chemicals recommended for protected cultivation.
12. Timely harvesting of crop.
13. To save the precious natural resource water, follow micro irrigation technologies (drip irrigation).

14. Use genetically pure & treated seed.

xii. Production constraints in agro-ecological region

1. Non adoption of package of practices
2. Most of the areas are under rainfed condition.
3. Wild animals
4. Good quality seed is inaccessible.
5. High cost of seed & poor purchasing power of farmers.
6. Water scarcity.
7. Protected cultivation is cost involving technologies.
8. Repair of the poly houses/ micro irrigation structures is a tedious task.
9. Damage of crop / poly houses /micro irrigation structure by wild animals.
10. Unawareness about scientific technologies.
11. Involvement of middle men in marketing.
12. Availability of agriculture inputs is not easy.
13. Use of unsafe agro chemicals.
14. Difficult labour availability.
15. Different biotic and abiotic stresses.

9I. Name of the Vegetable Crop : Pumpkin

i. Existing varieties being used

Arka Chandan, Ambili, Pusa Biswas, CO-1, CO-2, Solan Badami, Farmer's own saved seed.

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

Kashi Harit, Pusa Vikash, Punjab Samrat, BBS-750, BSB-950, VNR-14, Sonia F_1, Yuvraj, F_1-PU-1296, F_1 Banarasi, Surya, Mehek etc.

iii. Existing package of practices being used

1. No package of practices are used
2. Absence of crop rotation.
3. Random selection of variety (May or may not be suited to Agroeco-region).
4. Untimely sowing / planting of crop.
5. Use of untreated seed.
6. Unbalanced use of fertilizers.
7. Use of plant protection chemicals having long wetting period.
8. Use of traditional irrigation system.
9. No soil solarisation/ treatment during lean period.

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

1. Adoption of recommended Package of practices
2. Use of protected cultivation.
3. Adoption of crop/ soil health related crop rotations.
4. Recommended/suitable variety for Agroeco-region.
5. Use recommended spacing eg. 2.0-2.5 × 0.5-1.0 m Treating seed before sowing.
6. Balanced use of fertilizers (125: 155: 150 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).
7. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
8. Selection of optimum planting period.
9. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
10. Adoption of micro irrigation technologies for efficient use of available water.
11. Adoption of fertigation system for efficient use of fertilizers

v. Major insect pests associated with crop

Beetles and caterpillars, fruit fly

vi. IPM Module for management of insect pests

Red pumpkin beetle

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Dichlorovos 76% SC	500	627

vii. Major disease associated with crop

Powdery Mildew, Downy Mildew

viii. IPM Module for management of disease

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

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

Common weeds

x. IPM Module for management of weeds

Adoption of recommended Package of practices

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

1. Proper adoption of package of practices.
2. Use of well designed and recommended protected technology suited to area i. e poly houses, net house, insect proof net house, shed net house, poly tunnels with the use of mulches & micro irrigation structures.
3. To follow proper crop rotation.
4. Selection of varieties suited to Agroeco-region.
5. Use recommended spacing eg. 2.0-2.5 × 0.5-1.0 m
6. To use sufficient quantity of fully decomposed Farm Yard Manure (two year old)/ vermi compost.
7. Balanced use of fertilizers through fertigation.
8. To use technology such as soil solarisation/ chemical treatments for effective control of pests.
9. Timely sowing/ transplanting of crop.
10. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
11. Use bio pesticides/ plant protection chemicals recommended for protected cultivation.
12. Timely harvesting of crop.
13. To save the precious natural resource water, follow micro irrigation technologies (drip irrigation).
14. Use genetically pure & treated seed.

xii. Production constraints in agro-ecological region

1. Non-availability of good quality seeds on time.
2. Non adoption of package of practices
3. Wild animal damage
4. Good quality seed is inaccessible.
5. High cost of seed & poor purchasing power of farmers.
6. Water scarcity.

7. Protected cultivation is cost involving technologies.
8. Repair of the poly houses/ micro irrigation structures is a tedious task.
9. Damage of crop / poly houses /micro irrigation structure by wild animals.
10. Unawareness about scientific technologies.
11. Involvement of middle men in marketing.
12. Availability of agriculture inputs is not easy.
13. Use of unsafe agro chemicals.
14. Difficult labour availability.
15. Different biotic and abiotic stresses.

9J. Name of the Vegetable Crop : Pea

i. Existing varieties being used

Arkel or mixture of varieties

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

Region A: Pant Sabji Matar 3, Azad Pea 3, Pea 89
Region B: Pant Sabji Matar 3, G 10 and VL 7, Arkel, Azad Pea 3, VL 10 & VL 11, Pusa Pragati
Region C: Arkel, Azad Pea 3, VL-7, Pusa Pragati, Punjab Agetha 6

iii. Existing package of practices being used

Sowing by broadcasting method, no seed treatment, using own saved seeds to grow crop.

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

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

v. Major insect pests associated with crop

Pod borer, leaf minor

vi. IPM Module for management of insect pests

Adoption of recommended IPM modules

vii. Major disease associated with crop

Fusarium wilt, Powdery mildew

viii. IPM Module for management of disease

Adoption of recommended IPM modules

ix. Major weeds associated with crop

All seasonal weeds

x. IPM Module for management of weeds

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

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

Adoption of package of practices after proper soil nutrient analysis.

xii. Production constraints in agro-ecological region

Non availability of quality seeds on time.
Non adoption of package of practices.
Most of the areas are under rainfed condition.
Wild animals and scattered land holdings

9K. Name of the Vegetable Crop : Leafy vegetables

i. Existing varieties being used

Locally available varieties of palak, methi and Amaranthus

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

Beet leaf- All Green, Pusa Bharti, Pusa Jyoti, Pusa Harit
Kasuri Methi- Kasuri Methi, Kasuri Selection, Pant Ragini
Common Methi- Pusa Early Bunching
Coriander- Pant Haritima
Amaranthus- Pusa Choti Chaulai, Pusa Badi Chaulai, Pusa Kiriti, Pusa Kiran and Pusa Lal Chaulai.
Palak- All Green, Pusa Harit

iii. Existing package of practices being used

1. **Varieties-** farmers are using the local varieties of leafy vegetable
2. **Sowing methods:** Broadcasting method of sowing is used by farmers.
3. **Seed Treatment-** farmers of the state do not treat the seed materials
4. **Manures and fertilizers-** Farmers incorporated undecomposed cow dung in the field.
5. **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.
6. **Cuttings-** The leaves are not picked as per recommended practices as per variety.

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

1. Seed- Farmers should use improved varieties/ hybrids of leafy vegetables
2. Seed Treatment- to protect crops from different diseases, farmers must treat the seed by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or T*richoderma viride* 4g/kg before sowing of seeds.
3. Seed sowing: Seed is sown by line sowing method
4. Seed Rate- It is recommended to use the seed quantity for different as follows-
   Palak- winter crop-10-15 kg seeds/ha
   Summer crop-25-30 kg/ha
   Methi- direct sowing -20-30 kg/ha
   Amaranthus -direct sowing-2kg/ha
5. Transplanting- 1kg/ha
6. Spacing: sowing of seed should be done at proper spacing
   Palak: Row to Row- 20cm and plant to plant -5cm
   Methi: Row to Row-20-30 cm and plant to plant 10-15cm Amaranth: Row to Row-20-30 cm and plant to plant-10 cm
7. Manures and fertilizers- Farmers should incorporate well rotten cow dung (10-15 tonnes/ha) and NPK (50: 50:20). On the basis of soil testing. Top dressing of nitrogen after each cutting.
8. Application of Vermicompost @ 5qt/ha in the field is beneficial for leafy vegetables.
9. Cutting: cutting should be done at proper stage at 25-30 days after sowing.

v. Major insect pests associated with crop

Aphids, Painted bug, Laphygma, Brassica

vi. IPM Module for management of insect pests

Adoption of recommended IPM modules

vii. Major disease associated with crop

Leaf spot, White rust, Downey Mildew

viii. IPM Module for management of disease

Adoption of recommended IPM modules

ix. Major weeds associated with crop

Palak- jangli palak(Rumex acutus)

Methi- bathua, senji(*Melilotus alba)*

Amaranthus- Jungli Chauli(*A. viridis*) kataili chauli, Bathua

x. IPM Module for management of weeds

Adoption of recommended IPM modules

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

1. Follow deep summer / winter ploughing
2. Line sowing should be prefer
3. Follow proper crop rotation
4. Use of improve varieties of leafy vegetable
5. Timely weeding and hoeing should be done
6. Timely cuttings of leaves

xii. Production constraints in agro-ecological region

1. Seed Unavailability and proper irrigation facility.
2. Unavailability of quality seed
3. Farmers are not aware about improved varieties of leafy vegetables
4. Seed treatment is not being followed
5. Proper method of sowing is not followed
6. Imbalance use of fertilizers.
7. Disease and insect pest problem. They do not know how protect leafy vegetable from biotic stress.

10A. Name of the Fodder Crop : Berseem

i. Existing varieties being used

Vardan, local varieties.

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

Vardan, Meskawi, Pusa giant

iii. Existing package of practices being used

No package of practices are followed

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

1. Field preparation: 3-4 Harrowing + Leveling the field.
2. HYVS. – Mescavi, Warden. BL-10, 22,42, 180, Pusa Gaint & Bundel Berseem 243
3. Seed rate: 25-30 kg/ha
4. Sowing method:
   Wet method-like rice in puddled field
   Dry method: Without puddled.
5. Sowing time: First an week of October
6. Fertilizer: 30:60:70:: N:P2O5 K2O kg/ha
7. Irrigation: Field should remain at field capacity throughout the crop period after germination.
8. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.
9. Cutting management:
   First cut -45-50 DAS
   Other cutting at 25-30 days interval- total 5-6 cutting are taken
10. Yield: 800-1000g/ha. Green forage

v. Major insect pests associated with crop

Aphid, leaf minor, dusky bug, thrip, whitefly, crocket, and cutworm

vi. IPM Module for management of insect pests

Adoption of recommended IPM modules

vii. Major disease associated with crop

Root rot, Stem rot

viii. IPM Module for management of disease

Adoption of recommended IPM modules

ix. Major weeds associated with crop

Chicory

x. IPM Module for management of weeds

Adoption of recommended IPM modules

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

1. Berseem can be grown for getting for fodder availability during lean period.
2. The fodder for the milch animals will gives indirect earnings to the farm families.

xii. Production constraints in agro-ecological region

Irrigation facilities are not available. Most of the areas are rainfed in the district.

10B. Name of the Fodder Crop : Jai (Oat)

i. Existing varieties being used

Local varieties

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

JHO 11, Kent

iii. Existing package of practices being used

No package of practices are followed

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

1. Soil : Loam soils
2. Field preparation : 2-3 Harrowing + leveling
3. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
4. Seed rate: 100 kg/ha
5. Spacing : 30cm line to line distance
6. Sowing time: first week of October to last October
7. Weed control: Pendimethalin @3.3 L/ha in 500 L. water -spray after sowing but before germination.
8. Fertilizers : 80-100kgh/h : 60 kg P2O5 :40kg K2O/ha
9. Irrigation : Irrigate crop after each 20-25 days interval
10. Cutting management : At 50% flowering
11. Yield: 500-600q/ha green forage.

v. Major insect pests associated with crop

Lepidopteran caterpillars and moths

vi. IPM Module for management of insect pests

Adoption of recommended IPM Modules

vii. Major disease associated with crop

Leaf rust and stem rust

viii. IPM Module for management of disease

Adoption of recommended IPM

ix. Major weeds associated with crop

Ragweed, goose grass, wild mustard and buttonweed

x. IPM Module for management of weeds

Adoption of recommended IPM Modules

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

1. Oat can be grown for getting grains as well as for fodder availability during lean period.
2. The grains can be sold to market to get direct benefit and while using as fodder for the milch animals it gives indirect earnings to the farm families.

xii. Production constraints in agro-ecological region

Unavailability of seeds on time.

