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

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

A. General information about Agroeco-region

District : Rudraprayag
Agro-ecological region : Region A (up to 1000 m)
Main Blocks in Region : Agastymuni block
Main village cluster in blocks : 12
Irrigated Clusters : 2
Rainfed Clusters : 10
Existing rain water management facilities :

1. Limited to few farmers in low hills.
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 to a few farmers.

B. Productivity Enhancement

1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region

1. Water storage of roof harvesting water.
2. Poly tank for water storage for multiple uses and can be used for fish pond.
3. Low cost lining material to check seepage.
4. Efficient water application systems (sprinkler and drip).
5. Rejuvenation and popularization of traditional water harvesting systems.

2. Existing practices for soil health improvement

1. Use of undecomposed farmyard manure/compost.
2. Use of legume crop in mixed farming.
3. Meagre/ no use of bio-fertilizers.
4. Imbalanced nutrient use in crop production.
5. Use of raw/partially decomposed FYM.
6. Meagre/ no compost making/recycling of crop residue.
7. Mixed cropping of cereal and legume in areas around Tilwar *and Agastymuni* belts.
8. Soil health card scheme launched in 2015.

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

1. Organic inputs based farming system only.
2. Promotion of legume crop rotation.
3. Supply of vermin-beds for compost formation.
4. Promotion of crop and area based farming practices like growing of Fingermillet+Paddy+ Til+ Soybean system as mixed farming.
5. Imparting training and demonstrations on fortification of manures with organic farming.

i) Cereals and oilseeds

1. Seed/ soil inoculation with *Azotobacter* and Phosphorus. solubilising microbial culture (250-300g each/ acre for seed inoculation.
2. Soil test based balanced use of fertilizers in rainfed areas.

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

ii) Pulses and soybean

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

Iii) Vegetables and spices

1. Seed/ nursery soil inoculation with *Azotobacter*/ Azospirillum inoculant and Phosphorus solubilising microbial culture (each of 200 g/m^2 for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture at transplanting time.
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 different block level.
7. Capacity building for scientific use of organic manures, Integrated Nutrient Management, use of bio-fertilizers, use of different soil amendments, vermicomposting.
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.* Seed and others organic ertilizers, micro nutrient, bio-fertilizers at Nyaypanchayat level.

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

1. Alternative strategies are adopted based on available resources.
2. Occasional Occurrence: Frost, Drought, Cold wave.
3. Almost 87% agriculture is rainfed, which requires robust strategies of rainwater conservation and harvesting.
4. Soil erosion due to steep slopes and rainfall is quite high.
5. Field crops such as rice, wheat, barley, mandua, jhangora are major crops of the region.

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

1. 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.
2. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
3. The rain water should be properly stored (In polythene tank and by making bunds) and harvested for Kharif crops.
4. Soil erosion triggered by higher slope gradient is the major issue of Rudraprayag. Therefore water and soil conservation techniques like terrace farming, bunding should be encouraged.
5. The area of off season vegetable like vegetable pea should be increased.
6. The frost susceptible vegetable crops should be grown on southern aspect of topography, so that availability of radiation increases and effect of frost could be minimized.
7. Crop residues should be burnt in the night of expected frost night.
8. Organic mulch should be used in a vegetable field for enhancing energy level in field so that crop should be protected from frost.
9. The climatic conditions, slope gradients and soils are suitable for sub tropical (in Valley region Citrus fruits, Malta and orange).

6A. Name of Field Crop: Wheat

i.Existing varieties being used

Mundari, Lal Mishri, VL-738, VL 832, VL 738, VL 804, VL 802, UP 2572, HPW 251

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

VL-804, VL-904, VL -829, VL-90, HS-490, HS-507, HPW-349 and UP 2572.

iii. Existing package of practices being used

1. Use of old and traditional varieties as dual purpose.
2. Preparation of land with 1 or 2 ploughings with local plough no definite depth.
3. Seed rate and seed sowing of 150-175 kg/ha and broadcasting is followed.
4. Use of undecomposed FYM (rainfed) and un decomposed FYM in irrigated conditions as per availability.
5. Irrigation usually maximum area is rainfed and in valley condition 1 or 2 irrigations.
6. Most of agricultural operations are manual in nature.

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

1. Use of VL-907 as high yielding crop in valley areas.
2. Preparation of land- 2 ploughing + 1 harrowing with mould bold plough up to 10-15 cm depth.
3. Seed rate and seed sow -100-125kg/ha, line sowing 18-21 cm apart.
4. Application of organic manure at @ 10-15 ton/ha
5. Irrigation-As per irrigation facility.
6. Use of thresher to reduce the pilferages at various stages.

v. Major insect pests associated with crop

Termites and Aphids

vi. IPM Module for management of insect pests

Aphid

1. Avoid late sowing of crop to save crop from aphid.
2. Conservation and enhancement of biocontrol agents like Coccinellid beetles, *Chrysopa*, Syrphid and *Apanteles* protects the crop against aphid attack.

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.

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

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, Powdery mildew, Karnal bunt, Hill bunt

viii. IPM Module for management of disease

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

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

Karnal bunt: *Tilletia indica = Neovossia indica*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carboxin 75% WP (Seed Treatment/Kg)	2-2.5	
Thiram 75% WS (Seed Treatment/Kg)	2.5-3.0	7-10

Propiconazole 25% EC	500	30
Bitertanol 25% WP	2240	
Triadimefon 25% WP	500	25

ix. Major weeds associated with crop

Anagalis arvensis, *Argemone mexicana*, *Asphodelus tenuifolius*, *Avena fatua*, *Chenopodium album* , *Phalaris minor*

x. IPM Module for management of weeds

Mechanical and cultural practices

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

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

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

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

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

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

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

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Clodinafop Propargyl 15% WP	400	110
Diclofop methyl 28% EC	2500-3500	90
Fenoxaprop-p-ethyl 10% EC	1000-1200	110
Isoproturon 50% WP	2000	
Isoproturon 75% WPs	1330	60
Methabenzthiazuron 70 %WP (PE: 2DAS)	1500-2000	100
Methabenzthiazuron 70 %WP (POE: 16-18DAS)	1000-1250	100

Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Pendimethalin 30% EC(Light soil)	3300	
Pendimethalin 30% EC (Medium soil)	4200	
Pendimethalin 30% EC (Heavy soil)	5000	
Pinoxaden 5.1 %EC (POE: 30-35DAS)	800+900	90
Sulfosulfuran 75%WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

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

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

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

1. Organic methods are followed in cultural practices.
2. Use vermibeds and other heap method for higher production.
3. Adoption of low cost based cultivation practices,
4. Wheat-Horse gram/Soybean (rainfed),
5. Timely sowing, seed treatment and use of HYV are mantra for maximization of production.
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM
8. Sale of value added products as organics can enhance the income.
9. Packaging and sale of produce in small packets.

xii. Production constraints in agro-ecological region

1. Availability of farm labour for various operations.
2. Less availability of agriculture inputs in crop production.
3. Use of imbalance and unrecompensed FYM.
4. Wild animal damages like monkey, wild pigs and others are serious problems.

5. Non availability of active family labour, Migration, poor Irrigation facilities
6. Long harvest duration

6B. Name of Field Crop : Rice

i. Existing varieties being used

China-4, Lal Dhan, Lal – Safed Rikhua, Saket 4

Pant Dhan-11, Govind, HKR-47, Pant Dhan -6, VL-62, VL 91, VL-16, Sarju-52

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

(Irrigated - VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85*; Rainfed- Chatki Dhan- VL Dhan 208, VL Dhan 209; Jethi dhan –Vivek Dhan 154, VL Dhan 157, VL Dhan 156 and VL Dhan 158)

iii. Existing package of practices being used

1. Organic cultural practices are used.
2. Use of local varieties in production system
3. Preparation of land- 1 or 2 ploughing with local plough no definite depth and manual puddling is done.
4. Seed rate and seed sowing -150 kg/ha in direct seeding rice , and in transplanting 60-70 kg/ha is used.
5. More than 45 days seeding used.
6. Undecomposed FYM 70-100qt/ha as per availability. Irrigation-usually maximum area is rain fed and in valley condition as availability of irrigation roaster of village.
7. Manual harvesting and other operations in rice cultivation.

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

1. Organic packages of practices.
2. Preparation of land- 1 or 2 ploughing with local plough.
3. Seed rate and seed sowing of 100-125 kg /ha in direct seeding rice, and in transplanting 40-50 kg/ha and sowing of 25-30days seedings are used.
4. Application of well decomposed manure @ 15 ton/ha.
5. Proper application of compost and/or FYM should be done prior to sowing. Modern technique of DSR (Direct Seeded Rice) should be followed in rainfed conditions. Water harvesting tank need to be created in rain fed areas to provide timely irrigation.
6. Balanced use of nutrients to be applied in the soil as per the soil testing analysis. 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

Stem borer, Rice leaf folder, gallmidge, rice bugs and thrips

vi. IPM Module for management of insect pests

Stem borer:

1. In the stem borer endemic area, raise the nursery away from light source.
2. Raise nursery in narrow strip and mechanically destroy egg masses and moths
3. Remove seedling with Stem borer eggs before transplanting.
4. For the monitoring install the pheromone traps in the field at the rate of 3 traps per acre at a distance of 60 m in a triangular pattern and record the males trapped daily to access the peak population.
5. 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 at 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.

6. Use of trichocard, therefore, increases the cost of cultivation without gain. The conservation of *Telenomus* and *Tetrastichus* species is self sufficient to naturally reduce the stem borer population.
7. To increase the effectiveness of parasitoides and predators in the rice field and conserve and enhance the natural enemies which are already present in the field.
8. Create favourable condition for natural enemies.
9. Conserve and enhance the natural enemies which are already present in the field.
10. Create favourable condition for natural enemies.
11. Always leave a pest residue in the field at non-economic level, for natural enemy.
12. Reduce the harmful effect of pesticides on natural enemy by:
    I. Apply insecticide only when necessary, not regularly.
    II. Apply insecticide only when the pest population reaches Economic Threshold Level.
    III. Applying a selective insecticide which is less toxic to natural enemy.
    IV. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.
    V. Use selective formulation and application method.
    VI. Application of granular formulation is less harmful to natural enemy
13. Following insecticides may be used to control stem borers of rice when the population or damage of pest is recorded to 1 moth or 1 egg mass/ m^2 or 5% dead heart :

50 Days within transplating (2 inch water in field)

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

50 Days after tranplanting

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

Bio-insecticides

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

Leaf folder:

Following insecticides may be used to control leaf folders of rice

50 Days within transplating (2 inch water in field)

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 0.4% GR	10000	53
Cartap 4% Gr	18750	
Carbosulfon 6% G	16700	37

50 Days after transplating

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

Bio-insecticides

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

Rice bug: *Leptocorysa acuta*

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

Methyl parathion 2% DP	500	25000

Biological control

Parasitoids:

Gryon flavipes, attacking: eggs

Predators:

Micraspis discolor, attacking: nymphs, adults

Neoscona theisi, attacking: nymphs, adults

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

Orthetrum sabina, attacking: nymphs, adults

Pathogens: *Beauveria bassiana*, attacking: nymphs, adults

vii. Major disease associated with crop: Khaira, Riceblast, Brown Spot, Leaf blight, False smut

viii. IPM Module for management of disease:

During Nursery Sowing

Deep summer ploughing or soil solarisation

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

Fertilizers

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

Khaira disease: Due to Zinc deficiency)

Name of the Fungicides	**(gm/ml) /ha**
Zinc sulphate (Apply in soil at the time of plot preparation)	25000
Zinc sulphate spray (2.5 Kg Quick lime & 20 Kg Urea in 1000 lit. water	5000

Sheath blight: *Rhizoctonia solani*

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

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

Biofungicides:

Name of the Bio-fungicides	(gm/lit) /ha	Treatment
Trichoderma viride 1% WP (Strain T-14 in house isolate of M/s Indore Biotech Inputs and Research (P) Ltd., Indore)	5 -10 gm/lit water	Foliar spray: Mix 2.5 Kg of *Trichoderma viride* 1% WP in 500 lit. of water. Spray three times at 15 days interval uniformly over one hectare land 30 days after planting.