Zone B (1000-1500)

C1. Livestock : Cattle

1.A-Existing breeds available

Jersey cross, HolsteinFresian cross, Red Sindhi, Badri

1.B-Specific breeds to be introduced

Pure bred of Jersey and Holstein Fresian, Sahiwal

2.A-Existing feeds being used

Livestock- Jungle grass

2.B-Specific feeds to be introduced / advised

1. Livestock- Feed blocks, Nutritious grasses (Napier, Barseem, Oat, etc.), hay supplemented with grain, soy and other ingredients
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

3.A-Existing health services

Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals.
3. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Traditional management practices
2. Hygiene and drainage system is poor, with minimum usr of sanitizers
3. Mostly the tree leaves and fodder grasses are fed without chopping

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, Growing of fodder crops, disease management, etc.
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

C2. Livestock : Buffalo

1.A-Existing breeds available

Non-Descript, Murrah Cross

1.B-Specific breeds to be introduced

Pure Murrah

2.A-Existing feeds being used

Livestock- Jungle grass

2.B-Specific feeds to be introduced / advised

1. Livestock- Feed blocks, Nutritious grasses (Napier, Barseem, Oat, etc.), hay supplemented with grain, soy and other ingredients
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

3.A-Existing health services

Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals.
3. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Traditional management practices
2. Hygiene and drainage system is poor, with minimum usr of sanitizers
3. Mostly the tree leaves and fodder grasses are fed without chopping

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, Growing of fodder crops, disease management, etc.
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement.

C3. Livestock : Sheep

1.A-Existing breeds available

Not many farmers are rearing sheep in this Zone

1.B-Specific breeds to be introduced

None

2.A-Existing feeds being used

1. Sheeps are mostly kept on grazing.
2. Large flocks of sheep are used to migrate in alpine pasture lands in summer and migrate to tarai area during winters. They were least fed with concentrate.
3. Goats are kept on partial grazing but no stall feeding practices are followed.
4. Dry grasses are fed to the sheep and goats in lean period or during heavy snowfall in high altitude areas.
5. Feeding of concentrate mixture to sheep and goat is not in much practice

2.B-Specific feeds to be introduced / advised

Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

3.A-Existing health services

1. Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.
2. Treatment camps in Ahilyabaiholkar scheme is carried out in each block once in a year.

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals.
3. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Traditional management practices
2. Hygiene and drainage system is poor, with minimum usr of sanitizers
3. Mostly the tree leaves and fodder grasses are fed without chopping

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, growing of fodder crops, disease management, etc.
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

C 4. Livestock : Goat

1.A-Existing breeds available

Non-descript, local desi goats

1.B-Specific breeds to be introduced

Barbari

2.A-Existing feeds being used

1. Goats are mostly kept on grazing.
2. Large flocks of sheep are used to migrate in alpine pasture lands in summer and migrate to tarai area during winters. They were least fed with concentrate.
3. Goats are kept on partial grazing but no stall feeding practices are followed.
4. Dry grasses are fed to the goats in lean period or during heavy snowfall in high altitude areas.
5. Feeding of concentrate mixture to goat is not in much practice

2.B-Specific feeds to be introduced / advised

Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

3.A-Existing health services

1. Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.
2. Treatment camps in Ahilyabaiholkar scheme is carried out in each block once in a year.

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

1. More awareness is needed for availing the health services of Veterinary hospitals. More camps may

be organized for vaccination and check up of animals.
2. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Traditional management practices
2. Hygiene and drainage system is poor, with minimum usr of sanitizers
3. Mostly the tree leaves and fodder grasses are fed without chopping
4. There is a need more camps for treatment, vaccination i. e.6-12 camps per hospital per year

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, growing of fodder crops, disease management, etc.
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

C5. Livestock : Pig

1.A-Existing breeds available

Local desi non-descript

1.B-Specific breeds to be introduced

Large White Yorkshire, Landrace

2.A-Existing feeds being used

Waste food

Balanced/formulated feed mixture is not given to the pigs

2.B-Specific feeds to be introduced / advised

Promoting the use of nutritious food

3.A-Existing health services

1. Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.
2. Treatment camps in Ahilyabaiholkar scheme is carried out in each block once in a year.

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

1. More awareness is needed for availing the health services of Veterinary hospitals. More camps may be organized for vaccination and check up of animals.
2. There is more requirement of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. No proper housing system is for pig that are reared with poor hygiene.
2. No slaughter house is available for pig in Tehri.

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

Pigs are not reared as a commercial activity in Tehri and it is limited to the municipal areas only by a selected community.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

C6. Livestock : Poultry

1.A-Existing breeds available

Non-descript

1.B-Specific breeds to be introduced

Low technology input birds for backyard poultry and Fast growing strains for Broiler and Layer farming at selected clusters/pockets

2.A-Existing feeds being used

1. Backyard poultry birds are reared on homemade feed and kitchen waste
2. Some commercially run farms are using balanced formulated feed
3. As homemade feed is not available so it can be assumed that there is deficiency of 100% balanced conc. feed.

2.B-Specific feeds to be introduced / advised

Promoting the use of nutritious food

3.A-Existing health services

1. Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.
2. Treatment camps in Ahilyabaiholkar scheme is carried out in each block once in a year

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

1. More awareness is needed for availing the health services of Veterinary hospitals. More camps may be organized for vaccination and check up of animals.
2. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Poultry is mostly reared as backyard system, some farmers have started to it as deep litter system also.
2. Backyard poultry are fed with homemade feed whereas commercial farmers have stated to use balanced feed available in market but these are very few.

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

Pigs are not reared as a commercial activity in Tehri and it is limited to the municipal areas only by a selected community.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

Existing Man power & Infrastructure of Animal Husbandry

Resource		Manpower							Infrastructure	
Vety. Hospitals	Existing	38	31	-	24	-	77	-	26	Necessary equipments are available at each hospital
	Proposed	-	-	-	-	-	-	-	-	-
Mobile Vety. Unit	Existing	2	-	-	-	-	2	-	-	
	Proposed	9	9	--	9	-	18	-	-	All necessary equipments
Vety. Dispen.	Existing	93	-	65	-	-	-	-	16	
	Proposed	10	-	10	-	-	-	-	87	-
AI centres	Existing	44	27	11	-	-	2	-		
	Proposed	10	-	-	-	-	33	-	-	-
Disease Diag. Labs	Existing	-	-	-	-	-	-	-	-	-
	Proposed	-	-	-	-	-	-	-	-	-
Polyclinic	Existing	2	6	6	6	2	12	-	2	-
	Proposed	-	-	-	-	-	-	-	-	-
Ambu. Clinics	Existing	3	-	6	-	-	6	-	3 garage	-
	Proposed									

Availability of Medicines/ Vaccines : Adequate

Specific health services to be required/ advised for doubling income in specific agro-ecological zone : Additional post of one veterinary officer in block hospitals to monitor the extension activities and provide animal health services

Any other suggestions to improve the quality of Vety. Health services: Organization of capacity building programme for each cadre once in a year.

Problems of Animal Husbandry

Specific problems due to which income is not increasing

Poor accessibility	Yes
Water scarcity	Yes
Natural disasters	Yes
Wild life conflicts	Yes
Marketing of animals	No
Marketing of products	Yes
Budget	Yes
Manpower shortage	Yes
Capacity building	Yes
Equipment & Implements (old/ shortage, etc.)	Yes
Mobility	-
Risk cover (Insurance)	-
Relook to policies	-

Zone C (1500-2400)

C1. **Livestock: Cattle**

1.A - Existing breeds available

Jersey cross, Red Sindhi, Badri

1.B - Specific breeds to be introduced

Holstein Fresian x, Sahiwal x,

2.A-Existing feeds being used

Livestock- Jungle grass

2.B-Specific feeds to be introduced / advised

1. Livestock- Feed blocks, Nutritious grasses (Napier, Barseem, Oat, etc.), hay supplemented with grain, soy and other ingredients
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

3.A-Existing health services

Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.

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

1. More awareness is needed for availing the health services of Veterinary hospitals. More camps may be organized for vaccination and check up of animals.
2. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Traditional management practices
2. Hygiene and drainage system is poor, with minimum usr of sanitizers
3. Mostly the tree leaves and fodder grasses are fed without chopping

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, Growing of fodder crops, disease management, etc.
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

C2. Livestock : Buffalo

1.A-Existing breeds available

Non-Descript, Murrah Cross

1.B-Specific breeds to be introduced

Pure Murrah

2.A-Existing feeds being used

Livestock- Jungle grass

2.B-Specific feeds to be introduced / advised

1. Livestock- Feed blocks, Nutritious grasses (Napier, Barseem, Oat, etc.), hay supplemented with grain, soy and other ingredients
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

3.A-Existing health services

Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals.
3. There is more requirement of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Traditional management practices
2. Hygiene and drainage system is poor, with minimum usr of sanitizers
3. Mostly the tree leaves and fodder grasses are fed without chopping

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, growing of fodder crops, disease management, etc.
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement.

C 3. Livestock : Sheep

1.A-Existing breeds available

Non-descript, cross bred, gaddi

1.B-Specific breeds to be introduced

Ranbouillet, Russian /cashmiriMarino

2.A-Existing feeds being used

1. Sheeps are mostly kept on grazing.
2. Large flocks of sheep are used to migrate in alpine pasture lands in summer and migrate to tarai area during winters.
3. They were least fed with concentrate. Goats are kept on partial grazing but no stall feeding practices are followed.
4. Dry grasses are fed to the sheep and goats in lean period or during heavy snowfall in high altitude areas.
5. Feeding of concentrate mixture to sheep and goat is not in much practice

2.B-Specific feeds to be introduced / advised

Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

3.A-Existing health services

1. Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.
2. Treatment camps in Ahilyabaiholkar scheme is carried out in each block once in a year

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

1. More awareness is needed for availing the health services of Veterinary hospitals. More camps may be organized for vaccination and check up of animals.
2. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Traditional management practices

2. Hygiene and drainage system is poor, with minimum usr of sanitizers
3. Mostly the tree leaves and fodder grasses are fed without chopping

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, Growing of fodder crops, disease management, etc.
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement.

C4. Livestock : Goat

1.A-Existing breeds available

Non-descript, local desi goats

1.B-Specific breeds to be introduced

Barbari

2.A-Existing feeds being used

1. Goats are mostly kept on grazing.
2. Large flocks of sheep are used to migrate in alpine pasture lands in summer and migrate to tarai area during winters.
3. They were least fed with concentrate. Goats are kept on partial grazing but no stall feeding practices are followed.
4. Dry grasses are fed to the goats in lean period or during heavy snowfall in high altitude areas.
5. Feeding of concentrate mixture to goat is not in much practice

2.B-Specific feeds to be introduced / advised

Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

3.A-Existing health services

1. Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.
2. Treatment camps in Ahilyabaiholkar scheme is carried out in each block once in a year.

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

1. More awareness is needed for availing the health services of Veterinary hospitals. More camps may be organized for vaccination and check up of animals.
2. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Traditional management practices
2. Hygiene and drainage system is poor, with minimum usr of sanitizers
3. Mostly the tree leaves and fodder grasses are fed without chopping
4. There is a need more camps for treatment, vaccination i. e.6-12 camps per hospital per year

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management,

Growing of fodder crops, disease management, etc.
2. Promoting the use of feeding manger and introduction of hand pulled chaff cutter.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

C 5. Livestock : Pig

1.A-Existing breeds available

Local desi non-descript

1.B-Specific breeds to be introduced

Large White Yorkshire, Landrace

2.A-Existing feeds being used

1. Waste food
2. Balanced/formulated feed mixture is not given to the pigs

2.B-Specific feeds to be introduced / advised

Promoting the use of nutritious food

3.A-Existing health services

1. Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.
2. Treatment camps in Ahilyabaiholkar scheme is carried out in each block once in a year

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

1. More awareness is needed for availing the health services of Veterinary hospitals. More camps may be organized for vaccination and check up of animals.
2. There is more requirement of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. No proper housing system is for pig that are reared with poor hygiene
2. No slaughter house is available for pig in Tehri

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

Pigs are not reared as a commercial activity in Tehri and it is limited to the municipal areas only by a selected community.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

C 6. Livestock : Poultry

1.A-Existing breeds available

Non-descript

1.B-Specific breeds to be introduced

Low technology input birds for backyard poultry and Fast growing strains for Broiler and Layer farming at selected clusters/pockets

2.A-Existing feeds being used

1. Backyard poultry birds are reared on homemade feed and kitchen waste
2. Some commercially run farms are using balanced formulated feed
3. As homemade feed is not available so it can be assumed that there is deficiency of 100% balanced conc. feed

2.B-Specific feeds to be introduced / advised

Promoting the use of nutritious food

3.A-Existing health services

1. Veterinary hospital wise treatment and sterility camps are being organized in the whole district with block veterinary hospital as a nodal centre.
2. Treatment camps in Ahilyabaiholkar scheme is carried out in each block once in a year

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals.
3. There is more requirements of camps per hospital i.e. 12 to 18 camps per hospital per year.

4.A-Existing management practices

1. Poultry is mostly reared as backyard system, some farmers have started to it as deep litter system also
2. Backyard poultry are fed with homemade feed whereas commercial farmers have stated to use balanced feed available in market but these are very few.

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

Pigs are not reared as a commercial activity in Tehri and it is limited to the municipal areas only by a selected community.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.

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

1. Non availability of proper breeds nearby.
2. Non availability of feed material with low prices.
3. Timely health check-ups of animals.
4. Lack of training & awareness.
5. High Disease Infestation due to mismanagement

C7. Livestock : Fisheries

1.A-Existing breeds available

Mahaseer

1.B-Specific breeds to be introduced

Fisheries- Mahaseer, Grass carp, Silver carp, common carp.

2.A-Existing feeds being used

Local grass, household waste

2.B-Specific feeds to be introduced / advised

Fisheries: Fish meal

Existing Man power & Infrastructure of Animal Husbandry

Resource		Manpower							Infrastructure	
	No.	V. O.	LEO	Pharmacist	Lab. Tech.	Livestock Assistant	Para vets	Buildings	Equipments	
Vety. Hospitals	Existing	38	31	-	24	-	77	-	26	Necessary equipments are available at each hospital
	Proposed	-	-	-	-	-	-	-	-	-
Mobile Vety. Unit	Existing	2	-	-	-	-	2	-	-	
Vety. Dispen.	Proposed	9	9	--	9	-	18	-	-	All necessary equipments
	Existing	93	-	65	-	-	-	-	16	
AI centres	Proposed	10	-	10	-	-	-	-	87	-
	Existing	44 10	27	11	-	-	2 33	-		
Disease Diag. Labs	Proposed	--	-	-	-	-	-	-	-	-
	Existing	-	-	-	-	-	-	-	-	-
Polyclinic	Proposed	-	-	-	-	-	-	-	-	-
	Existing	2	6	6	6	2	12	-	2	-
Ambu. Clinics	Proposed	-	-	-	-	-	-	-	-	-
	Existing	3	-	6	-	-	6	-	3 garage	-
	Proposed									

Availability of Medicines/ Vaccines : Adequate

Specific health services to be required/ advised for doubling income in specific agro-ecological zone : Additional post of one veterinary officer in block hospitals to monitor the extension activities and provide animal health services.

Any other suggestions to improve the quality of Vety. Health services : Organization of capacity building programme for each cadre once in a year.

Problems of Animal Husbandry

Specific problems due to which income is not increasing

Poor accessibility	Yes
Water scarcity	Yes
Natural disasters	Yes
Wild life conflicts	Yes
Marketing of animals	No
Marketing of products	Yes
Budget	Yes
Manpower shortage	Yes
Capacity building	Yes
Equipment & Implements (old/ shortage, etc.)	Yes
Mobility	-
Risk cover (Insurance)	-
Relook to policies	-
Risk cover (Insurance)	-
Relook to policies	-

D . Integrating Farming System

1.A Existing farming system

Crops + livestock

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

Crops + Livestock + Backyard Poultry + Mushroom cultivation + Honey Bee + Fodder production

E. Reducing post harvest losses and value addition

1.A Existing grading facilities

-

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

For grains:

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

For horticultural crops:

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

2.A Existing processing facilities

Grading machines should be installed at block/village level

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

For grains:

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

For horticultural crops:

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

3.A Existing packing facilities

Processing units should be installed

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

For grains:

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

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables

3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed
8. Litchi peeling and shredding unit

4.A Existing storage facilities

Packing facilities are needed at block level

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

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

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, Dehradun

2.A Existing plantation

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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

Natural fodder available

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

Medium and high Hills;

Tall fescue (Festuca arundinacea
Rye grass (*Lolium perenne*)
White clover (*Trifolium repens*)
Red clover (*Trifoliun pretense*)**

Tall fescue

1. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
2. Fertilizer management- 60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
3. Irrigation management- Crop must be irrigated after each cut provided water is available
4. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval

Rye grass

1. Seed rate(Kg/ha)- 18-20
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

White clover

1. Seed rate(Kg/ha)- 6-8 Kg
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal)
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

Red clover

1. Seed rate(Kg/ha)- 6-8 Kg
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal)
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

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. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
9. Contour trenching (staggered/continuous).

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

Not available

4.C Treatment 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/Rice-Toria-Potato

Seeds, fertilizers, pesticides etc.

In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn) /ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop.

Foliar spray of 1% $FeSO_4$ in rice nursery.

Radish/Capsicum/French bean-Cauliflower/ Cabbage/ Green pea

In deficient soils, application of 10 kg Borax/ha or foliar spray of 0.2% Borax in standing crop. Dip potato tubers in 30 g borax/l solution for a half hour and dry them in shade before planting.

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.

Mango/Litchi/Lime

In Zn deficient soils, application of 10 (sandy loam)- 20 (Clay loam) kg $ZnSO_4$ (21% Zn) /ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop

Foliar spray of 1% $FeSO_4$ in rice nursery and groundnut.

In Mn deficient soils, application of 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 10 kg Borax/ha. In standing crop, two foliar spray of 0.2% Borax at interval of 30-45 d.

In deficient soils, application of 215 kg gypsum/ha.
Two foliar spray of 0.2% $ZnSO_4$ +0.2% $MnSO_4$ + 0.1% $CuSO_4$ + 0.25% Lime in Feb. & March.
Two foliar sprays of 0.2% Borax in April at fortnightly interval.
Apply FYM as per age of the plant.

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. 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.

II. 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.

III. 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.

IV. 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.

V. 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.

VI. Maize

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual line sowing.
3. Manual weed control.
4. Manual earthing-up of plants.
5. Manual fertilizer application.
6. Manual harvesting.
7. Manual shelling.

VII. 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.

VIII. 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. 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.

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.

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.

IV. 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.

V. 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.

VI. Maize

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 sowing / power tiller operated maize planter.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Manual earthing-up of plants
5. Plant protection by manually operated sprayers.
6. Manual harvesting using improved sickles.
7. Shelling by hand held maize sheller / power operated maize sheller.

VII. Potato

1. Seedbed preparation 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. Earthining 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.

VIII. 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

Seeds, fertilizers, pesticides, information, Farm Yard Manure, Seed, Water and Tillage Machinery etc.

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

Increase in number of sales and community centres for easy and timely availability of seeds, seedlings, fertilizers and required information

Lower Hills

1. Fertilizer application should be based on soil test value at right time, right place with 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 manures and composts such as vermicompost, biofertilizer to supplement costly fertilizers to reduce cost up to 25-30%.
4. Inclusion of pulses in crop rotation.
5. Need based and recommended concentration of plant protection chemicals using correct method of application.
6. Enhanced use of bio-agents to control disease and pests; avoid use of costly chemicals.
7. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons.
8. Use optimum and recommended seed rate at optimum spacing and depth.
9. Use good quality of water and avoid excess use of water for irrigation.
10. Sprinkler and drip methods for irrigation should be encouraged to improve water use efficiency.
11. Promote reduced tillage operations.

Mid Hills

1. Encourage use of well decomposed organic manures and biofertilizers; avoid excessive use of chemical fertilizers.
2. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
3. Avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
4. Need based application of insecticides and pesticides, preferably enhanced the use of bio-agents.
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. Sprinkler and drip methods for irrigation should be encouraged to improve water use efficiency.
9. Use of mulches and available composts/organic manures
10. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
11. Promote reduced tillage operations.

4. Factors responsible for increasing cost of cultivation in the specific agro-ecological region of district

Irrigated valleys and lower hills

Situation-I represents subtropical climate with moderating high temperature (18-30^0 C) medium rainfall, low humidity (40-50%) and experiences no snowfall. This situation covers 12% area. 80% of total precipitation is received during June to September. Sal in outer Himalayas and pine and oak in mid and inner Himalayas are the predominant vegetation. Soils are alluvial sandy loam to loam.

Rainfed lower hills

Situation-II represents about 8% of the area. Soils are gravelly and chirty, deep, sandy loam to silty clay loam. Soils are acidic in nature.

Mid hills south aspects

Situation-III occupies about 36% area better suited to human settlement due to forest free cultivated land and maximum exposer to sunlight and represent sub-temperate climate. About 75% of total precipitation is received during rainy season, 12% in winter and 13% in summer. The situation is dominated by chir (pine) forest vegetation. Most of the area is rainfed. The soils are eroded, chirty/gravelly sandy loam to silty loam. Soil mass is heterogeneous and poor in fertility.

Mid hills north aspects

Situation-IV occupying about 24% area. The irrigated area is 8% by gullies. It has good cover of oak and its association. Duration of exposer to sunlight is the major factor influencing the microclimate and type of vegetation. Relative humidity is high (60-70%). Temperature is moderately low due to vegetation and high shading effect. Rainfall is high with occasionally snowfall. About 75% precipitation is received during rainy season, 15% in winter and 10% in summer. The soils are moderately to highly acidic in nature at high elevation areas.

High hills

Situation-V occupies about 12% area. The irrigated is only 4-5% by gullies. Represents temperate climate with mean annual temperature ranging from 11-15 ^{0}C, about 90% of rainfall is received during rainy season, 8% in winter and 2% in summers. The soils are highly acidic, high in unhumified organic matter.

Very high hills

Situation-VI occupies about 4% area and is confined to inner Himalayas. Climate is humid temperate with low to very low annual mean temperature ranging from (5-11^0 C). The rainfall is low and snowfall is high and land covered under heavy snow for more than six months. The weather remains foggy with high humidity. Kharsu oak and Himalayan fir are the dominant vegetation. The soils are highly acidic (4.0-5.0 pH).

Alpine pasture

Situation-VII soils exist above timber line from 300 m, occupies about 4% of area. Shrubs of medicinal plants are found abundantly. The situation represents alpine climate where temperature throughout the year is very low range from 2 to 16^0 C. the rainfall is negligible.

Factors responsible for increasing cost of cultivation

The area covered under a thick layer of snow.

1. Heterogeneous soils, soils of each situation differ widely in their physical, physico-chemical characteristics as they are developed from a variety of rocks and minerals under joint influence of vegetation, physiography and climate.
2. Sloping lands with high rate of removal of soil and nutrients from surface through erosion resulting to depletion of soil fertility.
3. Scattered holding and marginal land size.
4. 90 % of areas of mid and high hills are rainfed.
5. High rates of migration from hills to plains of males and young boys in search of jobs.
6. Women based farming system without technical knowledge – how and inputs.
7. Low efficiency of conventional farm tools and implement.
8. Indigenous breed of livestock with low production and working efficiency.
9. Poor quality of FYM. The method of preparation and application of FYM are defective generally heaped in an open area resulting into loss of nutrients.
10. Mostly soils are slightly to strongly acidic in nature depending upon elevation, vegetation and development of soil from rocks and minerals causing nutrient imbalance in soil and impose hidden nutrient toxicity and deficiency symptoms in crops retard growth and yield.
11. Minimum use of fertilizers: farmers are mostly small and marginal economically backward, not able to apply recommended doses of fertilizers. The average consumption is < 10 kg N:P:K ha-1.
12. Non availability of quality seeds of varieties recommended for rainfed upland situations.
13. The inputs are costly and therefore, the small and marginal farmers are not able to adopt the improved technology.
14. Non availability of inputs at right time and right place.
15. Sowing of crops is at the mercy of rains which are erratic. Thus planting is delayed and not done on suitable time. Sowing are done more than once either because of insufficient moisture mostly in rabi crops or due to crust formation in kharif.
16. Farmers follow practice of dry sowing. In such situation the seeds are eaten by birds and grubs resulting in inadequate plant population.
17. Due to limited moisture and nutrient supply the growth of crops is not proper and vegetative phase of growth (flowering and fruiting) are advanced.
18. Improper seed bed preparation: in order to utilize moisture, the farmers do not wait for fine preparation of fields and rush for sowing. This results in improper germination and infestation of weeds.
19. Severe infestation of insect-pest: white grubs and cut worms are the serious polyphagous pests, kill plants and reduce plant population up to 70-80 %. Due to non availability of suitable plant

protection chemicals as well as high cost they are beyond the means of farmers. Besides, non availability of water for solution also pose problems.