Rice blast: *Magnaporthe grisea*

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

Bacterial leaf blight: *Xanthomonas oryzae*

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

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

Biofungicides

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

Brown leaf spot: *Cochiobolus miyabianus*

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

Propineb 70 %WP	1500-2000	
Idifenphos 50% EC	500-600	21
Captan 75% WP	1000	

Biofungicides

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

False smut: *Ustilaginoidea virens*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Copper hydroxide 77% WP	2000	
Copper hydroxide 53.8 %DF	1500	10

ix. Major weeds associated with crop

Oxalis sp., *Cyperus* sp., *Echinocloa* sp., *Chenopodium album*, *Cynodon* sp., *Digitaria sanguinales*, *Eleusine* sp.

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	

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

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

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

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices.
3. Jethirice- Wheat/Lentil/Barley or Rice- Wheat /onion.
4. Timely Sowing or transplanting as per season.
5. Contour cultivation and care soil & water conservation measures, maximum use of value added compost/FYM.
6. Organic lebelling and marketing of produce.
7. Sale of value added products at higher price.

xii. Production constraints in agro-ecological region

1. Rainfed farming system.
2. Less availability of agriculture inputs,
3. Use of imbalance and /or undecomposed FYM.
4. Wild animal damages
5. Availability of less household labour for agricultural operations.
6. Poor or no Irrigation facilities.

6 C. Name of Field Crop : Finger millet

i. Existing varieties being used

1. Band muthi (*Muthinda*) types
2. Khuli muthi(Jhampa)

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

VL Mandua 324, and VL Mandua 352, PRM 1

iii. Existing package of practices being used

1. Mixed farming with soybean, til and mandua is common practice.
2. Traditional seed varieties are predominat in cropping system.
3. Use of undecomposed FYM 100 q/ha
4. One hoeing in rainy season is essential.
5. Manual harvesting is mostly preffered/done.

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

1. Preparation of land with use of 2 or 3 ploughing
2. Seed rate and seed sowing of 14-16kg/ha.
3. Application of FYM @10 ton/ha.
4. Use of white colour mandua under organic conditions

v. Major insect pests associated with crop Stem borer

vi. IPM Module for management of insect pests

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

vii. Major disease associated with crop

Blast

viii. IPM Module for management of disease

1. Grow resistant variety such as VL 149.
2. 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, Euphorbia hirata*, S*olanum* sp, *Cyprus* spp.

x. IPM Module for management of weeds

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

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

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Fingermillet- Wheat/Lentil/Barley and/or Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley is used.
4. Timely Sowing and seed treatment is essential.
5. Contour cultivation and care soil & water conservation measures for high production.
6. Maximum use of value added compost/FYM
7. Sale of value added products of organic produce.

xii. Production constraints in agro-ecological region

1. Less availability of agriculture input,
2. Use of imbalance and un decomposed FYM, climate changing,
3. Wild animal damages are serious.

Manual operations are done.

6D. Name of the Field crop : Barnyard Millet

i. Existing varieties being used

Non described (Dwarf 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

PRJ-1,VL Madira 172 and VL Madira 207

iii. Existing package of practices being used

1. Traditional seed variety.
2. Use of undecomposed compost @ 10t/ha.
3. 1-2 interculture operations are done.
4. All agricultural operations are done manaually.

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

1. Preparation of land with use of 1-2 ploughings.
2. Use of seed rate @ 14-16kg/ha.
3. Application of FYM @ 10 ton/ha.
4. Replacement of PRJ-1 in all low and valley areas for doubling of production.

v. Major insect pests associated with crop

Stem borer

vi. IPM Module for management of insect pests

-

vii. Major disease associated with crop

Blight & smut

viii. IPM Module for management of disease

Grow resistant variety like PRJ 1.

ix. Major weeds associated with crop

Oxalis latifolia, *Phylanthus niruri , Amaranthus viridis, Euhorbia hirata*, S*olanum* sp, *Cyprus* sp

x. IPM Module for management of weeds

1. Weeding, hoeing
2. Deep ploughing

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.
4. Delayed sowing in PRJ-1 was beneficial to ward off bird damage at maturity time.
5. Maximum use of value added compost/FYM in field.
6. Use of local made thresher to reduce drudgery and pilferages at various levels.

xii. Production constraints in agro-ecological region

1. Less availability of agriculture inputs, use of imbalance and un decomposed FYM in field.
2. Wild animal damages are high.
3. Non-availability of active farm labour is serious.
4. No or poor Irrigation facilities.

7A. Name of the Pulse crop : Lentil

i. Existing varieties being used

Chhota masur

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

PL-4, PL-7, PL-8, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL Masoor 514

iii. Existing package of practices being used

1. Mixed with wheat in sowing.
2. Traditional seed variety and use of undecomposed FYM @5-8 t/ha.
3. 1-2 inter cultural aoperation are done.

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

1. Preparation of land with 1 or 2 ploughing is done.
2. Seed rate and seed sowing of 20-25kg/ha, with spacing 30x10cm.
3. Application of FYM @ 10 t/ha.
4. Suitable for unproductive and rain fed system.
5. Use of VLmasoor-125 for high pulse production.

v. Major insect pests associated with crop

White fly, Fruit borer, Thrips

vi. IPM Module for management of insect pests

Mechanical, cultural and biological control

vii. Major disease associated with crop

Yellow Mosaic, Blast, 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

ix. Major weeds associated with crop

Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Weeding, hoeing and deep ploughing

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) is followed.
4. Use of High yielding varieties with contour cultivation and care soil & water conservation measures to be taken.
5. Maximum use of fortified manures or compost for high pulse production.
6. Sale of value added products as organic.

xii. Production constraints in agro-ecological region

1. Availability of high yielding varieties of Lentil.
2. Farmers don't follow proper package of practices.
3. Proper market linkage is not available.
4. Improper use of irrigation facilities.
5. Lack of quality input.

7B. Name of 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

U-31, PU-35

iii. Existing package of practices being used

It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

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

1. Timely sowing of crop in IInd fortnight or month of May to first week of July.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and PSB is beneficial. Application of optimal doses of compost and farm yard manure enhances crop production. Sowing in line must be promoted for proper intercultural operations.
4. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
5. Arrangement of irrigation facilities in case of drought should be available. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. Major insect pests associated with crop

White fly, Fruit borer, Thrips

vi. IPM Module for management of insect pests

Cultural, mechanical and biological methods

Fruit Borer

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

White fly

Name of the Insecticides	(gm/ml) /ha	
Phorate 10% CG	10000	

vii. Major disease associated with crop

Yellow Mosaic, Blast

viii. IPM Module for management of disease

Trap for white fly to control yellow mosaic

ix. Major weeds associated with crop

Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Weeding, hoeing and ploughing.

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

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

xii. Production constraints in agro-ecological region

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

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

i. Existing varieties being used

Toor

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

Pant Arhar-291, VL Arhar 1, Pant Arhar-3

iii. Existing package of practices being used

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

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

1. Timely sowing of crop in from mid of May to June.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and PSB is essential. Application of optimal doses of compost or FYM enhances crop production. Sowing in line must be promoted for proper intercultural operations.
4. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
5. Arrangement of irrigation facilities in case of drought should be available.

v. Major insect pests associated with crop

White fly, Fruit borer, Thrips

vi. IPM Module for management of insect pests

Cultural, mechanical and biological methods

Pod borer: *Helicoverpa armigera*)

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

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

Redgram thrips: *Scirtothrips dorsalis*

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

vii. Major disease associated with crop

Yellow Mosaic, Blast

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Weeding, hoeing and ploughing.

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

1. Sowing of crop in suitable cropping pattern.
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 or varieties to ensure sustainability.

xii. Production constraints in agro-ecological region

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

7 D. Name of Pulse/oilseed Crop : Soybean

i. Existing varieties being used

Kala bhat (Oval), PS-1024, PRS-1, Shilajeet

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 S-56,VLS-47, PS-1092, PRS 1, VLS 21, VLS 59, VLS 63, VLB-65, PS-1225, PS-1347, PS-19

iii. Existing package of practices being used

1. Mixed farming is predominant in low or valley areas.

2. Use of local or traditional seed variety.
3. Application of undecomposed FYM 75-100 ton/ ha.
4. Manual intercultural operations and small land holding
5. Mechanical harvesting is mostly preferred.

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

1. Preparation of land by doing 1 or 2 ploughings.
2. Seed rate and seed sowing -100-125/ha,
3. Application of 10 ton/ha FYM as per availability.
4. Irrigation-usually maximum area is rain fed.
5. Use of bio-fertilizers as seed and soil treatment.

v. Major insect pests associated with crop

Semilooper, Girdle beetle, White fly, Jassids, Stem fly, Defoliators etc.

vi. IPM Module for management of insect pests

Cultural practices:

1. The cultural practices make the environment less favorable for the pests and more favorable for its natural enemies.
2. The following are cultural practices recommended for the management of soybean insect pests.
3. 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.
4. Optimal fertilizer dose of NPK and S @ 20:60-80: 30-40:20 kg/ ha should be applied.
5. Application of excessive dose of nitrogen fertilizer causes the infestation of all insect pests on soybean.
6. Crop rotation with non-leguminous plants is recommended for the management of leaf miner.
7. 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 biocontrol agents, like coccinellid beetles, *Chrysoperla* etc. In girdle beetle and semilooper endemic areas, intercropping with maize or sorghum should be avoided.
8. Planting of trap crops like castor for tobacco caterpillar, groundnut for leaf miner, marigold for pod borer and Dhaincha (*Sesbania sesban*) for girdle beetle.
9. 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

A.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.

B.Physical control:

1. Reduction of pest population by using device which affect them physically or alter their physical environment.
2. Manipulation of temperature, humidity, light is used for this purpose.
3. This includes the following:
   a. Light traps should be placed at ground level early in the season for collection and destruction of the leafminer moths.
   b. Installation of light traps in the field for monitoring and collection of adult moths.

C.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

D.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

Tobacco caterpillar: *Spodoptera litura*

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

Green semilooper: *Plusia orichalcea*

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	150	22
Indoxacarb 15.8% EC	333	31

Lambda cyhalothrin 4.9 % CS	300	31
Profenofos 50% EC	1000	40

Leaf eating caterpillar

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

White fly : *Bemisia tabaci*

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

Jassids

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

Stem fly

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Thiamethoxam 30% FS (Seed Treatment/Kg)	10	
Chlorantraniliprole 18.5% SC	150	22
Indoxacarb 15.8% EC	333	31
Lambda cyhalothrin 4.9% CS	300	31
Profenophos 50% EC	1500	30

Girdle beetle

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

Bio-insecticides

Tobacco caterpillar (*Spodoptera litura*)

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

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

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

Semilooper (*Chrysodeixis acuta*)

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

Soyabean leaf miner (*Odontota horni*)

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

Major disease associated with crop

YMV, Leaf spot, Blight, Collar rot, Rust

viii. IPM Module for management of disease

Rust: *Phakopsora pachyrhizi*

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

Collar rot: *Sclerotium rolfsii*

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

ix. Major weeds associated with crop

Oxalis latifolia, *Phylanthus niruri , Amaranthus viridis, Euphorbia hirata*, S*olanum* sp, *Cyprus* spp.

x. IPM Module for management of weeds

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

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

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

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

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

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

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

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

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

1. Organic cultivation,
2. Supply of more vermibeds for higher compost production.
3. Adoption of low cost based cultural practices.
4. Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely sowing and seed treatment with bioagent prior to sowing.
6. Use of HYV,
7. Contour cultivation and care soil and water conservation measures to avoid erosion.
8. Maximum use of value added compost/FYM
9. Good storage condition
10. Sale of value added products as organic through organic certification agency.

xii. Production constraints in agro-ecological region

1. Quality seed for higher production
2. Less availability of agriculture inputs, use of imbalance and undecomposed FYM in field crops.
3. Wild animal damages are serious.

7E. 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 and PPS-1

iii. Existing package of practices being used

1. Organic system as mixed farming is prevalent.

2. Old and mixed seed is mostly used.
3. Use of bulk unrecompensed FYM @ 8-10 t/ha in farming.
4. Mixed seeds are used for commercial cultivation.