20. Weeds; common weeds of the upland rainfed areas are Tipatiya (Oxalis latifolia), Pardeshi(Galensojaparviflora), Gajar grass (Parthenium Sp.)Kuni(Lantena camera) Kala bansa (Eupatorium sp.).The loss in general in food crops is high from 50-75 %.
21. Improper terrace management: most of terraces developed by farmers are on steep slopes with outward gradient.
22. Lack of proper drainage system for safe disposal of excess rainwater. The heavy runoff of water washes away the top fertile soil lead to steady depletion of nutrients and organic matter.
23. Coarse textured soils (charty/gravely) with low moisture and nutrient retention capacity.
24. Lack of proper storage facilities for crops (cold storage).
25. Lack of awareness for protected cultivation techniques and facilities for commercial high value crops (poly houses, poly tunnels, poly for raising nursery and cash crops.
26. No good marketing facilities.
27. Lack of proper irrigation facilities for minor irrigation and drip irrigation with fertigation.
28. Poor connectivity of road transport system.
29. Lack of farmer's participatory approach models for crop production technologies under hill agricultural system for the state.

H . Off-farm income

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

SHGs are operative in the district

Bhairav(Silkholi), Durga(Silkholi), Laxmi(Saud), Jaleshwar (Saud), Nagraj(Devri Talli), Siv Madir(Devri Talli), Nagraj(Dhikhol Gaon), Surkanda(Suta), Adarsh(Suta), Santoshi(Mathlau Talla), Nagraja (Mathlau Talla), Jai Ma(Kaddu Khal), Ambedkar(Bat), Saraswati (Kaddu Khal), Ghatakaran(Kirada), Ma Bhuvneshwari(Kirada), Hanuman(Ranakot), Jai Dhari Ma(Gorthikanda), Laxmi(Muner), Jan Kalyan(Lwarkha), Mahila Jagrati(Chopra), Siddheshwar (Sarot), Nagraj(Bayad gaon), Shivshakti(Kecchu), Chandervadni (Mahad), Laxmi(Bagi), Chandravadni(Arota), Chandravadni (Chaka), Pragati(Thath), Lakshey(Chameli), Ma Rajeshwari (Noga), Shiv(Semwal).

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

SHGS can be created/ encouraged for micro-entrepreneurship and collective farming

SHG already formed and need to be encouraged:

Bhairav(Silkholi), Durga(Silkholi), Laxmi(Saud), Jaleshwar (Saud), Nagraj(Devri Talli), Siv Madir(Devri Talli), Nagraj(Dhikhol Gaon), Surkanda(Suta), Adarsh(Suta), Nagraja(Mathlau Talla), Jai Ma (Kaddu Khal), Ambedkar(Bat), Saraswati(Kaddu Khal), Ghatakaran (Kirada), Ma Bhuvneshwari(Kirada), Hanuman (Ranakot), Jai Dhari Ma (Gorthikanda), Laxmi (Muner), Jan Kalyan (Lwarkha), Mahila Jagrati(Chopra), Shivshakti(Kecchu), Chandervadni(Mahad), Laxmi (Bagi), Chandravadni(Arota), Chandravadni(Chaka), Pragati (Thath), Lakshey(Chameli), Ma Rajeshwari(Noga), Shiv(Semwal)

1. There is need to have regular monitoring and follow up of SHG's by the forming agencies and time to time evaluation of the group.
2. Regular monitoring by the concerned agency must be ensured like ensuring regular meeting of the SHG, checking their register, regular collection of the money, help during conflicts, solving problems occurring during banking etc. and submitting the monitoring report to their concerned officials so that steps can be taken by the high officials to ensure regular continuity of the SHG.
3. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
4. A large number of groups discontinued as they were not having knowledge regarding income generating activities that can be started (what activities can be taken up, how to operate it, where to market the produce etc.) So there is need of encouragement, motivation along with imparting

knowledge, skills and linking them to market.

5. Trainings should be provided to the rural women on income generating activities as per the need of rural women, marketing potential and availability of locally available resources.
6. Loan procedure should be made more flexible with less interest rate.
7. As there were problems like non-cooperation among members, confusion regarding money matter, lack of confidence on office bearers with respect to group money etc., there is need of organizing training on good governance, democratic election and how to solve financial and administrative issues.
8. SHG's formed should be grouped into clusters, federations and registered cooperatives so as to converge with govt. schemes, facilitate collective purchase of input and marketing of products.
9. To encourage people to form and sustain SHG's so that new enterprise developed, intensive work needs to be done with them in sustainable manner.
10. Enterprises need to be identified depending upon local resources- human and material.
11. Market linkages need to be developed so that people can sell their produce gainfully.
12. To encourage SHG's better planning, training and sustained efforts on long term basis are required.\
13. 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.

Problems related with SGHS

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. Very less micro-entrepreneur employment present
2. Rearing of angora rabbit, sheep, weaving of woollen garments, ringaal basketry, preservation of locally available fruits and vegetables

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

1. Above existing micro-enterprise can be further promoted
2. Value added product making
3. Mushroom production
4. Honey Bee production
5. Processing of fruits and vegetables
6. Sericulture
7. Vermi-composting units

3.A Existing skill development facilities

1. Very less skill development facilities available
2. Office of Development commissioner (handicrafts)
3. Handicraft marketing, service and extension centre

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

agricultural income

1. Value added product making
2. Mushroom production
3. Honey Bee production
4. Processing of fruits and vegetables
5. Sericulture
6. Vermi-composting units
7. Training centre, processing and packaging units as per the locally available resources

4.A Existing women skilling facilities

Very less women skilling facilities available

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

1. Woollen knitting and handicraft
2. Training centre, processing and packaging units as per the locally available resources

5.A Existing youth skilling facilities

Less facilities are available

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

1. Value added product making
2. Mushroom production
3. Honey Bee production
4. Processing of fruits and vegetables
5. Sericulture
6. Vermi-composting units
7. Training centre, processing and packaging units as per the locally available resources

Beekeeping

Beekeeping is an environment friendly and agro-forestry based occupation. It provides enormous potential for income generation, poverty alleviation and sustainable use of forest resources. Beekeeping is one of the oldest traditions in India for collecting the honey. Honey bee farming is becoming popular due its demand in national and international markets as well. *Apis cerana indica* is the indigenous bee, is known to be the ideal pollinator for organically grown mountain crops due to its capacity to significantly enhance agricultural productivity. India has a potential to keep about 120 million bee colonies that can provide self-employment to over 6 million rural and tribal families. In terms of production, these bee colonies can produce over 1.2 million tons of honey and about 15,000 tons of beeswax.

Less Investment: Bee Farming is not a manufacturing activity, as such costly machine and tools are not required. There is nothing like production capacity as well. Only small wooden frames with boxes are needed. Their sizes are also standardized. To begin with around 15 such sets/boxes can be purchased or assembled at rate of Rs.1500.00 per box that would cost Rs.22, 500/- for 15 Boxes. Honey extractors would cost to the tune of Rs.5, 000/- each with filtration facilities. For other miscellaneous expenditures including training and consultancy services a sum of Rs.5000.00 can be earmarked. That means total of Rs.32, 000.00 would be required to start Bee Farming with 15 Boxes which is equivalent or less than the cost of cultivation of one acre of paddy field.

More Returns: As per the established norms, each box comprises 7-8 hives which is able to harvest around 30-35 kg of honey in a year. The annual harvest of honey starting with 15 bee boxes could be 450-525 kg depending on the flowering season. Even after considering very conservative selling price of Rs. 150/- per kg; the annual realisation would be to the tune of Rs. 67,500/- to Rs.78,750/-. Therefore, Bee Farming can be considered as an excellent, profitable agro-based green enterprise for landless farmers and entrepreneurs.

Beekeeping in Uttarakhand: Beekeeping has been an integral part of human society since centuries in

hill regions of Uttarakhand state. The state of Uttarakhand has a predominantly agrarian economy and large number of small and marginal farmers in the mountainous state call for augmenting agricultural production by organic means. The indigenous bee sub-species *Apis cerana indica* commonly is ideal pollinator for organically grown mountain crops, with the capacity to significantly enhance agricultural productivity with an indirect but vital role in combating soil degradation by pollinating wild plants thereby enabling improved regeneration of bio mass, to be returned to the soil. Beekeeping with *Apis cerana indica F*. is a common practice in hills of Garhwal and Kumoun Himalaya which is carried out mostly by using traditional methods since long past and is stationary in nature. In these regions, beekeeping is also carried out with *Apis mellifera,* but in winter season, due to temperature lower than 20ºC, colonies are being migrated to plains. According to report given by KVK Jeolikot(2017), in Uttarakhand, there are about 4,790 beekeepers with 45,247 number of *A. cerana indica* colonies yielding 546.70 mt of honey production. Whereas, in Almora region of Uttarakhand, there are about 400 beekeepers with 1,165 number of *A. cerana indica* colonies yielding 16.4 mt of honey production. The Uttarakhand state has extremely rich bee forage plants. In most of the remote areas where *Apis cerana indica* beekeeping is common, the use of pesticides and chemicals is negligible, the level of dangerous chemicals in the atmosphere is insignificant and the environmental pollution is at minimal level. Honey produced from such areas is purely natural, free of any residues and can be sold as an organic product. There is vast potential for beekeeping in the country. However, due to lack of knowledge, scientific beekeeping is not being practiced by, most of the beekeepers. It is necessary for beekeepers to participate in the trainings / other capacity building programmes on the subject to gain scientific knowledge on the subject. Selection of good apiary site, good quality bees and proper management are the main keys for success of beekeeping. Following are the important points to start beekeeping and further management practices.

1. Selection of good apiary site: Select apiary site by considering the following:

1. Apiary ground should be clean & free from dry leaves etc. to avoid fire during summer
2. Apiary site should be away from power station, brick kilns, highway and train tracks
3. Site should be open & at dry place having shade
4. Site should be easily accessible by road
5. Fresh running water should be easily available near the apiary
6. It should have natural / artificial wind breaks
7. Site should receive early morning and afternoon sunshine
8. There should not be other commercial apiary within 2-3 kilometers from the apiary site
9. There should not be any source of stagnant / dirty water, chemical industry/ sugar mill, etc., nearby the apiary
10. Area should be rich in bee flora

2. Selection of good quality bees: Beekeeping depends on floral resources, climatic conditions, management and also quality of bees, particularly queen. Therefore, the following should be kept in mind to select the bee colonies:

1. Buy disease free bee colonies from existing reputed beekeepers after getting training on the subject.
2. Select and multiply honey bee colonies only from disease resistant, high honey yielding, young, healthy and high egg laying capacity queen, less swarming tendency etc.
3. Keep colonies with good prolific queens
4. Capture few bee colonies from their natural abodes in forests which may be used for further breeding/ multiplication to prevent inbreeding.

3. Management of apiary:

A. Placement of colonies in apiary

1. Hives should be as per specification of BIS/ISI and should be of locally available seasoned light weight wood. Unseasoned and heavy wood should be avoided
2. Avoid nailing the bottom board with the brood chamber
3. Restrict number of bee colonies in a apiary from 50-100

4. Keep row to row and box to box distance as10 and 3 feet, respectively

Hives used for traditional beekeeping in hilly areas are

Wall hives: Wall hives locally known as 'Khadra', 'Jaala' or 'Jalota' are rectangular structures made in the walls of houses and 'Chhaan' or 'Sunni' (cattle sheds) at the time of construction. Each hive has a small round or rectangular opening on the outer side as an entrance for bees. The size of 'Jalotas' varies in different locations; usually they are 45-60 cm in length, 25-30 cm in width and 20-30 cm in height . Generally one hive is made in each wall, but numbers may vary from 2-4. The interiors of hives are smoothed with cow dung and clay. In winters due to lack of floral resources and extreme cold in the hills, the population of *Apis cerana* colonies decreases to a great extent. Thick wall hives provide considerable insulation in such conditions.

Log hives: Two types of log hives are found, Type I: These are made up of cylindrical hollowed pieces of tree trunk 60-100cm long and 20-40 cm in diameter; however size depends upon the circumference of available trunks. This type of log hives is usually made from the trunk of *Quercus leucotrichophora, Q. floribunda, Rhododendron arboreum and Pinus roxburbhii.* The entrance is made at the mid front side. Both sides are plastered with a mixture of cow dung and clay. Type II: Old cooperages locally known as 'Pariya' or 'Dokha' when rendered useless for milk products, are used as hives. These are about 70-90 cm long with the diameter at top from 25-35 cm and thickness of log 3-5cm. An entrance is made towards the outside and the hive is placed horizontally on a raised platform of stones or the wall of a courtyard. It is mainly made up of the wood of *Ougeinia oogeinesis, Rhododendron arboreum, Toona* spp. A stripe of old comb is fixed to the upper part, inside the hive, and is plugged with a wooden or metal cover, then sealed with a mixture of clay and cow dung. The wooden lid is fixed at the top with an entrance on it.

Miscellaneous Types: These are rectangular box hives made up of separate wooden boards with movable top cover . Their size varies in different localities. Usually these are 80-110 cm long, 25-30 cm wide and 40-50 cm high. During extraction, the top cover is removed along with attached combs and bees, and taken away from the hive, then each comb is smoked and shaken gently. Bees return to the hive and beekeepers cut combs easily.

All hives are made from locally available materials, thus are economically cheaper and environmentally friendly. These hives have thicker walls as compared to modern hives thus provide protection to bees from extremely low and high temperatures. In higher hills traditional hives are more suitable than modern hives but for the drawback in colony management.

B. Inspection of colonies

1. Adopt general colony and personal hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board, top cover, etc. frequently
2. Check the colonies periodically for any abnormalities or changes in behaviour of bees
3. Inspect colonies on clear sunny days preferably at temperatures between 20 and 30°C
4. Do not inspect colonies in cold, windy and cloudy days
5. Use smoker when needed to subdue the bees
6. Use protective dress and veil while inspecting colonies
7. Handle colonies gently, avoid jerks
8. Avoid crushing bees as it could lead to stinging
9. Isolate the diseased colonies from healthy ones.
10. Handle diseased and healthy colonies separately

C. Provision of fresh water in the apiary

Ensure availability of fresh water preferably in shallow containers near the apiary to maintain a healthy apiary. Water is needed for the following

1. Maintenance of adequate humidity in a colony to ensure proper incubation of eggs
2. For feeding bee bread by nurse bees, the mixture of honey and pollen of certain consistency is required for which water is needed
3. When temperature in the apiary increases beyond 37°C, water is used by bees to evaporate and cool

the colony

D. Dearth period management

1. Provide 50% sugar syrup to the colonies during dearth periods when honey stores in the colonies is not adequate and nectar is not available in the area. The syrup should be prepared by boiling clean water in the vessel and sugar added with slow stirring for few minutes. Cover the vessel with lid and let it cool. Feed cooled syrup.
2. Sugar syrup should be kept in such a way that the bees should not drown in it. This should be ensured by using shallow vessels with straw to facilitate easy feeding
3. Do not prepare the feed in open in the apiary and avoid dripping on the ground to prevent robbing by bees and ants
4. Feed the colonies in the evening preferably after sunset
5. Feeding should be given to all colonies in the apiary at one time
6. Pollen substitute comprising of fat free soyabean flour (3 parts) + Brewer's yeast (1 part) + skimmed milk powder (1 part) + sugar (22 parts) +honey (50 parts) made in the form of patties should be provided when pollen stores in the colonies is not adequate and pollen is not available in the area
7. Provide fresh water near the colony in shallow vessels
8. Extra frames should be stored in air tight chambers and fumigated with sulphur powder regularly
9. Old and dark combs should be discarded

E. Care during honey extraction

1. Use honey extractor, containers and other bee hive tools /equipments made of stainless steel / food grade plastic. Don't use tins & containers made of other degraded material
2. Wash all the equipments / containers etc. thoroughly with warm water before honey extraction
3. Extract honey from super chambers only
4. Select frames only with 75% sealed cells with ripened honey for extraction
5. Cover the entrance gate of the colony with small branches or twigs to avoid robbing
6. Extract honey in a closed room and not in the open to avoid robbing
7. Do not leave super and brood frames, after extraction of honey open in the apiary;
8. Do not spill honey in the apiary

F. Care during migration

1. Migrate colonies during non-availability of flora to areas with abundant flora.
2. Before migration survey the area to assess the availability of the flora to locate the colonies
3. Ensure honey extraction before migration
4. Close the entrance gates of the colonies in the evening after all worker bees are inside the colony
5. Pack the colonies internally and externally before migration to avoid jerking
6. Colonies in the vehicle should be packed in such a way that the entrance side should face the front side of the vehicle
7. Start migration late in the evening and ensure the colonies reach the destination within 10-12 hrs. the next day morning and entrance gates are opened after landing in the new location
8. Avoid jerking in the way while transporting bee colonies

G. Seasonal management of apiary

a**) Summer Management**

1. Keep the colonies in thick shade
2. Regulate the microclimate of the apiary by using wet gunny bags over top cover and sprinkling water around the colonies in the apiary during noon hours.
3. Provide fresh water in/near the apiary

b) Monsoon management

1. Clean and bury deep the debris lying on the bottom board
2. Keep the surroundings of the colony clean by cutting the unwanted vegetation which may hamper free circulation of the air
3. Provide artificial feeding (sugar syrup and/or pollen substitute) as per requirement of the colony

4. Check the robbing within the apiary
5. Unite weak/laying worker colonies
6. Control predatory wasps, ants, frogs, lizards in the apiary

c) Post monsoon season management

1. Provide sufficient space in the colony
2. Strengthen the colonies to stimulate drone brood rearing
3. Control ectoparasitic mites, wax moth and predatory wasps

(d) Winter management

1. Examine the colonies and provide winter packings in weak colonies specially in hilly areas
2. Feed sugar/pollen substitute to weak colonies as stimulative feeding to provide energy and initiate brood rearing
3. Shift the colonies to sunny places
4. Protect the colonies from chilly winds by using wind breaks
5. Unite the weak colonies with stronger ones

e) Spring management

1. Unpack the colonies, clean the bottom board, replace the worn out hive parts and provide sufficient space
2. Provide stimulative sugar/pollen substitute to increase brood rearing
3. Equalise the colonies
4. Extra frames should be raised by providing comb foundation sheets
5. Replace the old queens with new ones through mass queen rearing or divide the colonies
6. Manage the colonies in such a way to prevent swarming
7. Monitor regularly for ectoparasitic mites and adopt control measures

H. Protecting colonies from pesticides

1. Persuade the farmers not to use pesticides or use selective pesticides that are less harmful to bees at recommended concentrations
2. Avoid the use of dust formulations as they are more harmful to bees than spray formulations
3. Prior information about spraying would help in reducing poisoning of bees
4. Avoiding spraying of pesticides during flowering of the crop and peak foraging time of the bees would help in reduction in the mortality of foraging bees
5. Spraying may be done in the evening after sun set when bees do not forage
6. Colonies may be temporarily shifted if heavy spraying schedule is fixed
7. If shifting of the colonies is not possible, feed with 200 ml sugar syrup and close the gate by using wire screen for the day of spraying.

I.Methods of attracting and catching swarms

1. Swarming is a natural process for propagation of honey bees. Swarms are the lone source of bees in traditional beekeeping of *Apis cerana* while only a few empty hives are inhabited by absconded or feral colonies.
2. Empty hives are cleaned and smeared with clay, cow dung or both. Honey or jaggery are put inside hive to be used as bait to attract the swarm.
3. Flowering shoots of *Brassica campestris, or Raphanus sativus* can also be used just above the hive entrance, hoping that scout bees will find their home in the empty hive.
4. When swarms is found in the vicinity, water can be sprinkled and soil or ash can be thrown to settle them. 'Tofri' or 'Garori' (special baskets) made up of 'Ringal' (bamboos); 'Jhola' (bag) can be used to catch and carry swarms. 'Kutrine' (burning cotton cloth) is used as a traditional smoker and 'Talikh' (a cloth) to save faces while catching the swarm.
5. To catch a swarm layer of jaggery or honey is applied at the inner base of the basket and hang it inverted near the settled cluster. The cluster is gently displaced from the other side with smoke to direct the bees towards the basket. As the swarm makes a cluster on the basket, it is transferred to the hive. When the bees are settled the basket is removed. Finally the hive is closed with its wooden

cover and be smeared with a mixture of cow dung and clay.

J. Management of Honey Bee Diseases and pest

Honey bees could be affected by diseases and the real cause of abnormality or any disease present in the honey bee broods need to be ascertained before taking up any control measures. It is best to contact the researchers/scientists/beekeeping experts at the nearest centre or university or Government department working on honey bees. After the exact diagnosis of the causal agent of the particular disease, the guidelines/ recommendations given by the expert should be followed in true letter and spirit. However, general advisory for the management of common diseases of honey bees is given below:

1. Select good site to locate the apiary preferably in an open, dry place with shade.
2. Adopt general colony hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board frequently.
3. Select and multiply honey bee colonies only from disease resistant stocks.
4. Keep colonies with good prolific queens.
5. Create broodlessness in colony for at least 15 days by enclosing the queen in a queen cage.
6. Check the colonies periodically for any abnormalities or changes in behaviour of bees.
7. If you observe any colonies with disease, isolate them from healthy ones. Handle diseased and healthy colonies separately.
8. Keep the colonies strong by adding sealed brood comb or worker population only from healthy colonies and also by providing adequate food during dearth periods.
9. Prevent robbing, drifting, absconding and avoid migration of bee colonies when you notice disease symptoms.
10. Follow 'Shook Swarm' or shaking method to remove contaminated combs completely by transferring entirely new combs in one operation to the colonies with disease symptoms. Destroy the removed combs by burning.
11. Sterilise the combs and equipments by any one of the following methods:

a. Disinfect the empty combs and equipments with 80 per cent acetic acid @ 150 ml per hive body in piles for few days at a protected place. Air the treated materials before use.
b. Dip the contaminated equipments and combs in soap solution containing 7 per cent formalin for 24 hours. Then wash the treated material with water, dry and use.

12. Use of antibiotics to control honey bee diseases is likely to result in contamination of honey causing problems in export of honey.
13. The traditional method to check the entry of ants is spreading ash or turmeric powder in
14. their way.

K. Honey Extraction

The main honey seasons in hilly areas are '*Chait*' (April), '*Baisakh*' (May) and '*Ashaad*' (July-August). In some localities, an additional extraction during '*Kartik*' (October) is also done. Colonies yield most honey in '*Chait*'-'*Baisakh*' and the least in '*Kartik*'. Traditional tools used are '*Dathule*'. (sickle) to open the cover or wooden plug and '*Buwan*' (traditional brush) made up of '*Babul*' (*Eriophorum comosum*) to brush off bees. Besides these traditional smokers, large pans for keeping combs, a pot with water and '*Parunla*' or knife for cutting '*Faur*' or '*Fwar*' (bee combs) are required at the time of harvest. Honey is mostly extracted at night but a few beekeepers do it in day time also. Combs are cut down, leaving the innermost comb for feeding and to attract swarms the next year. Honey combs are squeezed after removing the brood area from the cut combs. The harvested honey has many impurities like insect body parts, wax cells, etc. Usually, squeezed combs are thrown away after extraction, which can be fed to cattle especially bulls. Honey is stored in plastic or metal containers and in bottles.