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

1. Preparation of land- 1 or 2 ploughings.
2. Use of 4-5 kg/ha for commericial cultivation with spacing of 30x10cm.
3. Irrigation-usually maximum area is rain fed
4. **Land preparation:** One ploughing followed by 2-3 harrowings and planking.
5. **Sowing time to improve productivity and income:**

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

6. **Seed rate and spacing:**

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

7. **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.
8. Vermicompost: 5t/ha at the time of field preparation about 20 days before sowing.
9. **Harvesting and threshing:**

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

v. Major insect pests associated with crop

Aphid, saw fly, white fly

vi. IPM Module for management of insect pests

Aphid

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

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

Mustard saw fly : *Athalia lugens proxima*

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

vii. Major disease associated with crop

White rust, Powdery mildew, Blight, *Sclerotinia* rot

viii. IPM Module for management of disease

1. For management of *Sclerotinia* rot wider spacing (45x15cm) should be maintained,
2. Apply colonized *Trichoderma* decomposed cow dung/ FYM in the soil,
3. Seed treatment with garlic bulb extracts (2%).
1. Field sanitation *i.e.* collect and burn the diseased plants debris to minimize the primary source of inoculum.
2. Timely sowing of crop
3. Crop rotation with non host crops (like rice or maize) for at least 5 years in case of severe disease problems

Alternaria blight or Leaf spot: *Alternaria brassicae*

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

White rust : *Albugo candida*

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

ix. Major weeds associated with crop

Cyperus sp.,

x. IPM Module for management of weeds

Weed management:

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

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

1. Use of high yielding varieties *viz.* PT-303 or PT-507.
2. Sowing as sole cropping in field.
3. Timely sowing of crop for higher production.

xii. Production constraints in agro-ecological region

1. Inadequate seeds of high quality sarson to farmers,
2. Mixed farming system reduces the yield potential.

8A. Name of the Fruit crop: Peach

i. Existing varieties being used

Paradelux, July Elberta, Red June

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

Alxander, Red Globe, Crest heaven, Glo Heaven, Nectarine- Snow Queen

iii. Existing package of practices being used

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

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

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

v. Major insect pests associated with crop

San Jose, Tent Caterpillar, Fruit Borer, Leaf Curl 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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

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

Peach Leaf Curl Aphid:

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

Peach leaf curl aphid

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

Peach Fruit Fly:

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

vii. Major disease associated with crop

Gummosis is major problem

viii. IPM Module for management of disease

1. Use of proper cultural or field operation with minimum damage to the crop.
2. Use of borax as spray of soil application.
3. Use of antibiotic as prophylactic spray.

ix. Major weeds associated with crop

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

x. IPM Module for management of weeds

Though mechanical, chemical and control.

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

High density plantation with (3x3mts) supplemented with drip irrigation system.

xii. Production constraints in agro-ecological region

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

8 B. Name of the Fruit crop: Pear

i. Existing varieties being used

Gola

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

Gola, Hokoi, Sukoi and Schineski.

iii. Existing package of practices being used

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

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

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

v. Major insect pests associated with crop: San jose scale, Tent caterpillar, 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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.

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

Peach Leaf Curl Aphid:

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

Peach leaf curl aphid

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

Peach Fruit Fly:

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

vii. Major disease associated with crop

Fruit rot

viii. IPM Module for management of disease: Use of proper cultural or field operation with minimum damage to the crop

ix. Major weeds associated with crop

Chenopodium album, Cyperus rotundus, Cynodon dactylon and Parthenium spp.

x. IPM Module for management of weeds

Though mechanical, chemical and control.

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region High density plantation with (3x3mts) supplemented with drip irrgation system.

xii. Production constraints in agro-ecological region

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

9A. Name of the Vegetable crop : Cabbage

i. Existing varieties being used

Pride of India, Golden acre as OP

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

T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole, Green star and Pride of India

iii. Existing package of practices being used

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

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

Promotion of high yielding, round shaped, 100% heading percentage, mature within 90 days.

v. Major insect pests associated with crop

Butterflies , Aphids, *Plutell*a and bugs

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 egg*s* and larva 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.

Dimond back moth: *Plutella Xyllostella*

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

Bioinsecticides

Name of the Bio-insecticides	**(gm/ml) /ha**	**Waiting period (days)**

Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	600-1000	
Bacillus thuringiensis serovar kurstaki (3a,3b,3c) 5% WP	500-1000	
Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500	

Cabbage/cauliflower Aphid

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

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

Painted bug

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

vii. Major disease associated with crop

Stem rot, Black rot, Black spot on leaf

viii. IPM Module for management of disease

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

ix. Major weeds associated with crop

Parthenium spp., Chenopodium album, Krishaneel, Oxalis *latifolia*.

x. IPM Module for management of weeds

Weeding, hoeing and ploughing.

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

1. Use of hybrid varieties suitable for year round production system.
2. Adoption of compact and high heading percentage cultivars.
3. Popularization of rainy season hybrids in valley areas.

xii. Production constraints in agro-ecological region

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

9 B. Name of the Vegetable crop : Cauliflower

i. Existing varieties being used

Unknown varieties available in the market.

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

Early Kunwari, Pusa Kartiki, Pusa Early Synthetic, Pusa Shubhra, Pant Shubhra, Hisar No.1, Snow crown, Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2

iii. Existing package of practices being used

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

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

1. Selection of hybrids as per maturity group of crop
2. Need to develop seed production program in cauliflower.
3. Use of micronutrients especially borax

v. Major insect pests associated with crop

DBM, Aphids are serious problem

vi. IPM Module for management of insect pests

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Hand picking and destruction of cabbage butterfly egg*s* and larva
3. in nursery as well as main crop to reduce the pest multiplication.
4. 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.

Dimond back moth: *Plutella Xyllostella*

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

Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

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

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

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

vii. Major disease associated with crop

Black rot and stalk rot are serious problem

viii. IPM Module for management of disease

***Xanthomonas* Black rot:**

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

ix. Major weeds associated with crop

Parthenium sp., *Chenopodium album*, Krishaneel, *Oxalis latifola.*

x. IPM Module for management of weeds

Weeding, hoeing and 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. Intercropping with coriander and rye in valley or low hills.

xii. Production constraints in agro-ecological region

1. Non availability of suitable varieties as per agro-ecological situation.
2. Buttoning and leafyness are common problem
3. Lack of technical knowledge
4. Less availability of high quality seeds
5. High prices of hybrid seeds
6. High post-harvest losses due to long distance
7. Low prices of farm produce
8. Lack of knowledge about the cultivation practices
9. Lack of processing facilities.

9C. Name of the Vegetable crop : Radish

i. Existing varieties being used

Mixture of varieties from unknown source

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

Early Mino, Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant

iii. Existing package of practices being used

Mixed cropping with other rabi crops.

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

1. Use of long white tapering varieties
2. Line sowing and use of less or non-pithy varieties
3. Use of round shaped varieties for culinary purpose.
4. The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha.
5. For 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. Depending upon the cultivars, the roots become ready for harvesting in about 25-35 days after sowing. Early and rapid maturing European cultivars reach harvest maturity in 25-30 days after sowing.

v. Major insect pests associated with crop

Aphids are problem

vi. IPM Module for management of insect pests

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

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the pests.
2. Yellow sticky trap is effective for controlling aphid population.
3. Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha if needed.

vii. Major disease associated with crop

White rust

viii. IPM Module for management of disease

Weeding manually

ix. Major weeds associated with crop

Not serious

x. IPM Module for management of weeds

Not applied

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

1. Use of short duration, non pithy, coloured varieties for year round production.
2. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Cauliflower early- Radish- Bottlegourd
   Brinjal-Radish –Chilli
   Bottle Gourd-radish-French bean

xii. Production constraints in agro-ecological region

1. Pithyness problem in low hills
2. Less availability of high quality seeds
3. High prices of hybrid seeds
4. Low prices of farm produce
5. Lack of knowledge about the cultivation practices
6. Lack of processing facilities
7. So far no minimum support price is fixed for the crop.

9 D. Name of the Vegetable crop : Tomato

i. Existing varieties being used

Non descriptive type.

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

Short and dwarf varieties – Pear shaped.

Indeterminate hybrid varieties, Avinash (A-2), Himsona,

Naveen2000+, Pusa Sheetal, Pusa Gaurav, Pant T-3.

iii. Existing package of practices being used

1. Without soil and seed treatment, poorly managed nurseries, and subterranean stakings.
2. Non- judicious use of manures and pesticides.
3. Generally crop grown in open field condition
4. Sowing time- Feb-March
5. Planting space-(90x30 cm and 60x60 cm) for tall and dwarf varieties respectively.
6. Manually harvesting and local sale.

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

1. Use of indeterminate, round, optimal fruits weight hybrids,
2. Use of organic manures in crop production.
3. Special training and pruning techniques, upright stacking and earthling up operation, with standard harvesting techniques and stages.
4. Use Indeterminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition.
5. Crop rotation Tomato-cowpea-Early cauliflower.

v. Major insect pests associated with crop

Fruit borer and white flies in low or valley areas are serious.

vi. IPM Module for management of insect pests

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

1. Growing trap crop of African tall marigold as border row before 15 days of transplanting is beneficial in reducing egg laying in main crop.
2. Field sanitation and clean cultivation is effective tool to suppress the pest population.
3. Setting of sex pheromone traps @ 5 trap/acre for monitoring is effective.
4. Spray of Ha NPV @ 500 LE/ha mixed with 0.1 per cent UV retardant (Tinopol) and 0.5 per cent jiggery is effective.
5. Use of Bt @ 0.50kg/acre and NSKE 5 per cent to kill early stage larvae. Release of the egg parasitoid, *Trichogramma chilonis* or *T. brasiliensis* @ 1Lakh/ha coinciding with flower initiation at 15 days interval may reduce the pest population.
6. Development of pyridalyl nanocapsule suspension for efficient management of tomato fruit and shoot borer (*Helicoverpa armigera*) is an efficient approach for frequent delivery and effective management.

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

Management strategies(white fly and other sucking pests)

A. Crop Hygiene

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

B. Other Cultural Control Practices

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

C. Insecticidal Control Practices.

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

White fly

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

vii. Major disease associated with crop

Buckeye fruit rot is a major serious disease.

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Trifolium alaxenderium, Cyperus rotundus, Cynodon dactylon.

x. IPM Module for management of weeds

Cultural and mechanical methods.

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

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

xii. Production constraints in agro-ecological region

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

9E. Name of the Vegetable crop : Potato

i. Existing varieties being used

Up-to-date, Kufri Jyoti, Kufri Chandramukhi, Kufri Bahar, K Badshah.

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

Kufri Girriraj, Kufri Chipsona 1, Kufri Chipsona 3,
K. Khyati, K. Pukhraj K Girdhari, K Himalini and K. Shailja

iii. Existing package of practices being used

1. Use of big sized tuber or division of tuber (50-60 g)
2. No seed/tuber treatment prior sowing.
3. Use of organic manures, sowing in flat bed.
4. Planting time - October
5. Spacing: 50-60 x 15-20 cm
6. Seed rate: 25-30 qt/ha

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

1. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with application of organic manures.
2. Early crop planting time – First fortnight of October
3. Main crop planting time- Second fortnight of October
4. Plant 25-30g seed size potato tuber@ 25-30q/ha.
5. Spacing: 60 x 20 cm
6. Dehaulming practise should be adopted for long duration storage of tubers.

v. Major insect pests associated with crop

Potato tuber moth, Epilachna beetle, Aphids, White grub

vi. IPM Module for management of insect pests

Potato tuber moth: *Phthorimaea operculella*

1. Heaps of green grasses may be kept at suitable interval in infested field during evening and next day early in the morning along with caterpillars to destroy.
2. Clean cultivation and mechanical destruction of caterpillars also help in reducing pest infestation.

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. Conservation and augmentation of natural parasitoids *viz. Pediobius foveolatus, Pleunotrogrus faveolatus* and *Tetrastichus* sp.
2. Application of Neem cakes is efficient in suppressing the pest population.

Aphids: *Myzus persicae*

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

Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG (Spray)	100	77
Thiamethoxam 25% WSG (Drenching)	200	77
Dimethoate 30% EC	660	
Oxydemeton-methyl 25% EC	1000	
Carbofuran 3% CG	16600	
Phorate 10% CG	10000	

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

vii. Major disease associated with crop

Late blight and common scab disease in the crop and tuber.

viii. IPM Module for management of disease

1. Only cultural practices are followed.
2. Use Certified seed/ disease free seed.
3. Plant improved/ resistant cultivars like Kufri Khyati, K. Pukhraj, K. Satluj and K. Chipsona-3
4. Regularly monitor the field and rouge the virus affected plants. Need based spraying of systemic insecticides should be done to check the vector population.
5. Stop irrigation before haulm cutting, leave tubers in soil for skin hardening for 10-15 days.