The beekeepers doing beekeeping with modern hives should use honey extractors to harvest honey. The quality of honey extracted using honey extracting machine is much better than squeezing method.

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:

Tarai, Bhawar & lower hills (600-1000m): Oct.- Mar. (02 crops)
mid hills (1000-1500m): Sept. – Nov.& Feb.-April (02 crop)
high hills (1500-2400m): Feb.-Nov. (03 crops)
higher hills (>2400m): Mar.- Oct. (03 crops)

Cultivated strain: Delta, U-3, S-11, MC-465, A-15

Spawning :The process of mixing of the spawn in the compost is known as spawning. Spawn is thoroughly mixed in the compost at the rate of 600-750 gm per 100 kg of compost (0.6-0.75%). The spawned compost is filled in tray or polypropylene bags covered with formalin treated news papers. In case of bags, they should be folded at the top and covered up. After spawning, temperature and humidity of crop room should be maintained at 22-26^{o}C and 85-90%, respectively for spawn run. Water should be sprayed over the covered news papers, walls and floors of the crop room. After 12-14 days of spawning white mycelial growth is seen running the entire length of the tray/bag. This is then covered with casing soil on the surface.

Casing soil : The significance of casing soil is to maintain the moisture content and exchange of gases within the surface of the compost which helps in the proper growth of the mycelium. The pH of the casing soil should be 7.5-7.8 and must be free from any infection or disease. In our country casing soil is prepared from the following ingredients.

Two years old manure + garden soil	3:1
Two year old manure + garden soil	2:1
Two year old manure + spent compost	1:1
Two year old manure + spent compost	2:1

Pasteurization of casing soil: The casing soil is piled on cemented floor and is treated with 4% formalin solution. Thorough turning of the soil is done and it is covered with polythene sheet for the next 2-3 days. After that remove the polythene cover and turn the casing soil so that it is free from the smell of formalin.

Using the casing soil: A layer of casing soil (3-4cm thick) is being spread uniformly on the compost when the surface has been covered by white mycelium of the fungus. Formalin solution (0.5%) is then being sprayed. Temperature and humidity of the crop room should be maintained at 14-18^{o}C and 80-85%, respectively. Proper ventilation should be arranged with water being sprayed once or twice a day.

Harvesting of crop: Pin head initiation takes place after 12-18 days of casing and the fruiting bodies of the mushroom can be harvested for around 50-60 days. The crops should be harvested before the gills open as this may decrease its quality and market value.

Productivity: From 100 kg compost prepared by long method of composting 14-18 kg of mushroom can be obtained. Similarly, 18-22 kg mushroom can be obtained from pasteurized compost (Short Method Compost).

2. Oyster mushroom

The species of the genus *Pleurotus* are commonly known as oyster mushroom or dhingri mushroom. This mushroom can be cultivated at a temperature range between 20-28^{o}C and relative humidity between 75-90 per cent.

Steps of cultivation process

Substrate and its preparation

The tropical wastes like rice straw, wheat straw, corncobs, dried water hyacinth, sugarcane bagasse, banana leaves, cotton waste or sawdust are used as substrate for cultivation. The straw should be cut into small pieces (3-5cm long) to facilitate proper wetting as well as to increase surface area. Although this mushroom can be cultivated on simple water soaked straw but there are chances of crop failure due to presence of contaminants. In order to avoid contaminations the straw should be treated by hot water and chemical.

Hot water treatment-The substrate should be is treated with hot water at 65^{o}C for 1 hour. The excess water is then drained off and substrate cool down to room temperature for spawning.

Chemical treatment- The materials are usually soaked in water chemically sterilized with carbendazim (7-10g) and formalin (120-150 ml)/ 100 litre of water for 16-18 hours. After that straw is taken out from solution and spread on clean cemented floor or on polythene sheet to evaporate the excess water. The ready substrate should contains 65-68 per cent moisture.

Proper timing for cultivation

Tarai, Bhawar & lower hills (600-1000m) : Feb-April & Aug.-Oct. (02 crops)
Mid hills (1000-1500m): March.- May & July.-Sept (02 crop)
High hills (1500-2400m): May- Aug. (02 crops)
Higher hills (>2400m): June- July (01 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:

Tarai, Bhawar & lower hills (600-1000m): April-Sept. (02 crops)
mid hills (1000-1500m): May - Aug (01 crop)

Cultivated species: *Calocybe indica* and *Macrocybe gigentium*

Spawning and crop management: About 18-20 days old spawn is used for spawning. Spawning

should be done @ 4 per cent of ready substrate. The spawning is usually done by mixing the spawn throughout substrate. The spawned substrate should be filled in polythene bags 4-5kg per bag. The bags should be folded at the top and covered up. The optimum temperature for growth of mycelium, ranges between is 20-37^{o}C. Relative humidity in growing room should be range between 80-85% during spawn-run. Spawn run usually takes about 15-20 days.

Casing: This mushroom needs casing for fruit body initiation. After complete spawn run casing is done and its thickness should be kept 2-3 cm is being spread uniformly on the surface of the spawn run substrate. Temperature and humidity of the crop room should be maintained at 25-35^{o}C and 80-85%, respectively. Proper ventilation and adequate light should be maintained and water being sprayed once or twice a day. After 10-12 day of casing fruit primordia (pin head) are formed and within 5-6 days the mature and ready for harvesting.

Harvesting: The fruit bodies should be harvested before spore release by twisting so that stubs are not left on substrate. After harvesting lower portion of stalk with adhering casing soil should be cut with sharp knife. About 70 kg fresh mushroom can be harvested per quintal of dry substrate.

I . Enabling Policies

1.A Existing policies related with agriculture and animal husbandry

Being sponsored by Agriculture and Veterinary department

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

Policies may be made to attract rural youth in agriculture to check migration

2.A Existing Institutions

SAU, ICAR institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, KVK, NGOs

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

SAU, ICAR institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, KVK, NGOs

3.A Existing Incentives

Enabled by state departments

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

The subsidy in cases like polyhouse, fish tank, poultry etc. may be increased so that more number of farmers can take benefit

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. More crops may be added in the PMFBY scheme
2. Trout crop & raceway insurance facility

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

1.A Existing marketing facilities

Facility of linkage to the market for farm produce is very poor

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

1. Transportation need to be strengthened with cold chain vehicle facilities.
2. Local or block level mandies to be established
3. Fish market, Trout fish market facility & Marketing of trout through farmers' co-operatives

2.A Existing grading facilities

Not available

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

Grading machines should be installed at block/village level

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

Processing facilities of farm produce should be installed at block/village level

For grains:

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

For horticultural crops:

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

2.D Packing facilities to be created for better marketing and value addition in the district

Packaging facilities of farm produce should be installed at block/village level

For grains:

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

For horticultural crops:

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

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

1. Market to the farm produce is a big problem for large scale production
2. Transportation problem.

3. No value addition plants of crops are available

K. Online Management and Evaluation

1.A Existing online management structure available

Internet etc.

1.B Restructuring required for online management and evaluation in specific agro-climatic region of district

Easily operative mobile app for farmers at village level should be constructed

2.A Existing evaluation procedure

Manual

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

Easily operative mobile app and software for online management and evaluation by state agriculture department and KVKs

3.A Existing monitoring system

Physical

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

Easily operative mobile app and software for monitoring by state agriculture department and KVKs

4.A Existing feedback system

Manually

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

Easily operative mobile app and software required

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

Easily operative mobile app and software required

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

Region A : 1000m

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties for increasing productivity

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953 and UP 2572); paddy (Irrigated - VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85,* Pant Dhan-19, Pusa Basmati 1509; Spring rice - VL Dhan 208 and VL Dhan 209; Jethi rice - Vivek Dhan 154 and VL Dhan 157); corn (Vivek QPM 9, Vivek Maize Hybrid 45, Vivek Maize Hybrid 53,CMVL Sweet Corn 1, CMVL Baby Corn 2) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag* and *Pratapnagar* blocks.
2. Promotion of high yielding varieties of Barley (VL Jau 118 and VLB 94) and finger millets (PRM 1, , VL Mandua 324, and VL Mandua 352) in *Chamba, Narendranagar, Thauldhar, Kirtinagar* and *Devprayag* blocks.
3. Promotion of high yielding variety of lentil (Pant Lentil -8, VL Masoor 125, VL *Masoor* 126, VL *Masoor* 507 and VL *Masoor* 514), horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19), soybean (Pant Soaybean 1092, Pant Soaybean 1225, VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65) and Pigeon pea (VL *Arhar* 1) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag* and *Pratapnagar* blocks.
4. Promotion of high yielding varieties of vegetable pea (Pant Sanbji Matar-3, Vivek Matar 10, & Vivek Matar 12), French bean (VL Bauni Bean 1 & VL Bean 2), tomato (Heemsona, Arka Rakshak, Naveen 2000+ and VL Tamatar 4), Capsicum (VL Shimla Mirch 3), Onion (Agri Found

Light Red, NHRDF Red & VL Piaz 3) and garlic (VL Garlic 1) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag* and *Pratapnagar* blocks. Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Construction of water harvesting ponds/ tanks, check bunds to harvest the rain water.
2. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
3. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
4. Creation of trenches for high percolation of water in most of the area of *Chamba*, *Narendranagar*, *Jakhnidhar*, *Bhilangana*, *Thauldhar*, *Kirtinagar*, *Thathyur*, *Devprayag* and *Pratapnagar* blocks.
5. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in low or valley areas of all the blocks of this region.
6. 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. Cultivation of Cinnamon (Tejpatta) plants at low hills in *Narendranagar* particularly Nala, Pali and Rampur cluster and *Devprayag* blocks.
2. Promotion of ginger cultivation in *Narendranagar, Jhakhnidhar* and *Devprayag* blocks.
3. Promotion of organic cultivation of turmeric in *Jakhnidhar, Devprayag* and *Narendranagar* blocks.
4. Promotion of production of tomato cultivation in *Narendranagr, Devprayag* and *Thathyur* block with proper crop rotation.
5. Promotion of production of pigeon pea in *Thauldhar, Chaka* cluster of *Jakhnidhar* block and *Devprayag* block.
6. Promotion of production of lentil in *Chamni*, *Nakot* clusters of *Chamba* block and *Jakhnidhar*, *Anjanisain* clusters of *Jakhnidhar* block.
7. Promotion of organic production of basmati rice in *Maletha* and *Pokhal* clusters in *Kirtinagar* block; *Tipali*, *Kot*, *Dadur* clusters in *Chamba* blcok and *Nala*, *Rampur*, *Jajal* in *Narendranagar* block.
8. Promotion of subtropical fruit crops Mango, Guava and Litchi in *Narendranagar*, *Kirtinagar*, *Devprayag*.

Management of wild animal problem

1. Promotion of protected cultivation of vegetables in *Nagni*, *Jardhar* clusters of *Chamba* block and in *Thauldhar* block.
2. Promotion of live fencing of wild rose, Karonda plant in surrounding the field in *Jakhnidhar* block.
3. Promotion of plantation Hishalu and other wild fruits in Van Panchayat area for wild animal in all blocks.
4. Strengthening of farmers through skill training
5. Organisation of regular trainings and feedback with experts regarding scientific methods of cultivation in each cluster.
6. Adoption of farm mechanization
7. Popularization of multi crop thresher and Power Tiller/ Power weeder at Nyay Panchayat level in all the blocks.
8. Promotion of improved sickle, maize sheller, Vivek Millet thresher cum pearler, VL Paddy thresher and Vivek small tool kit for reduction in drudgery of hill farmers.