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

1. Use resistant verities.
2. Burn the infected crop debris, avoid excess moisture,

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Cyazafamid 34.5% SC	200	27
Chlorothaonil 75% WP (per lit. water)	0.875-1.250	14
Azoxystrobin 23% SC	500	12
Mandipropamid 23.4% SC (per lit. water)	0.8	40
Propineb 70% WP	0.30%	15
Captan 50% WG	1500	21
Captan 75% WP	1667	8
Copperoxychloride 50% WP	1250	
Copperhydroxide 53.8% DF	1500	22
Dimethomorph 50% WP	1000	16
Hexaconazole 2% SC	3000	21
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Metalaxyl 8%+ Mancozeb 64%WP	2500	49
Metalaxyl 4%+ Mancozeb 64%WP	2500	24
Capatan70%+ Hexaconazole 5% WP	500-1000	21
Carbendazim 25%+ Mancozeb 50%WS	0.6-0.7/Kg	Seed Treatment
Cymoxanil 8%8% +Mancozeb 64%WP	1500	10
Famoxadone 16.6%+Cymoxamil 22.1% SC	500	40
Fenamidone 10%+ Mancozeb 50% WG	1250-1500	30
Metiram 55%+ Pyraclostrobin 5% WG	1500-1750	15
Metalaxyl 3.3%+ Chlorothanil 33.1% SC	0.02%	34

Potato scab: ***Streptomyces scabiei***

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

Thiram 75% WS (Seed Treatment/ Kg)	2.5-3.0	7-10

ix. Major weeds associated with crop

Cyperus spp. and *Chenopodium album*.

x. IPM Module for management of weeds

1. Mechanical and cultural method.
2. Proper crop rotation
3. Timely hand weeding
4. Winter/ summer ploughing

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

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D Dimethyl amine salt 58% SL	2000	3440
Oxyflourfen 23.5% EC	100-200	425-850

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

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

xii. Production constraints in agro-ecological region

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

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

Round and purple hybrids like Chhaya, Kanhaya, Ankur.

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

iii. Existing package of practices being used

1. Poorly managed nurseries infected with damping off.
2. Over aged or less vital seedling utilization
3. Transplanting is done on or before monsoon shower
4. Round and long purple type varieties are favoured

5. No control measure for shoot and fruit borers and *Phomopsis* blight.

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

1. Availability of purple and round varieties in cropping system.
2. Augmentation of assured irrigation for optimal production.
3. Use of black or plastic mulch in production chain
4. The recommended seed rate of brinjal: Hybrid-250g/ha, Open pollinated-500-600g/ha
5. Transplant seedlings properly as for non spreading type varieties- 60 cmx60cm, spreading type varieties - 75cm x 60cm.
6. Maturity stage of a particular crop so he can harvest the crop as per their object.

v. Major insect pests associated with crop

Shoot and fruit borers

vi. IPM Module for management of insect pests

Brinjal fruit & shoot borer: *Leucinodes orbonalis*

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

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC -	200	22
Emamectin Benzoate 5% SG	200	3
Thiacloprid 21.7% SC	750	5
Thiodicarb 75% WP	625-1000	6
Lambda cyhalothrin 5% CS	300	5
Cypermethrin 25% EC	150-200	1
Betacyfluthrin 8.49%+ Imidacloprid 19.81% OD	200	7
Triazophos 35% + Deltamethrin 1% EC	1250	3
Pyriproxyfen 5%+ Fenpropathrin15% EC	750	7

vii. Major disease associated with crop

Phomopsis blight is a serious problem.

viii. IPM Module for management of disease

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

5. Use nylon net of 40 gauge mesh for leaf curl management.

In Nursery

1. Soil solarization of nursery bed by covering with polythene sheet (25 – 50 micron) for 45 to 60 days during April-June.
2. Use TH/PsF colonized compost
3. Use resistant cultivars like Pant Rituraj.
4. Grow the nursery under tunnel of poly net of 50 mesh.

On Crop

1. Rogueing of virus infected plants followed by need based spraying of systemic insecticides for vector management
2. For the management of soil borne diseases follow crop rotation and rotate crop with maize, rice, wheat, okra or cowpea.

Blight

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

ix. Major weeds associated with crop

Euphrobia hirita, *cynadon dactylon*, *Cyprus* and *Oxalis*.

x. IPM Module for management of weeds

1. Hand weeding only.
2. The field should be kept weed-free, especially in the initial stage of plant growth, as weeds compete with the crop and reduce the yield drastically.
3. Frequent shallow cultivation should be done at regular interval so as to keep the field free from weeds and to facilitate soil aeration and proper root development.
4. Deep cultivation is injurious because of the damage of roots and exposure of moist soil to the surface. Two-three hoeing and the earthing up are required to keep the crop free of weeds.

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

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

xii. Production constraints in agro-ecological region

1. Non-availability of suitable hybrids in local market.
2. Serious wild animal's problems.
3. Poor technical knowhow.
4. Marketing problem is serious in rainy season.
5. Less availability of high quality seeds.
6. High prices of hybrid seeds.
7. Lack of knowledge about the cultivation practices.
8. Lack of processing facilities.

9G. Name of the Vegetable crop : Chilli

i. Existing varieties being used

Local and non descriptive varieties

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

Agni, Shikha, 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. Traditional seeds, No seed treatment, Poor nursery management, Transplanting on or before rainy or

monsoon season, Crop geometry knowledge is poor, Poor dry fruit storage.
2. Growing local varieties.
3. No line transplanting.
4. Generally they plant two over aged seedling at one place.
5. Sowing of untreated seed.

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

1. Use of seed treatment like Pant bio-agent 3 for managing seed and soilborne diseases.
2. Earthening up of plants within 45 days after transplantation to get rid off water logging.
3. Use of tall and cluster bearing type like local strain Lakhaur mirch.
4. Use of high dose of organic manure i.e. 200 q/Ha increases productivity and incidence of dieback and Anthracnose.
5. Grow high yielding varieties.
6. Adopt soil testing and transplant one seedling at one place.
7. Transplant the seedlings when they attain 5-6 leaf stage.
8. Transplant the seedlings at proper spacings *viz.* Kashi Anmol at 45 x 30 cm and Pusa Sadabahar, Pant C-1 at 50 x 50 cm.

v. Major insect pests associated with crop

Thrips problem is major problem

vi. IPM Module for management of insect pests

Chilli thrips, *Scirtothrips dorsalis* Hood

1. Thrips *Franklinothrips vespiformis* (Crawford) and *Erythrothrips asiaticus* R. &. M. are predaceous in nature and their population may be encouraged by avoiding chemical sprays.
2. Yellow or blue sticky trap is effective for controlling this pest.
3. If still the population persist spraying of imidacloprid 70% WG @ 0.25ml/l or acetamiprid 20%SP @ 0.2g/l or thiomethoxam 25%WG @ 0.2g/l or metasystox@1.5ml/l is effective.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 30% FS (Seed Treatment)	7/Kg	-
Imidacloprid 70% WS (Seed Treatment)	10-15/Kg	-
Cyantraniliprole 10.26% OD	600	3
Emamectin benzoate 5% SG	200	3
Spinosad 480% SC	160	3
Acetamiprid 20% SP	50-100	3
Thiacloprid 21.7% SC	225-300	5
Indoxacarb 14.5%+ Acetamiprid 7.7% SC	400-500	5
Flubendamide 19.92%+ Thiacloprid 19.92%	200-250	5
Methomil 40% SP	750-1125	5&6
Lambda cyhalothrin 5% EC	300	5
Ethion 50% EC	1500-2000	5
Fipronil 5% SC	800-1000	7
Imidacloprid 17.8% SL	125-250	40

vii. Major disease associated with crop

Dieback and anthracnose is major disease of low or valley areas.

viii. IPM Module for management of disease

Dieback

1. Use of disease-free seeds is important in preventing the disease. Seed treatment with Thiram or Captan 4g/kg is found to be -effective in eliminating the seed-borne inoculum.
2. Good control of the disease has been reported by three sprayings with Ziram O. 25% Captan 0.2% or miltox 0.2%. Chemicals like wettable Zineb 0.15% not only reduced the disease incidence but

also increased the yield of fruits.

Anthracnose

1. Seeds should be obtained from spotless fruits.
2. Debris of diseased crop should be collected and burnt.
3. Seed treatment with thiram or captan at the rate of 2.5 g/kg of seed

ix. Major weeds associated with crop

Euphorbia hirta, Cynadon dactylon, Cyprus and O*xalis latifolia.*

x. IPM Module for management of weeds

Manual weeding

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

1. Use of tall hybrids supplementation of organic packages of practices to be followed
2. Grow high yielding varieties.
3. Adopt soil testing.
4. Transplant one seedling at one place.
5. Transplant the seedlings when they attain 5-6 leaf stage.
6. Transplant the seedlings at proper spacing.

xii. Production constraints in agro-ecological region

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

9H. Name of the Vegetable crop : Cucumber

i. Existing varieties being used

Local and traditional varieties

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

For open field condition: Pusa Udhay, Pusa Barkha, Shubhangi, Himangi, Punjab Naveen, Tasty, Ruchi,

For protected condition- Hilton, Kian, Isatis, Malini etc.

iii. Existing package of practices being used

1. Use of traditional seeds,
2. Planting in rainy season,
3. Traditional stacking method,
4. Long harvest duration season,
5. Absence of crop rotation.
6. Random selection of variety (May or may not be suited to Agroeco-region).
7. Untimely sowing / planting of crop with untreated seed.
8. Use of traditional irrigation system.
9. No soil solarization/ treatment during lean period.

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

1. Glasshouse or polyhouse technology
2. Use of hybrids or/and pathenocarpic varieties
3. Management of crop geometry.
4. Use of organic manure or fertigation inside polyhouse.
5. Adoption of crop/ soil health related crop rotations.
6. Use recommended spacing e.g. 60-200 × 50-100 cm

7. Treating seed before sowing.
8. Selection of optimum planting period.

v. Major insect pests associated with crop

Leaf minor, white fly, trips, leaf eating caterpillar, fruit fly, cut worm, red pumpkin beetle.

vi. IPM Module for management of insect pests

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

Red pumpkin beetle

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

vii. Major disease associated with crop

Wilt, mildew and mosaic.

viii. IPM Module for management of disease

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

Downy mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Zineb 75% WP	1500-2000	
Cymoxanil 8%+ Mancozeb 64% WP	1500	10
Azoxystrobin 23% SC	500	7
Amectoctradin+ Dimethomorph 20.27% SC	800-1000	3

ix. Major weeds associated with crop

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

x. IPM Module for management of weeds

Manual weeding.

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

1. Polyhouse technology and hybrid cultivars can increase productivity 3-4 times in low hills.
2. Use of well designed and recommended protected technology suited to area i.e. houses, net house, insect proof net house, shed net house, poly tunnels with the use of mulches and microirrigation 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. To use technology such as soil solarization for effective control of pests.
8. Timely sowing/ transplanting of crop.
9. Use of different protected systems/materials *e.g.* Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
10. To save the precious natural resource water, follow micro irrigation technologies.
11. Use genetically pure & treated seed.

xii. Production constraints in agro-ecological region

1. Lack of plant growing structures.
2. Monkey, baboon, wild pigs are serious threats.
3. Good quality seed is inaccessible.
4. High cost of seed & poor purchasing power of farmers.
5. Water scarcity.
6. Protected cultivation is cost involving technologies.
7. Repair of the poly houses/ micro irrigation structures is a tedious task.
8. Damage of crop / poly houses /micro irrigation structure by wild animals.
9. Unawareness about scientific technologies.
10. Availability of agriculture inputs is not easy.

11. Difficult labour availability.
12. Different biotic and abiotic stresses.

9I. Name of the Vegetable crop : Pea

i. Existing varieties being used

Traditional field pea and/ or mixture of varieties.

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

Pusa Pragati, Vivek Pea 10, Round seeded varieties, Pant Sabji Matar 3 and VL 7.

iii. Existing package of practices being used

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

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

1. Use of tall varieties sown in line with effective stacking methods.
2. Management of powdery mildew and other diseases and *Fusarium* wilt in autumn season.
3. Sowing early maturing varieties at closer spacing (30 cm plant to plant and about 5-10 cm between plants) and higher seed rate (100-120 kg/ha).
4. Sowing time: Oct & Mid Nov
5. Seed rate: 100 Kg/ ha.
6. Water the crop as per need especially during flowering and pod setting.

v. Major insect pests associated with crop

Leaf miner

vi. IPM Module for management of insect pests

Cultural, mechanical and biological methods.

vii. Major disease associated with crop

1. Powdery mildew in all agroecological situations
2. *Fusarium* wilt in autumn sown crop

Powdery mildew

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

viii. IPM Module for management of disease

1. Use of organic inputs only
2. Use of rust and powdery mildew resistant strains.

ix. Major weeds associated with crop

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

x. IPM Module for management of weeds

Manual weeding

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

1. Increasing crop intensity with line sowing.
2. Use of tall cultivars in cropping system
3. Standardization of time for seed sowing in pea.

xii. Production constraints in agro-ecological region

1. Monkey, baboon, wild pigs are serious threats

2. Unawareness about scientific technologies.
3. Availability of agriculture inputs is not easy.
4. Difficult labour availability

C1. Livestock: Buffalo

1.A- Existing breeds available

Mostly non-descriptive.

1.B- Specific breeds to be introduced

Murrah and Neeli-ravi.

2.A- Existing feeds being used

Wild grasses, paddy straw, wheat straw, wild dried grasses, Leaves of trees such as silver oak, bhemal, khadeek, mulberry

2.B- Specific feeds to be introduced / advised

1. UMBB Feed blocks,
2. Use of green fodder maize, multi cut chari, Hybrid napier, tall fascue, Italian rai, Cox foot, Orchard grass fodder trees etc
3. Fortification of local Fodder, use of Chaff cutter.

3.A- Existing health services

State animal husbandry department (Vet. Hospital, LEO Centers) and BAIF.

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

Village level workers for first aid, vaccination and AI

4.A- Existing management practices

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

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

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

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

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

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

Feed and fodder shortage, local breed, low cost of milk

C2. Livestock: Cattle

1.A- Existing breeds available

Mostly non-descriptive, Badri, Cross bred of Jersey, HF, Sahiwal

1.B- Specific breeds to be introduced

Badri, Jersey Cross, Red Sindhi cross

2.A- Existing feeds being used

Wild grasses, Paddy straw,Wheat straw, dry grasses, oak, bhemal, khadeek, mostly rearing on grazing

2.B- Specific feeds to be introduced / advised

Fodder maize, multi cut sorgam (chari), Hybrid napier, fodder trees, Fodder treatment and Chaff cutter.

3.A- Existing health services

State animal husbandry department and BAIF.

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

Village level workers for first aid, vaccination and AI.

4.A- Existing management practices

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

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

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

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

1. Poor breeds.
2. Shortage of feed and fodder.
3. Improper feeding.
4. Poor housing and management of animals.
5. Improper health services and mostly unproductive animals.

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

1. Feed and fodder shortage,
2. local breed,
3. low cost of milk

C3. Livestock: Goatary

1.A-Existing breeds available

Mostly non-descriptive.

1.B-Specific breeds to be introduced

Barbari

2.A-Existing feeds being used

grazing

2.B-Specific feeds to be introduced / advised

grazing

3.A-Existing health services

State animal husbandry department.

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

Village level workers for first aid, vaccination

4.A-Existing management practices

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

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

Development of pasture land, scientific management

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

Lack of range land management

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

1. Lack of range land management,
2. Managemant problems as proper vaccination,
3. Ecto and endo parasite control and breed improvement.

C4. Livestock: Poultry

1.A-Existing breeds available

Local, Croiler, RIR, Uttara fowl

1.B-Specific breeds to be introduced

Croiler, Kadaknath, Cob, Cari-Davendra, Cari-Nirbheek

2.A-Existing feeds being used

kitchen waste

2.B-Specific feeds to be introduced / advised

Starter, grower, finisher feed according to age

3.A-Existing health services

State animal husbandry department.

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

Specific poultry management services

4.A-Existing management practices

Mostly backyard poultry.

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

High yielding breeds, proper feeding and management practices

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

Poor breed and management

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

Poor breed and management

C5. Fisheries

1.A-Existing breeds available

Local, Silver carp, grass carp and common carp

1.B-Specific breeds to be introduced

Silver carp, grass carp and common carp

2.A-Existing feeds being used

House hold waste

2.B-Specific feeds to be introduced / advised

pelleted fish feed having 25-30% protein

3.A-Existing health services

State fisheries deptt. (fisheries inspector at district level)

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

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4.A-Existing management practices

-

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

-

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

-

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

Non availability of quality fish seed is major problem

D. Integrating Farming system

1.A-Existing farming system

Animalhusbandry+crop/Vegetable

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

Agri-HortAnimal-processing based farming system

Activity	**Area**
A. Cropping system:	**8 nali**
Paddy-Cabbage/Pea	
Capsicum-radish-cauliflower	
Paddy-Radish-garden pea-Frenchbean	
B . Horticulture	**8 nali**
Peach, plum apricot and walnut	
C Livestock	**2 nali**
Cow/buffalo	
Backyard poultry	
Goatary	
Fishery	
Beekeeping	
D. Processing	**2 nali**

Washing and cleaning of season vegetables, biogas/vermicompost/biopesticides

Total cost : 50,000.0

Total income : 1.5 lakhs

Net income : 1.00 lakh (Approx.)

E. Reducing post harvest losses and value addition

1.A- Existing grading facilities

Not available in area

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

For grains:

Indented cylinder for rice/paddy grading

For horticultural crops:

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

2.A- Existing processing facilities

Not available in area

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

1. Establishment of minimal processing plants in various location based on crop and area specific.
   Amaranthus - Tilwara
   Barnyard millet – Rudraprayag
   Fingermillet- Agastymuni
2. Establishment of small or cottage level processing units for market surplus in Gola Nashpati, Chullu, delicious local Malta for food products.
3. Establishment of wine factories for gola, chullu, plum and other forest products. Food processing units of Deptt of Horticulture and Units of some NGOs

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. Small capacity flour mill with packaging facility at village level for particular commodity
5. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
6. Cleaner, splitter, grader and packaging at village level for pulse milling
7. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity

For horticultural crops:

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity at *Tilwara.*

3.A- Existing packing facilities

Not available

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

A factory based on plastic cartoon, *Kilta*, Dalia of various grade and size based on weight of the fruit is needed for seasonal vegetables.

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Small LDPE and HDPE polybags for particular commodity
3. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
4. Paperboard boxes for particular commodity
5. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
6. Shrink and wrapping packaging for fresh and minimal processed

4.A- Existing storage facilities

At present no storage facilities are available in the distt.

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

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. Cold storage structures
4. Zero energy cool chamber for hilly areas
5. Solar power cooling chambers

F. Waste land development and waste water

1.A- Existing practices of soil water conservation

Using indigenous technology use for water conservation includes formations of bund, growing of Napier and other perennial grasses, multiple forest species as per need are requirement.

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

1. Storage of wastewater by using low cost water harvesting technology as *kuchha* and *Pucca* tank.

2. Polytank can be constructed as (5x3x2m) capacity to meet the lean season demand of seasonal vegetables and for non agricultural use also.
3. In wasteland, a wide scope of fodder plantation of *Morus*, Chhanchru, *Melilotus* spp. can be utilized.
4. In dry and unirrigated situation there is scope of bael, amla can be included. There is need to put fodder crops in wasteland.

2.A- Existing plantation

Tun, shirish, Bheemal, Kachnar, Kharik, shisham in low and mid hills Utis, banj,chhanchru, leucinia, Mulberry

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

1. Morus, Shirish, Kharik, Oak, Bheemal, Kachnar, Vilyati khair etc are useful as dual purpose species to meet fodder, firewoodr and other requirement of the farmers. Sufficient plants are available at forest nurseries for plantations.
2. Rejuvenation/repair of faulty/abandoned terraces;
3. Stabilization of eroded land using biological/ engineering measures.
4. Plantation of suitable trees/brushes in waterlogged and eroded areas.
5. All agricultural operations should be done on contours i.e. across the existing land slope.
6. 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.
7. 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.
8. Diversion of runoff through ditches from upper slopes to safer places.
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.

3.A- Existing fodder production

Crop stobbers, Wild grasses, Forest leaves etc.

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

Napier grass, Tall fescue, Perennial rye, Pangola grass, Clovers

4.A- Type of waste water

Home and kitchen waste

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. Multistage filtration unit should be established to recycle the waste water for multiple purposes.
2. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
3. Industrial wastewater should not be used for irrigation directly; and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.
4. Sewage water from cities should be treated by municipal corporations or other agencies.

G. **Reduced cultivation cost**

1.A- Existing inputs being given

Traditional and unprocessed inputs are used in agricultural practices. Drudgery prone implements/tools are in practice for various operations.

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

Application of nutrients based on soil test basis as major and micro elements.

2.A- Existing mechanization

1. Limited use of power driven implements in land preparation.
2. Small tools like sickle, hand hoe etc are being adopted by progressive farmers.

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

1. Power tiller, power weeder, and shrub cutter, Multiple crops threshers are becoming popular and are available in pockets.
2. Old wooden based impelents are being replaced with iron/alloy (Plough, Danalla,) based tools are available.

3.A- Existing collective inputs

Community pasture land, Service bulls, Irrigation channel and source, Irrigation tanks.

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

1. Custom hiring energy based implements *viz.* Small tractor, tiller, Power sprayers and Mandua thresher.
2. Hydrum irrigation can reduce the cost of cultivation along with reduction of farm labour.

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

1. High labour cost.
2. High hybrid seed cost.
3. No storage facilities for perishable product.
4. No chilling plant for milk.

H. Off-farm income

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

ATI, ATMA, CHIRAG, AAJIVIKA, NABARD, Hill Valley development.

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

1. Formation of various groups for collection and procurement of market surplus:
    1. Rajmash collection and procurement group
    2. Marchha/Amaranths collection group
    3. Gola Nashpati group
    4. Malta collection and procurement group
    5. Cheura collection and extraction group
    6. Milk collection and chilling group
    7. Sheep and goat production group
    8. Wool collection and sale group
2. 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.
3. 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.
4. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
5. 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.
6. 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.

7. Loan procedure should be made more flexible with less interest rate.
8. 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.
9. 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.
10. 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.
11. Enterprises need to be identified depending upon local resources- human and material.
12. Market linkages need to be developed so that people can sell their produce gainfully.

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 rained depending upon rains with very low and uncertain productivity.
9. Young people do not stay in villages and move to other areas or take up other profession such as tourism, transport, hospitality etc.
10. People remaining in villages are not very enterprising.
11. It is seen in the survey that all individuals who took loan increase their livestock only that is their traditional work and did not start any other enterprises.

2.A- Existing Micro-entrepreneur employment

Five groups are working for collection of small fruits for juice preparation.

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

1. Garwali food products for religious tourism
2. Mushroom production and processing units
3. Honey and honey products unit
4. Milk and milk products shops

3.A- Existing skill development facilities

Extension training institute

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

1. Mushroom production and training facilities at Tilwara.
2. Development of advanced horticultural handling *units at Rudraprayg and Agastaymuni.*
3. Fish ponds at *Bheeri.*
4. Dairy/Poultry/ gottary units at *Kakraghat.*
5. Value addition and food chain centre
6. Storage, grading and Packaging centre
7. Silk worm based skill development units *Guptkashi and Syalsod.*
8. Bio-agant and bio-fertilizers production lab at Bheeri.
9. Tissue culture lab for massive production of elite planting material at *Rudraprayag.*

4.A- Existing women skilling facilities

Not Available

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

agricultural income

1. Khadi and Kargha training for women skill.
2. Drugery reduction practices for high efficiency
3. Herbal dye based skill training and skill for local textiles.
4. Value addition skill for women.
5. Training centre, processing and packaging units as per the locally available resources.

5.A- Existing youth skilling facilities

Extension training institute

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

1. Mushroom production and training facilities
2. Development of advanced horticultural handling units
3. Fish ponds
4. Storage, grading and Packaging centre
5. Silk worm based skill development units
6. Bio-agent t and bio-fertilizers production lab
7. Tissue culture lab for massive production of elite planting material

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* sp. 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 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

I. Enabling Policies

1.A- Existing policies related with agriculture and animal husbandry

Subsidies and incentives are given on all agricultural inputs. More than 50% subsidies are granted on all inputs and implements.