Adoption of efficient irrigation techniques

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

1. Popularization of soil testing in intensive mode and distribution of soil health cards to farmers for judicious use of fertilizers.
2. Promotion of cultivation of green manuring crops like Sesbania and Sunhemp.
3. Adoption of well decomposed FYM and other compost.
4. Promotion of bio- fertilizers and recommended doses of FYM and vermi-compost to improve soil health.
5. Promotion of soil nutrient and irrigation based full package of practices during cultivation of crop varieties.

Other

1. Promotion of biotic & abiotic stress resistance varieties and alteration in cropping pattern.
   Promotion of Pusa Hydrogel technology in the cultivation of vegetables, pulses and cereals in all blocks.

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of high milk breeds of cows (Shaiwal, Red Sindhi & Jersey), buffaloes (Murrah) and goats (Beetal, Sirohi & Jamunapari) in *Narendranagar, Thauldhar* and *Chamba* block.
2. Establishment of Fodder Bank in *Narendranagar, Thauldhar*, *Devprayag, Pratapnagar* and *Chamba* block to meet fodder requirement of area particularly during lean period.
3. Establishment of milk chilling plant at *Narendranagar*, *Thauldhar* and *Chamba* block
4. Promotion of Urea, Molasses, and Mineral mixer blocks at *Nyaypanchayat* level.
5. Strengthening of traditional water bodies/ rivulets with Mahaseer or carps at Chamba and Devprayag block.
6. Promotion of availability of feed material with low prices & timely health check-ups of animals.
7. Introduction and promotion of Cross bred milch breed of animal for increasing income of marginal farmers.
8. Appointment of more numbers of veterinary experts at block level.
9. Organisation of regular vaccination and diseases management on time.

Strategy 3 : Integrating Farming system

Development of following IFS model in each cluster for one acre.

Cropping systems (Area 4000 m^2)

Rice-wheat

Horsegram/Pigeon pea-Lentil

Tomato/capsicum-Vegetable pea

Horticulture

Mango/Guava/Lemon (100 plants)

Livestock

Cow (1)/ Buffalo (1) + Backyard poultry (100)

Others

One vermicompost of 20 m^2

One Polytunnel of 10 m^2 for nursery raising

Fodder production mainly hybrid napier (CO-4) in bunds

Strategy 4 : Reducing post harvest losses and value addition

1. Installation of mini grading & processing centres for Fruit & vegetable at Chamba.
2. Establishment of packing & Storage facilities for Processed/raw fruits and vegetables.
3. Development of Dehusker, Pearler, grader, miller and packaging unit for coarse grain cereals at each Nyaypanchayat level.
4. Establishment of storage facilities like warehouses, cold storage and cold chamber at each block level.

Strategy 5 : Waste land development and waste water

1. Promotion of practices developed by institutes like IISWC, Dehradun
2. Plantation of Mulberry plants, Wild fruit plants (wild apricot, golden raspberry, Wild pear), Fodder

trees (Bheemal, Utees,) may be promoted at village level in each cluster.
3. Construction of trenches, LDPE tanks and check dams/ trenches at each clusters of the region A.
4. Plantation of fodders like perennial grasses viz. Sita grass, Guinea, napier etc
5. Contour making for arable purpose in waste land.
6. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Judicious application specific fertilizers and micronutrients like Zinc, Boron & Phosphorus etc. after soil testing in every block.
2. Promotion of Custom Hiring Centre (CHC) for the use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers etc.) at cluster or Nyaypanchayat level.
3. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers.
4. Establishment of sales and community centres at each cluster for easy and timely availability of seeds, seedlings, fertilizers.
5. Promotion of recommended seed rate, spacing and depth.
6. Promotion of need based application of pesticides and other agricultural inputs.
7. Promotion of hand tools in agricultural and horticultural operations.
8. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
9. Promotion of pressurized irrigation techniques in horticultural crops

Strategy 7 : Off-farm income

1. Creation of SHGS and encouragement of micro-entrepreneurship and collective farming of all blocks.
2. Promotion of value added product making.
3. Promotion of Mushroom production, Honey Bee production, Sericulture woollen knitting and handicrafts for small and landless farmers in all blocks.
4. Establishment of processing centres for fruits and vegetables and establishment of Vermi-composting units.

Strategy 8 : Enabling Policies

1. Implementation of Soil Health Card Scheme in each block.
2. Establishment of soil testing labs at block level.
3. Implementation of policies for control of wild animal menace in agricultural areas.
4. Land consolidation in Tehri Garhwal district is essentially required.
5. Labelling of organic inputs and certification mechanism for various crops in all blocks.
6. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material of Mango, Guava and Citrus fruits etc.
7. Addition of more crops in the PMFBY scheme.
8. Policies may be made to attract rural youth in agriculture to check migration.
9. Enhancement of subsidy in cases like polyhouse, fish tank, poultry etc. so that more number of farmers can take benefit.

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

1. Establishment of mini *Mandis* or *Hatts* and *Mandis* at each block level and connect it to Electronic National Agricultural Market (eNAM) for better pricing.
2. Promotion of local *Hatt* at Tahsil level in all blocks. To check the interference of middle men in marketing of agricultural produce of the farmers, proper marketing network to be developed
3. Creation of better transportation facilities with cool chain van at Block level.
4. Creation of direct linkages with food processing industries for better prices.
5. Establishment of strong linkages with various stake holders to furnish information on crop produce

and surplus.
6. Establishment of procurement and collection centre at Nyaypanchyat level for agricultural surplus with proper labelling.
7. Installation of grading, processing and packaging facilities at block/village level

Strategy 10 : Online Management and Evaluation

1. Mobile apps/ software for online management and evaluation may be developed and farmers as 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, evaluation and feedback.
3. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
4. Organization of monthly review meeting at district to solve the problems related with farmers.
5. Promotion of use of radio, TV talks and use of Whatsapp etc. for effective implementation of program.

Region B: 1000-1500m

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties for increasing productivity

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349, HS-365, HS-507 and UP 2572); Barley (VL Jau 118 and VLB 94); paddy (Irrigated - VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85*, Pant Dhan-19, Pusa Basmati 1509; Rainfed- Chatki Dhan- VL Dhan 208, VL Dhan 209; Jethi dhan –Vivek Dhan 154, VL Dhan 157, VL Dhan 156 and VL Dhan 158) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag* and *Pratapnagar* blocks.
2. Promotion of high yielding varieties of specialty corn (CMVL Sweet Corn 1, CMVL Baby Corn 2).
3. Promotion of high yielding varieties of finger millets (PRM 1, , VL *Mandua* 324, VL *Mandua* 352 7); Barnyard millet (PRJ-1, VL Madira 172 and VL *Madira* 207) and Amaranthus (VL *Chua* 44); Buckwheat (VL *Ugal* 7 & PRB 1) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag* and *Pratapnagar* blocks.
4. Promotion of high yielding variety of lentil (Pant Lentil 08, VL Masoor 125, VL *Masoor* 126, VL *Masoor* 129, VL *Masoor* 50 and VL Masoor 514), horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19), soybean (Pant Soaybean 1092, Pant Soaybean 1225, VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65) and Pigeon pea (VL *Arhar* 1, Pant Arhar-3 and Pant Arhar-291) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag* and *Pratapnagar* blocks.
5. Promotion of high yielding varieties of vegetable pea (Pant Sanbji Matar-3, Vivek Matar 10, Vivek Matar 11 & Vivek Matar 12), Capsicum (VL Shimla Mirch 3, Yellow Wonder, Pusha Dipti, Bharat, Indira, Aasha, Orobelle, Natasha, Swarna), Potato (Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3, Kufri Jyoti, Kufri Chandramukhi), French bean (Pusa Anupama, VL Bauni Bean 1 & VL Bean 2), tomato (Heemsona, Arka Rakshak, Naveen 2000+ and VL Tamatar 4), Onion (Agri Found Light Red, NHRDF Red & VL Piaz 3) and garlic (VL Garlic 1 & VL Lahsun 2) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag and Pratapnagar* blocks.
6. Promotion of millets (Finger millet - , VL Mandua 324, and VL Mandua 352; Barnyard millet (VL Madira 172 and VL Madira 207) in *Thualdhar, Jakhnidhar, Bhilangana and Pratapnagar* blocks.
7. Promotion of subtropical fruit crops Lemon, Pomegranate (Kandhari, Ganesh), peach (Floradasun, FL16-33), nectarine in Chamba, Thualdhar, Jakhnidhar, Bhilangana and Pratapnagar.
8. Promotion of high density plantation of Pomegranate (variety Kandhari) and Nectarine (Snow queen).
9. Promotion of Kiwi plantation (Allision, Havard, Monty, Brunno) in Chamba and Thatyur blocks.

Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Construction of water harvesting ponds/ tanks, check bunds to harvest the rain water.
2. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
3. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
4. Creation of trenches for high percolation of water in most of the area of *Chamba*, *Narendranagar*, *Jakhnidhar*, *Bhilangana*, *Thauldhar*, *Kirtinagar*, *Thathyur*, *Devprayag* and *Pratapnagar* blocks.
5. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in low or valley areas of all the blocks of this region.
6. 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 apple in *Chamba* and *Thathur* blocks especially *Chamba-Mussouri* fruit belt.
2. Cultivation of Cinnamon (Tejpatta) plants at low hills in *Narendranagar* particularly Nala, Pali and Rampur cluster and *Devprayag* blocks.
3. Promotion of ginger cultivation in *Narendranagar, Jhakhnidhar* and *Devprayag* blocks.
4. Promotion of organic cultivation of turmeric in *Jakhnidhar, Devprayag* and *Narendranagar* blocks.
5. Promotion of onion and garlic cultivation in *Thauldhar, Narendranagar* and *Pratapnagar* blocks.
6. Promotion of production of vegetable pea and okra in *Thualdhar* and *Pratapnagar* blocks.
7. Promotion of off season vegetables (tomato, capsicum, cole crops etc.,) cultivation in *Chamba, Thathyur, Narendranagar, Pratanagar* and *Devprayag* blocks.
8. Promotion of production of tomato cultivation in *Narendranagr, Devprayag* and *Thathyur* block with the use of proper crop rotation.
9. Promotion of production of pigeon pea in *Thauldhar, Chaka* cluster of *Jakhnidhar* block and *Devprayag* block.
10. Promotion of production of lentil in *Chamni*, *Nakot* clusters of *Chamba* block and *Jakhnidhar*, *Anjanisain* clusters of *Jakhnidhar* block.
11. Promotion of organic production of basmati rice in *Maletha* and *Pokhal* clusters in *Kirtinagar* block; *Tipali*, *Kot*, *Dadur* clusters in *Chamba* blcok and *Nala*, *Rampur*, *Jajal* in *Narendranagar* block.
12. Promotion of stone (Peacanut, Apricot) and citrus fruits (Malta).

Management of wild animal problem

1. Promotion of protected cultivation of vegetables in *Nagni*, *Jardhar* clusters of *Chamba* block and in *Thauldhar* block.
2. Promotion of live fencing of wild rose, Karonda plant in surrounding the field in *Jakhnidhar* block.
3. Promotion of plantation of wild fruits like Kafal, Wild apricot (Chullu), wild pear in Van Panchayat area for wild animal in all blcoks.

Strengthening of farmers through skill training

Organisation of regular trainings and feedback with experts regarding scientific methods of cultivation in each cluster.

Adoption of farm mechanization

1. Popularization of multi crop thresher and Power Tiller/ Power weeder at Nyay Panchayat level in all the blocks.
2. Promotion of improved sickle, maize sheller, Vivek Millet thresher cum pearler, VL Paddy thresher and Vivek small tool kit for reduction in drudgery of hill farmers.

Adoption of efficient irrigation techniques

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available,
2. Drip Irrigation in integration with water harvesting structure where irrigation water is not available

3. Green House Cultivation for Vegetables

Management of soil health

1. Popularization of soil testing in intensive mode and distribution of soil health cards to farmers for judicious use of fertilizers.
2. Promotion of cultivation of green manuring crops like Sesbania and Sunhemp.
3. Adoption of well decomposed FYM and other compost.
4. Promotion of bio- fertilizers and recommended doses of FYM and vermi-compost to improve soil health.
5. Promotion of soil nutrient and irrigation based full package of practices during cultivation of crop varieties.