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

1. Section of crop and area specific crop production program as per organic policy of state.
2. Timely and assured supply of agricultural inputs to farmers at door.
3. Popularization of polyhouse technology for vegetables and flower production

4. Inclusion of hybrid seed program for crop production.
5. Extending MSP for more number crops including all millets, malta, spice crops and other crops. A separate provision of fund and identification of agency to procure and disposal of surplus produce to stackholder.
6. Labelling of organic inputs and certification mechanism for more number of crops.
7. Expand application scientific methods and mechanized cultivation
8. Issueing up of udhyan and krishak cards for widespread use of Govt. incentives/subsidies to farmers.
9. Effective and workable Nursery act to avoid spurious or unreliable planting material in the state.
10. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
11. Soil health card scheme be effective for each farmers.
12. Institutional support in the form of subsidises and incentives can raise the farm production and income in larger interest of farm.
13. Declaration of minimum support price and crop insurance policy incentives is known on or before sowing season to avoid glut or deficiency.

2.A- Existing Institutions

ICAR Institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, NGOs

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

1. Establishment of food processing units at distt level to procure and marketing of surplus.
2. Need to develop or establish animal breeding program
3. Testing of new crops in non-traditional areas for doubling the crop production.

3.A- Existing Incentives

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

1. An assured bonus to farmers to grow new crop or higher production potential
2. Selection of farmers at village for trendsetter for dissemination of technical knowledge and technology may be awarded
3. Free access to library and one institute at least once in a year.

4.A- Existing risk coverage facilities

Crop and Animal Insurance Schemes

4.B- Risk coverage facilities to be suggested for doubling income in the specific agro-ecological region

1. Risk coverage may be applicable for all agricultural products and animals
2. Declaration and minimum support price be fixed well in time

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

1.A- Existing marketing facilities

One mandi samiti office is established at Agastymuni.

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

Contractual farming, linkages with MNCs and NCs, Mahila hat, weekly bazaar, local mandi, AC van.

2.A- Existing grading facilities

Nil

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

For grains:

1. Indented cylinder for rice/paddy grading

For horticultural crops:

1. Size grader for particular commodity for millets and grains.

2. Weight grader for particular commodity for seasonal vegetables.

2.C- Processing facilities to be created for better marketing and value addition in the 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. Small capacity flour mill with packaging facility at village level for particular commodity
5. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
6. Cleaner, splitter, grader and packaging at village level for pulse milling
7. Pearler, grader, miller and packaging unit for millets

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

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

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Small LDPE and HDPE polybags for particular commodity
3. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
4. Paperboard boxes for particular commodity
5. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
6. Shrink and wrapping packaging for fresh and minimal processed

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

Canning and food Processing centre at *Rudraprayag and Nala.*

K. Online Management and Evaluation

1.A- Existing online management structure available

Internet etc.

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

Each village should be connected by Internet facility with proper device, awareness about internet user.

2.A- Existing evaluation procedure

Manual

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

GPS, e-mail, Whattsapp, ITC tools

3.A- Existing monitoring system

Physical

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

Regular visits and online report submission, farmer feed back

4.A- Existing feedback system

Manually

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

Internet and proper software for evaluating ongoing activities

5.A- Existing reading system

Literature, Booklets, Hindi Extension Journals etc.

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

Farm advisory portal, online helpdesk services

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

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS-490, HS-507, HPW-349 and UP 2572), Barley (VL Jau 118 and VLB 94)
2. Promotion of high yielding varieties of Paddy (Chaiti Dhan- VL Dhan 208 and VL Dhan 209, Jethi dhan – Vivek Dhan 154 and VL Dhan 157, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355 plus)
3. Promotion of high yielding varieties of specialty corn (CMVL Sweet Corn 1, CMVL Baby Corn 2)
4. Promotion of high yielding varieties of Soybean (VLS 47, VL Soya 59, VL Soya 63, VL Soya 65, PS-1092, PRS 1, PS-1225, PS-1347, PS-19), Horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19)
5. Promotion of high yielding varieties of Finger millet (, VL Mandua 324, and VL Mandua 352).
6. Promotion of high yielding varieties of Barnyard millet (PRJ-1,VL Madira 172 and VL Madira 207)
7. Promotion of high yielding varieties of Urd (PU-31 and PU-40).
8. Promotion of high yielding varieties of Arhar (Pant Arhar-291, VL Arhar 1, Pant Arhar-3)
9. Promotion of high yielding varieties of Lentil (PL-4, PL-7, PL-8, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL *Masoor 514*).
10. Promotion of high yielding varieties of Toria/Sarson (PT-303, Uttara, PT-508 and VL Toria 3, Pant Pili Sarson-1, Pant Sweta).
11. Promotion of high yielding varieties of tomato (VL Tamatar 4, Avinash A-2 , Himsona, Naveen2000+, Pusa Sheetal, Pusa Gaurav, Pant T-3).
12. Promotion of high yielding varieties of chilli (Agni, Shikha, Kashi Anmol, Pant C-1, Tajwasni, Pusa Sadabhar, Punjab Lal, Panjab Surkh, CH-1 and CH-3), VL Shimla Mirch 3, Onion (VL Piaz 3), Garlic (VL Garlic 1).
13. Promotion of high yielding varieties of Pea (Vivek Matar 10 and Vivek Matar 12)
14. Recommended package and practices will be followed for the above said crop varieties
15. Introduction, validation, adoption and pomotion of hybrids varieties in vegetable in valley and low hills areas.
16. Promotion of high yielding varieties of Brinjal (Chhaya, Kanhaya, Ankur, Navkiran, Brinjal 704 (SunGro Seed), VNR212 (VNR Seed), Indan Supriya (Indo-American), Pant Rituraj, Pant Samrat and Kashi Taru.
17. Promotion of high yielding varieties of Cauliflower (Early Kunwari, Pusa Kartiki, Pusa Early Synthetic, Snow Crown, Snow Queen.

Strengthening of traditional water storage structure

1. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
2. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
3. Creation of trenches for high percolation of water in most of the area of *Narayankoti, Tilwara, Kund, Bheeri belts of Agastaymuni, Jakholi* blocks.
4. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in low or valley areas of all the blocks of this region.

Adoption of cluster approach for holistic development

1. Promotion of off season vegetables cultivation in low and valley areas of *Nala and Narayankoti* clusters.
2. Establishment of high density orchards of Peaches at *Sansari and Tilwara* block.
3. Rejuvenation of senile orchards of Gola pear with improved varieties *viz.* Kieffer and other tropical pears in Bheeri and Kund areas of *Jakholi and Ukhimath* blocks respectively.
4. Cultivation of Cinnamon (Tejpatta) plants at low hills in Agastyamuni *l* block particularly *Parkhandi, Fegu, Narayankoti* clusters.
5. Promotion of ginger cultivation in *Jakholi and Agastyamuni* Blocks.
6. Promotion of organic cultivation of turmeric in *Jakholi and Ukhimath* Blocks.
7. Promotion of production of lentil and Tor in *Kabiltha, Kotma and Kalimath valley in Ukhimath* Block.

Management of wild animal problem

1. Enacting legislative measures for protection of crop from wild animals against wild pig.
2. Planting of xerophytes plants or agave against monkeys and baboons in Gaiwala clusters
3. Construction of fencing and permanent structure for highly affected areas in Gair and Gadgoo areas clusters.
4. Promotion of cultivation of lime/lemon at larger scale in *Tamariya and Durghadhar areas of Jakholi* block.
5. Growing of lime/lemon in larger scale in fruit crops, ginger or turmeric in shady areas, Lemon grass to ward of wildlife in cultivated field
6. Promotion of cultivation of Kafal, Hishalu, and other wild fruits in different pockets in forest areas for wild animals.

Adoption of Farm mechanisation (Power tiller, thresher etc)

1. Promotion of serrated sickle, Vivek Millet thresher cum pearler, VL Paddy thresher and Vivek small tool kit for reduction in drudgery of hill farmers.
2. Popularization of multi crop thresher and Power Tiller/ Mini Tractor at Nyaypanchayat level in all three blocks.

Management of soil health in low or valley areas

Promotion of vermi compost unit and green manuring in all the villages of this region.

Availability of manures and use of fertiliser in cropping system

1. High biological activities in low hills belts more supplementation of manures and fertilizers in all field and horticultural crops
2. Use of NADEP, Heap method, Vermicomposting and vermiwash techniques for manure results in doubling of agricultural productivity.
3. Timely and judicious use of fertilizers based on LCC, soil and water testing reports, based on cropping system can enhance productivity in low hills and limited irrigated Sera areas.

Others

1. Cluster approach for holistic development
2. Soil health improvement practices
3. Selection of right crop & variety
4. All the field operation timely
5. Use of only well decomposed FYM/ value added compost
6. Seed treatment through bio agent strictly in the cluster
7. Promotion of moisture conservation practices
8. Focus on timely weed management
9. Take care of IPM techniques based on organic inputs.
10. Adoption of Farm mechanisation(Power tiller, thresher etc)

Strategy 2 : Livestock: Goatry, Poultry, Fisheries

1. Improvement of local existing breeds with new breed like HF, Jersey, Red Dane in cattle, Murrah in

Buffaloes, Replacement of Carp in fisheries and croilers dual purpose in mid and high etc.
2. Need to establish fodder bank to supply good quality fodder seeds to farmers in rainy season.
3. Creation of more green fodder production with growing of MPT and Napier production.
4. Two hatechery plant in poultry to at *Tilwara* and *Agstymuni* to meet the need of broilor and croilor.
5. Establishment of service bulls station at Nyayapanchayt level for breed improvement as per livestock breeding policy.
6. Addition of fingerlings in *Mandakini, Alkananada* and other rivulets.

Strategy 3 : Integrated Farming system

1. Promotion of different Integrated Farming System modules such as :
2. Protected cultivation+ Composting+Goatry/backyard poultry
3. Fodder production+ Mini dairy + Composting + Protected cultivation
4. Seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea) + Planting material supply + Mushroom

Strategy 4 : Reducing post harvest losses and value addition

1. Creation of larger facilities of infrastructure for reducing post harvest losses in horticultural commodities *viz*. Long term storage, warehouses, development of cottage industries at village level for unfinished products at *Tilwara, Agastaymuni and Bheeri*.
2. More refrigerating van/Reefers for quick transportation for perishable commodities like flowers and vegetables.
3. Pickle making of wild Aonla in Food and processing units at *Agstyamuni*
4. Cluster approach is useful for small and marginal farmers to procure input and disposal of surplus in areas.

Strategy 5 : Waste land development and waste water

1. Afforestation of MPT for fodder plants, growing of bael, or wild amla, cheura and other economical important plants in wasteland.
2. Need to develop more forest nurseries to supply fodder plants to farmers in rainy season.
3. Construction of check dam, making trenches and other water harvesting structures for water storage.
4. Promotion of perennial grasses in *Gaiwala, Sirsi, Chandrapuri and Fegu* cluster for higher green grass production.
5. Contour making for arable purpose in waste land in Mandakini and Alaknanda basin for maximum use of wasteland.
6. Afforestation of MPT *viz. Chancharu, Beemal, Sirish, Kanchnar* and others and perennial grasses in steep slope in Jakholi and Agastymuni blocks.
7. Promotion of plantation of mulberry, wild fruit plants in *Bedubagar* and *Bansbeeda* clusters in Agastyamuni block, wild fruit plants and fodder trees (*Bheemal, Celtis and Toon*) in Jakholi block.
8. Popularization of soil bunds to save excessive loss of nutrients in wasteland of all blocks.
9. Popularization of trenches for percolation of water to avoid surface run off.
10. Construction of check dam and artificial structure to maximize water conservation in low and valley areas in Mandakini, Madhuganga basin, Madmaheshwar valley and Kotma valley to reduce the soil erosion.
11. Construction of tank for storage of water for lean season in all blocks.
12. Storage of rain water in monsoon season.
13. Rejuvenation/repair of faulty/abandoned terraces in Gaiwala and Fegu clusters.
14. Stabilization of eroded land using biological/ engineering measures.
15. Plantation of suitable trees/brushes in waterlogged and eroded areas.
16. All agricultural operations should be done on contours i.e. across the existing land slope.
17. 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.