Other

1. Promotion of biotic & abiotic stress resistance varieties and alteration in cropping pattern.
2. Promotion of Pusa Hydrogel technology in the cultivation of vegetables, pulses and cereals in all blocks.

Strategy 2 : Livestock: Goatry, Poultry, Fisheries

1. Promotion of high milk breeds of cows (Shaiwal, Red Sindhi & Jersey) and goats (Beetal, Sirohi & Jamunapari) in *Thauldhar*, *Thatyur, Pratapnagar* and *Chamba* blocks.
2. Establishment of Fodder Bank in *Narendranagar, Thauldhar*, *Thatyur, Pratapnagar* and *Chamba* block to meet fodder requirement of area particularly during lean period.
3. Establishment of milk chilling plant at *Narendranagar*, *Thauldhar* and *Chamba* block
4. Promotion of Urea, Molasses, and Mineral mixer blocks at *Nyaypanchayat* level.
5. Strengthening of traditional water bodies/ rivulets with Mahaseer or carps at Chamba and Devprayag block.
6. Promotion of availability of feed material with low prices & timely health check-ups of animals.
7. Introduction and promotion of Cross bred milch breed of animal for increasing income of marginal farmers.
8. Appointment of more numbers of veterinary experts at block level.
9. Organisation of regular vaccination and diseases management on time.

Strategy 3 : Integrated Farming system

Development of following IFS model in each cluster for one acre.

Cropping system (Area 4000 m^2)

Rice-wheat

Horsegram/Pigeon pea-Lentil

Tomato/capsicum-Vegetable pea

Horticulture

Stone fruits/Apple/Kiwi/pear (100 plants)

Livestock

Cow (1)/Goat/Sheep (10) + Backyard poultry (100)

Others

One vermicompost of 20 m^2

One Polytunnel of 10 m^2 for nursery raising

Fodder production mainly hybrid napier (CO-4) in bunds

Strategy 4 : Reducing post harvest losses and value addition

1. Installation of mini grading & processing centres for Fruit & vegetable at Chamba.
2. Establishment of packing & storage facilities for Processed/raw fruits and vegetables should be installed.
3. Development of Dehusker, Pearler, grader, miller and packaging unit for coarse grain cereals at each Nyaypanchayat level.
4. Establishment of storage facilities like warehouses, cold storage and cold chamber at each block level.

Strategy 5 : Waste land development and waste water

1. Promotion of practices developed by institutes like IISWC, Dehradun
2. Plantation of Mulberry plants, Wild fruit plants (wild apricot, golden raspberry, Wild pear), Fodder trees (*Grewia*, *Alnus*, *Quercus*) may be promoted at village level in each cluster.
3. Construction of trenches, LDPE tanks and check dams/ trenches at each clusters of the region A.
4. Plantation of fodders like perennial grasses viz. Sita grass, Guinea, napier etc
5. Contour making for arable purpose in waste land

Strategy 6 : Reduced cultivation cost

1. Judicious application specific fertilizers and micronutrients like Zink, Boron & Phosphorus etc. after soil testing in every block.
2. Promotion of Custom Hiring Centre (CHC) for the use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers etc.) at cluster or Nyaypanchayat level.
3. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers.
4. Establishment of sales and community centres at each cluster for easy and timely availability of seeds, seedlings, fertilizers.
5. Promotion of recommended seed rate, spacing and depth.
6. Promotion of need based application of pesticides and other agricultural inputs.
7. Promotion of hand tools in agricultural and horticultural operations.
8. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
9. Promotion of pressurized irrigation techniques in horticultural crops.

Strategy 7 : Off-farm income

1. Creation of SHGS and encouragement of micro-entrepreneurship and collective farming of all blocks.
2. Promotion of value added product making.
3. Promotion of Mushroom production, Honey Bee production, Sericulture woollen knitting and handicrafts for small and landless farmers in all blocks.
4. Establishment of processing centres for fruits and vegetables and establishment of Vermi-composting units.

Strategy 8 : Enabling Policies

1. Implementation of Soil Health Card Scheme in each block.
2. Establishment of soil testing labs at block level.
3. Policies must be implemented for control of wild animal menace in agricultural areas.
4. Land consolidation in Tehri Garhwal district is essentially required.
5. Labelling of organic inputs and certification mechanism for various crops in all blocks.
6. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material of Apple, Stone and Citrus fruits etc.
7. Addition of more crops in the PMFBY scheme.
8. Implementation of policies to attract rural youth in agriculture to check migration.
9. Enhancement of subsidy in cases likes polyhouse, fish tank, poultry etc. so that more number of farmers can take benefit.

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

1. Establishment of mini *Mandis* or *Hatts* and *Mandis* at each block level and connect it to Electronic National Agricultural Market (eNAM) for better pricing.
2. Promotion of local *Hatt* at Tahsil level in all blocks. To check the interference of middle men in marketing of agricultural produce of the farmers, proper marketing network to be developed
3. Creation of better transportation facilities with cool chain van at Block level.
4. Creation of direct linkages with food processing industries for better prices.

5. Establishment of strong linkages with various stake holders to furnish information on crop produce and surplus.
6. Establishment of procurement and collection centre at Nyaypanchyat level for agricultural surplus with proper labelling.
7. Installation of grading, processing and packaging facilities at block/village level

Strategy 10 :Online Management and Evaluation

1. Development of mobile apps/ software for online management and evaluation may be developed and farmers as well as concerned experts may be linked with it.
2. Formation of district level committees of State line departments with KVK experts for field and as well as online monitoring, evaluation and feedback.
3. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
4. 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.

Region: C (1500-2400 m)

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties for increasing productivity

1. Promotion of high yielding varieties of wheat {VL *Gehun* 829, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 (from 1500 to 1700m amsl), VL Gehun 832 and HPW 155, HS 365 and UP 2572(from 1700 to 2400m amsl)}, Barley (VL Jau 118 and VLB 94 upto 1700 amsl) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag* and *Pratapnagar* blocks.
2. Promotion of high yielding varieties of specialty corn (CMVL Sweet Corn 1, CMVL Baby Corn 2 (upto 2000m amsl).
3. Promotion of high yielding varieties of finger millets (PRM 1, and VL Mandua 352 upto 2000m amsl); Barnyard millet (PRJ-1 and VL Madira 172 and VL Madira 207 upto 2000m amsl) and Amaranthus (VL *Chua* 44); Buckwheat (VL *Ugal* 7 & PRB 1) in *Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag* and *Pratapnagar* blocks.
4. Promotion of high yielding varieties of vegetable pea (Pant Sanbji Matar-3, Vivek Matar 11 for main season & VL Ageti Matar 7 for August sown*), C*apsicum (Shimla Mirch 3 upto 1800m amsl, Yellow Wonder, Pusha Dipti, Bharat, Indira, Aasha, Orobelle, Natasha, Swarna), Potato (Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3, Kufri Jyoti, Kufri Chandramukhi), French bean (Pusa Anupama, VL Bean 2), tomato (Heemsona, Arka Rakshak, Naveen 2000+ and VL Tamatar 4 upto 1800m amsl), Onion (Agri Found Light Red & VL Piaz 3) and garlic (VL Garlic 1) in Chamba, Narendranagar, Jakhnidhar, Bhilangana, Thauldhar, Kirtinagar, Thathyur, Devprayag and Pratapnagar blocks.
5. Promotion of Kiwi plantation (Allision, Havard, Monty, Brunno) in Chamba and Thatyur blocks.
6. Promotion of high yielding varieties of apple (Super Cheif, Red Cheif, Scarlet spur, Oregon Spur and Jeromine) in Chamba and Thatyur blocks; walnut cultivation (Gobind, CITH-1,2,3) in Chamba, Thatyur, Pratapnagar and Thauldhar blocks; Peach (Floradasun, FL16-33, July Elberta, Nectarines) and Plum (Santa rosa, Mariposa) in Chamba, Thatyur and Paratapnagar blocks.

Recommended package and practices will be followed for the above said crop varieties

Strengthening of traditional water storage structure

1. Construction of water harvesting ponds/ tanks, check bunds to harvest the rain water.
2. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
3. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
4. Creation of trenches for high percolation of water in most of the area of *Chamba*, *Narendranagar*, *Jakhnidhar*, *Bhilangana*, *Thauldhar*, *Kirtinagar*, *Thathyur*, *Devprayag* and *Pratapnagar* blocks.

5. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in low or valley areas of all the blocks of this region.
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Adoption of cluster approach for holistic development

1. Rejuvenation of existing senile orchards of apple in *Chamba* and *Thathur* blocks especially *Chamba-Mussouri* fruit belt.
2. Cultivation of Cinnamon (Tejpatta) plants at low hills in *Narendranagar* particularly Nala, Pali and Rampur cluster and *Devprayag* blocks.
3. Promotion of ginger cultivation in *Narendranagar, Jhakhnidhar* and *Devprayag* blocks.
4. Promotion of organic cultivation of turmeric in *Jakhnidhar, Devprayag* and *Narendranagar* blocks.
5. Promotion of onion and garlic cultivation in *Thauldhar, Narendranagar* and *Pratapnagar* blocks.
6. Promotion of production of vegetable pea and okra in *Thualdhar* and *Pratapnagar* blocks.
7. Promotion of off season vegetables (tomato, capsicum, cole crops etc.,) cultivation in *Chamba, Thathyur, Narendranagar, Pratanagar* and *Devprayag* blocks.
8. Promotion of production of tomato cultivation in *Narendranagr, Devprayag* and *Thathyur* block with the use of proper crop rotation.
9. Promotion of production of pigeon pea in *Thauldhar, Chaka* cluster of *Jakhnidhar* block and *Devprayag* block.
10. Promotion of production of lentil in *Chamni*, *Nakot* clusters of *Chamba* block and *Jakhnidhar*, *Anjanisain* clusters of *Jakhnidhar* block.
11. Promotion of organic production of basmati rice in *Maletha* and *Pokhal* clusters in *Kirtinagar* block; *Tipali*, *Kot*, *Dadur* clusters in *Chamba* blcok and *Nala*, *Rampur*, *Jajal* in *Narendranagar* block.
12. Promotion of subtropical fruit crops stone and citrus fruits.

Management of wild animal problem

1. Promotion of protected cultivation of vegetables in *Nagni*, *Jardhar* clusters of *Chamba* block and in *Thauldhar* block.
2. Promotion of live fencing of wild rose, Karonda plant in surrounding the field in *Jakhnidhar* block.
3. Promotion of plantation of wild fruits like Kafal, Wild apricot (Chullu), wild pear in Van Panchayat area for wild animal in all blcoks.

Strengthening of farmers through skill training

Organisation of regular trainings and feedback with experts regarding scientific methods of cultivation in each cluster.

Adoption of farm mechanization

1. Popularization of multi crop thresher and Power Tiller/ Power weeder at Nyay Panchayat level in all the blocks.
2. Promotion of improved sickle, Vivek Millet thresher cum pearler and Vivek small tool kit for reduction in drudgery of hill farmers.

Adoption of efficient irrigation techniques

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available,
2. Drip Irrigation in integration with water harvesting structure where irrigation water is not available
3. Green House Cultivation for Vegetables

Management of soil health

1. Popularization of soil testing in intensive mode and distribution of soil health cards to farmers for judicious use of fertilizers.
2. Promotion of cultivation of green manuring crops like Sesbania and Sunhemp.
3. Adoption of well decomposed FYM and other compost.
4. Promotion of bio- fertilizers and recommended doses of FYM and vermi-compost to improve soil health.
5. Promotion of soil nutrient and irrigation based full package of practices during cultivation of crop

varieties.

Other

1. Promotion of biotic & abiotic stress resistance varieties and alteration in cropping pattern.
2. Promotion of Pusa Hydrogel technology in the cultivation of vegetables, pulses and cereals in all blocks.

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5. Contour making for arable purpose in waste land.
6. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

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