18. 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.
19. Diversion of runoff through ditches from upper slopes to safer places.
20. 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.
21. Contour trenching (staggered/continuous).
22. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
23. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Use of drudgery prone implements *viz.* improved sickle, small threshers, Tillers and other garden tools with reduce the drudgery and indirectly improve the production resulting in income of small farmers.
2. Encourages use of well decomposed FYM or vermicompost, biofertilizers.
3. Avoid broadcasting of seeds and other inputs in crop production program
4. Need based application of pesticides, preferably use bioagents.
5. Encourages optimum and recommended seed rate at optimum spacing and depth.
6. Use of mulch (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
7. Use of modern techniques to use water use efficiency in horticultural crops.
8. Tillers and other garden tools Tillers and other garden tools with reduce the drudgery and indirectly improve the production resulting in income of small farmers.
9. Promotion of line sowing and balanced application of organic manures in crops.
10. Promotion of recommended seed rate, spacing and depth.
11. Promotion of need based application of pesticides and other agricultural inputs.
12. Promotion of hand tools in agricultural and horticultural operations.
13. Promotion of use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers
14. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
15. Promotion of modern irrigation techniques in horticultural crops.

Strategy 7 : Off-farm income

1. Scope or potential of subsidiary occupation like silkworm, bee keeping, poultry, fish farming and mushroom will harness the potential of new or improved technology in farming occupation.
2. Emphasis on promotion of religious tourism for panch kedar yatra to serve organic and local delicacy.
3. Promotion of mushroom and bee keeping centre at Agastymuni to meet the requirement of compost and spawn.
4. Promotion of apiculture for small and landless farmers in valley areas.
5. Promotion of cultivation and collection of medicinal plants.
6. Promotion of skill development in women and youth in all three blocks
7. The encouragement to existing SHGs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. may be provided for better performance in all three blocks.
8. New SHGs may also be created in other villages of three blocks.

Strategy 8 : Enabling Policies

1. Institutional support in the form of subsidises and incentives can raise the farm production and income in larger interest of farmers.
2. Mandatory meterological/ observatory at block level to get first hand information of climatic

changes.

3. Labelling of organic inputs and certification mechanism for more number of crops.
4. Expand application scientific methods and mechanized cultivation
5. Issueing up of Udhyan and Krishak cards for widespread use of Govt. incentives/subsidies to farmers.
6. Effective and workable Nursery act to avoid spurious or unreliable planting material in the state.
7. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
8. Soil health card scheme be effective for each farmers.

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

1. Laisoning/linkages of various line departments to furnish information of crop produce and surplus.
2. eMarketing of apple and amaranths in *Triyuginarayan* areas
3. Establishment of mandis for temporary storage and sale of commodities at *Agastymuni.*

Strategy 10 : Online Management and Evaluation

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

Agro-Ecological Region: Region B (1000m - 1500m)

A. General information about Agroeco-region

District : Rudraprayag
Agro-ecological region : Region B (1000-1500m)
Main Blocks in Region : Jakholi and Agastymuni block
Main village cluster in blocks : 42
Irrigated Clusters : Nil
Rainfed Clusters : 42
Existing rain water management facilities :
1. Limited to few farmers
2. Diversion of perennial springs and streams through small channels or guhls.
3. Village pond (Taal and Chaal)
4. Collection from hill slope (Khaal)
5. Hydrum as lift device
6. Roof water harvesting but limited

B. Productivity Enhancement

1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region

1. Water storage of roof harvesting water.
2. Poly tank for water storage (5x3x2 m) for multiple uses.
3. Construction of underground pucca tank for app purposes.
4. Use of hydrum technology for water lifting during lean season.
5. Construction of local chal/ khal and trenches for limited water storage.

2. Existing practices for soil health improvement

1. Use of undecomposed farmyard manure/compost.
2. Use of legume crop in mixed cropping in mid hills of Rudraprayag.
3. Meagre/ no use of bio-fertilizers.
4. Use of raw/partially decomposed FYM.
5. Meagre/ no compost making/recycling of crop residue.
6. Mixed cropping of cereal and legume in few pockets
7. Mandatory soil health card scheme launched in 2015.

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

1. Organic inputs based farming system only.
2. Promotion of legume crop rotation
3. Supply of vermi-beds for compost formation.
4. Promotion of crop and area based farming practices like growing of Paddy+ Soybean+Til+ Urd system as mixed farming.
5. Imparting training and demonstrations on fortification of manures with organic based farming.

Cereals and oilseeds

1. Seed/ soil inoculation with *Azotobacter* and Phosphorus solubilising microbial culture (250-300 g each/ acre for seed inoculation/ and 1-1.5 kg each mixed in well decomposed @ 25 kg FYM/ acre for soil inoculation).
2. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
3. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost.

Pulses and soybean

1. Seed with specific *Rhizobium* inoculants 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* inoculants and Phosphorus solubilising microbial culture at transplanting.
3. Distribution of soil health cards to each and every farmer along with nutrient recommendation for different crops
4. Establishing soil testing labs for major and micro plant nutrients at block level
5. Capacity building for scientific use of organic manures, Integrated Nutrient Management, use of bio-fertilizers, different soil amendments and vermicomposting.
6. Organization of camps for general awareness regarding harmful effect of burning crop residues.
7. Popularization of legume-cereal rotation for improving the soil fertility in the region.
8. Availability of all inputs *viz.,* fertilizers, micro nutrient and bio-fertilizers at Nyaypanchayat level.

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

1. Occasional occurrence: frost, drought, cold wave.
2. Almost 87% 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, barley, Mandua, Jhangora are major crops of the region.
5. Alternative strategies are adopted based on available resources.

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 strategies 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 in mid hills of Rudraprayag. Therefore water and soil conservation techniques like terrace farming, bunding etc should be encouraged.
4. The area of off season vegetable like vegetable pea 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 climatic conditions, slope gradients and soils are suitable for sub tropical (in Valley region Citrus fruits, Malta and orange).
9. Due to increasing temperature the new orchards should be developed at higher altitudes to meet out the chilling requirement and to maintain quality of the fruits. Delayed sowing of barnyard millet in Month of May/June.
10. Scope of adoption of kiwi, strawberries, pears, prunes and other forest plants in wasteland management these areas. Introduction of new crops like pomegranate, persimmon and kagzi lime in non conventional areas.
11. Popularization of polyhouse technology for higher productivity.
12. Adoption of new and malt rich cultivars in barley involve less organic inputs.

13. Sowing late sown varieties of wheat
14. Cultivation of off season vegetable
15. Use of hybrid varieties for higher production in valley areas.

6A. Name of Field Crop : Wheat

i. Existing varieties being used

Mundaria, Lal Mishri, VL-738

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

VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 and UP 2572)

iii. Existing package of practices being used

1. Use of old and traditional varieties as dual purpose (Cereals and fodder) purpose.
2. Preparation of land 1 or 2 ploughing with local plough no definite depth
3. Seed rate and seed sowing -150-175 kg/ha, Broad casting
4. Use of organic manure
5. Use of un decomposed FYM (rainfed) and un decomposed FYM in irrigated conditions as per availability
6. Only rain fed areas in the farmers cluster blocks.
7. Use of chemicals is completely prohibited.
8. Manual operations

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

1. Use of VL-907 as high yielding crop in valley areas.
2. Preparation of land- with 2 ploughings + 1 harrowing with mould bold plough up to 10-15 cm depth.
3. Use of seed rate with 100-125kg/ha in line sowing with 18-21 cm apart.
4. Application of manure @ 10-15 t/ha.
5. Use of thresher to reduce the pilferages at various stages.

v. Major insect pests associated with crop

Termites and Aphids

vi. IPM Module for management of insect pests

Aphid:

1. Avoid late sowing of crop to save crop from aphid.
2. Conservation and enhancement of biocontrol agents like Coccinellid beetles, Chrysopa, Syrphid and Apanteles to protect the crop against aphid attack.

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.

Thiamethoxam 30% FS (Seed Treatment/Kg)	3.3 per Kg

vii. Major disease associated with crop

False smut, Rust, Loose smut

viii. IPM Module for management of disease

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

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

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

Carbendazim 50% WP (Seed Treatment/Kg)	1.0	2.0
Carboxin 75% WP (Seed Treatment/Kg)	1.5-1.9	2-2.5
Tebuconazole 2% DAS	0.02	1.00
Difenoconazole 3% WS	0.06	2.0

Biofungicides

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

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

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

ix. Major weeds associated with crop

Anagalis arvensis, *Argemone mexicana*, *Asphodelus tenuifolius*, *Avena fatua*, *Chenopodium album* , *Phalaris minor*

x. IPM Module for management of weeds

Weeding, hoeing and deep ploughing.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Organic cultivation,
2. Use vermibeds, NEDEP and other heap method for higher manure production.
3. Adoption of low cost based cultivation practices.
4. Adoption of Wheat-Horse gram/Soybean for high crop production.
5. Timely Sowing and use of high yielding varieties in crop production scheme with prior seed treatments.
6. Contour cultivation and care soil and water conservation measures for enhancing productivity.
7. Maximum use of value added compost/ fortified FYM to maximize the production.
8. Sale of value added products as organics can enhance the income.
9. Production and sale in small packets.

xii. Production constraints in agro-ecological region

1. Non-availability of farm labour for various operations.
2. Less availability of agriculture inputs
3. Use of imbalance and undecomposed FYM in field.
4. Wild animal damages like monkey and wild boar is serious.
5. Non availability of active family labour, migration, poor irrigation facilities.
6. Long harvest duration of crop in hilly areas.

6B. Name of Field Crop : Rice

i. Existing varieties being used

China 4, Lal Dhan, Lal Safed Rikhua, Saket 4

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

Irrigated - VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85*; Rainfed- Chatki Dhan- VL Dhan 208, VL Dhan 209; Jethi dhan –Vivek Dhan 154, VL Dhan 157, VL Dhan 156 and VL Dhan 158)

iii. Existing package of practices being used

1. Organic cultural practices are used.
2. Use of local varieties in production system
3. Preparation of land with 1 or 2 ploughings with local plough no definite depth, Manual puddlings.
4. Use of high seed of 150 kg/ha in direct seeding rice and in transplanting 60-70 kg/ha. Overagged seedlings of more than 45 days are used.
5. Application of 70-100q/ha for crop production as per availability. Irrigation is done lowland rice as per availability of irrigation roaster of village.
6. Manual harvesting and other operations

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

1. Organic packages of practices are followed.
2. Preparation of land with 1 or 2 ploughing with local plough.
3. Seed rate and seed sowing of 100-125/ha in direct seeding rice and in transplanting 40-50 kg/ha is used.
4. Application of 15 t/ha FYM is recommended.

v. Major insect pests associated with crop

Stemborer, Rice leaf folder, gallmidge, rice bug, thrips

vi. IPM Module for management of insect pests

Stem borer:

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

I. Apply insecticide only when necessary, not regularly.
II. Apply insecticide only when the pest population reaches Economic Threshold Level.
III. Applying a selective insecticide which is less toxic to natural enemy.
IV. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.
V. Use selective formulation and application method.
VI. Application of granular formulation is less harmful to natural enemy

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

50 Days within transplating (2 inch water in field)

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

50 Days after tranplanting

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5 %SC	150	47
Fipronil 5% SC	1000-1500	32

Fipronil 80 %WG	50-62.5	19
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75 %SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20% WG	125	30
Thiacloprid 21.7 %SC	500	30
Acephate 75% SP	666-1000	15
Acephate 95 %SG	592	30
Chromafenozide 80% WP	94-125	32
Monocrotophos 36% SL	1400	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Carbosulfon 25 %EC	800-1000	14
Chlorpyriphos 20% + Acetamiprid 0.4% EC	2500	10
Phosphamidon 40% + Imidachlorpid 2 %SP	600-700	22
Flubendamide 4%+ Buprofezin 20% SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

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

Leaf folder:

Following insecticides may be used to control leaf folders of rice

50 Days within transplating (2 inch water in field)

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 0.4% GR	10000	53
Cartap 4% Gr	18750	
Carbosulfon 6% G	16700	37

50 Days after transplating

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

Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Quinalphos 25 %EC	1000	40
Flubendamide 4%+ Buprofezin 20 %SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

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

Rice bug: *Leptocorysa acuta*

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

Biological control

Parasitoids:

Gryon flavipes, attacking: eggs

Predators:

Micraspis discolor, attacking: nymphs, adults

Neoscona theisi, attacking: nymphs, adults

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

Orthetrum sabina, attacking: nymphs, adults

Pathogens:

Beauveria bassiana, attacking: nymphs, adults

Thrips

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

vii. Major disease associated with crop

Khaira, Riceblast, Brown spot, Leaf blight, False smut

viii. IPM Module for management of disease

During Nursery Sowing

Deep summer ploughing or soil solarization

During transplanting

1. Do not planting under full or partial shade to avoid bacterial blight (BLB) infection.
2. Transplant 2-3 seedlings in one spot.
3. Row to row spacing 20 cm and plant to plant spacing 10 cm.

After transplanting till maturity

Drain of water to check spread of sheath blight and bacterial blight.

Khaira disease: Due to Zinc deficiency)

Name of the Fungicides	**(gm/ml) /ha**
Zinc sulphate (Apply in soil at the time of plot preparation)	25000
Zinc sulphate spray (2.5 Kg Quick lime & 20 Kg Urea in 1000 lit. water	5000

Rice blast: *Magnaporthe grisea*

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

Bacterial leaf blight: ***Xanthomonas oryzae***

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

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

Biofungicides

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

Brown leaf spot: ***Cochiobolus miyabianus***

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

Biofungicides

Name of the Bio-fungicides	(gm/ml) /ha	Waiting period (days)

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

ix. Major weeds associated with crop

Oxalis latofolia, *Cyperus* spp., *Echinocloa* sp., *Chenopodium album*, *Cynodon* sp., *Eleusine* sp.

x. IPM Module for management of weeds

Rice Nursery:

Summer ploughing of main field to destroy weeds and expose soil and wet bed method for raising rice nursery.

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

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Anilofos 18% EC (Transplanted rice)	1660-2500	
Anilofos 2% G (Transplanted rice)	20000-25000	30
Bispyribac Sodium 10% SC (Nursary)	200	
Butachlor 50% EC (Transplanted rice)	2500-4000	90&120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90&120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Cyhalofop butyl 10% EC	750-800	90
2,4-D Ethyl Ester 38% EC	2500	
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Fenoxaprop-p-ehtyl 9% EC (Transplanted rice)	625	70 Post
Fenoxaprop-p-ehtyl 6.9% EC	812-875	61
Flufenacet 60% DF (Transplanted rice)	200	90-110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiargyl 6% EC (Transplanted rice)	1066	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90
Anilofos 24%+ 2,4-D ethyl ester 32% EC	1000&1500	90 (Transplanted rice)
Bensulfuron methyl 0.6% + Pretilachlor 6 G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)

Cinmethylin 10% EC (Transplanted rice)	750-1000	60
Paraquat dichloride 24% SL (Before sowing)	1250-3500	

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

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

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

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

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

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

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

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Azimsulfuron 50% DF (Transplanted & Direct sown)	70	59
Bensulfuron methyl 60%DF (Preemergence)	100	88
Bensulfuron methyl 60%DF (Postemergence)	100	71
Bispyribac Sodium 10% SC (Transplanted rice)	200	78
Butachlor 50% EC (Transplanted rice)	2500-4000	90-120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90-120
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 %WDG (Transplanted rice)	83.3-100	110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75&90
Bensulfuron methyl 0.6% + Pretilachlor 6% G	10000	88 (Transplanted rice)

Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Metsulfuron methyl 10%+ Chlorimuron ethyl 10% WP	20	90(Transplanted rice)

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

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

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

1. Organic cultivation is followed.
2. Adoption of low-cost based cultivation practices,
3. Jethirice - Wheat/Lentil/Barley or Rice- Wheat /onion system for high production.
4. Timely Sowing and transplanting of rice gave more yields.
5. Contour cultivation, care of soil and water conservation measures, and maximum use of value added compost/FYM produce high yield.
6. Organic lebelling and marketing of produce.
7. Sale of value added products.

xii. Production constraints in agro-ecological region

1. Rainfed farming system is predominant.
2. Less availability of agricultural inputs.
3. Use of imbalance and /undecomposed FYM in crop production.
4. Wild animal damages are serious.
5. Non-availability of active household labour(s) for agricultural operations.
6. Poor Irrigation facilities in mid hills.

6C. Name of Field Crop : Finger millet

i. Existing varieties being used

Band muthi (*Muthinda*) types

Khuli muthi (*Jhampa*)

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

VL Mandua 324, and VL Mandua 352, PRM 1

iii. Existing package of practices being used

1. Mixed farming with soybean, urd and other crops like til are followed.
2. Traditional seed variety in use.
3. Use of undecomposed FYM @ 100 q/ha is applied.
4. One hoeing in rainy season is essential.
5. Manual harvesting for all practical purposes.

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

1. Preparation of land with 2 or 3 ploughings.
2. Use of 14-16kg/ha for crop production.
3. Application of 10 t/ha FYM for crop production.
4. Use of white colour mandua under organic conditions

v. Major insect pests associated with crop

Stem borer.

vi. IPM Module for management of insect pests

Cultural, mechanical and biological control

vii. Major disease associated with crop

Blast

viii. IPM Module for management of disease

Grow resistant variety such as VL 149

ix. Major weeds associated with crop

Oxalis latifolia, *Phylanthus nature, Amaranths virilise, Euphorbia hirata*, S*olanam* spp., *Cyprus* spp.

x. IPM Module for management of weeds

Weeding, hoeing and deep ploughing.

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. Finger millet- Wheat/Lentil/Barley is followed.
4. Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley is beneficial.
5. Contour cultivation and care soil and water conservation measures are adopted.
6. Use of fortified FYM for maximization of crop production.
7. Sale of value added products of organic produce

xii. Production constraints in agro-ecological region

1. Less availability of agriculture input.
2. Use of imbalance, undecomposed FYM and climate changing.
3. Wild animal damages are serious.
4. Unavailability of proper irrigation facilities.
5. Lack of quality seed, poor awareness of seed treatment, poor weed management,
6. Lack of awareness about pest and disease management among farmers, difficulties to use heavy modern agriculture implement due to hilly terrain.
7. Proper marketing of agriculture produce is not available.
8. Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

6D. Name of the Field crop : Barnyard Millet

i. Existing varieties being used

Non descriptive or mixture of varieties (Dwarf 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

PRJ-1,VL Madira 172 and VL Madira 207

iii. Existing package of practices being used

1. Traditional seed variety,
2. Use of undecompensed compost @ 10t/ha is applied.
3. 1-2 intercultural operation
4. Manual operation for all practical purpose.

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

1. Preparation of land- 2or 3 ploughing,
2. Seed rate and seed sowing -14-16kg/ha,
3. Irrigation-usually maximum area is rain fed
4. Replacement of PRJ-1 in all three blocks is completed.

v. Major insect pests associated with crop

Stem borer

vi. IPM Module for management of insect pests
Cultural, mechanical and biological methods
vii. Major disease associated with crop
Blight and smut
viii. IPM Module for management of disease
Grow resistant variety like PRJ 1.
ix. Major weeds associated with crop
Oxalis latifolia, *Phylanthus nature , Amaranths virilise, Euphorbia hirata*, S*olana*m *nigra*, *Cyprus* sp
x. IPM Module for management of weeds
Weeding, hoeing and deep ploughing.
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
4. Delayed sowing in PRJ-1 was beneficial to ward of bird damage at maturity time.
5. Maximum use of value added compost/FYM for high yield.
6. Use of local made thresher to reduce drudgery and pilferages at various levels.

xii. Production constraints in agro-ecological region
1. Less availability of agriculture inputs, use of imbalance and undecomposed FYM in production.
2. Wild animal damages are serious.
3. Labour issues are serious in terms of availability and rate.
4. Serious white grub problem.

7A. Name of the Pulse Crop : Lentil
i. Existing varieties being used
Chhota masur
ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region
PL-4, PL-7, PL-8, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL Masoor 514
iii. Existing package of practices being used
1. Mixed with wheat in sowing
2. Traditional seed variety and use of undecomposed FYM 5-8 t/ha is applied.
3. 1-2 inter cultural operations are done.

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region
1. Preparation of land with 1 or 2 ploughing.
2. Seed rate @ 20-25kg/ha with spacing 30x10cm is optimal.
3. Application of 10 t/ha FYM is recommended.
4. Suitable for unproductive and rain fed system
5. Use of VLmasoor 125 for large scale cultivation

v. Major insect pests associated with crop
White fly and Fruit borer, Thrips
vi. IPM Module for management of insect pests
Cultural, mechanical and biological control
vii. Major disease associated with crop
Wilt , Yellow Mosaic, Blast
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.

ix. Major weeds associated with crop

Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Weeding, hoeing and deep ploughing.

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

1. Organic cultivation is practized.
2. Adoption of low cost based cultivation practices.
3. Horsegram/Soybean- Lentil (rained) is best cropping pattern.
4. Use of high yielding, contour cultivation and care soil & water conservation measures.
5. Use of fertified FYM or compost for higher production.
6. Sale of value added products as organic.

xii. Production constraints in agro-ecological region

1. Availability of high yielding varieties of Lentil.
2. Sowing of crop in suitable cropping pattern.
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, oilseeds and pulse crops.
5. Cluster based farming and inters cropping.
6. Needs to promote local germplasm/local cultivars.

7B. Name of 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

U-31, PU-35

iii. Existing package of practices being used

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. 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. Timely sowing of crop in IInd fortnight or month of May to first week of July.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and PSB. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.

v. Major insect pests associated with crop

White fly, Fruit borer and Thrips.

vi. IPM Module for management of insect pests

Cultural, mechanical and biological methods

Fruit Borer

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

White fly

Name of the Insecticides	(gm/ml) /ha	
Phorate 10% CG	10000	

vii. Major disease associated with crop

Yellow Mosaic, Blast

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Weeding and hoeing and deep ploughing

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

1. Sowing of crop in suitable cropping pattern.
2. Need of agriculture diversification with horticultural crops along with livestocks management.
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. Needs to promote local germplasm or local varieties.

xii. Production constraints in agro-ecological region

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment.
3. Lack of awareness about pest and disease management among farmers,
4. Proper marketing of agriculture produce is not available.
5. Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

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

i. Existing varieties being used

Toor

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

Pant Arhar-291, VL Arhar 1, Pant Arhar-3.

iii. Existing package of practices being used

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

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

1. Timely sowing of crop in from mid of May to June.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and PSB are important. Application of proper application of compost and farm yard manure gave more yield. Sowing in line must be promoted for proper intercultural operations are essential.
4. Arrangement of irrigation facilities in case of drought should be available.

v. Major insect pests associated with crop

White fly, Fruit borer, Thrips

vi. IPM Module for management of insect pests

Cultural, mechanical and biological control

Pod borer: *Helicoverpa armigera*)

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

Redgram thrips: *Scirtothrips dorsalis*

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

vii. Major disease associated with crop

Yellow mosaic, Blast

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Weeding and hoeing

Deep ploughing

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

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

xii. Production constraints in agro-ecological region

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment.
3. 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.
5. Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

7D. Name of Pulse/oilseed Crop : Soybean

i. Existing varieties being used

Kala bhat (Oval)

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

VL S-56, PS-1092, PRS 1, VLS 2, VLS 47, VLS 59, VLS 63

iii. Existing package of practices being used

1. Mixed farming is followed.
2. Traditional seed variety.
3. Use of unrecompensed FYM 75-100t/ ha.
4. Manual intercultural operations and small land holding is serious problem.
5. Mechanical harvesting in most of operations.

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

1. Preparation of land with 1 or 2 ploughings.
2. Use of 100-125kg/ha for crop production.
3. Irrigation-usually maximum area is rain fed.
4. Use of bio-fertilizers as seed and soil treatment.

v. Major insect pests associated with crop

Semilooper, defoliators and beetle

vi. IPM Module for management of insect pests

Cultural practices:

1. The cultural practices make the environment less favorable for the pests and more favorable for its natural enemies.
2. The following are cultural practices recommended for the management of soybean insect pests.
3. Removal and destruction of infected stubbles followed by deep summer ploughing destroys the pupae of girdle beetle in the soil.
4. Optimal fertilizer dose of NPK and S @ 20:60-80: 30-40:20 kg/ ha should be applied.
5. Application of excessive dose of nitrogen fertilizer causes the infestation of all insect pests on soybean.
6. 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.
7. Planting of trap crops like Dhaincha (*Sesbania sesban*) for girdle beetle.
8. 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
Girdle beetle	MACS 1410, Dsb 23-2, Himso 1685, JS 20-89, KDS 726
Defoliators	Dsb 23-2, KDS 726, PS 1543, PS 1569

A.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. Hand picking and mechanical destruction of matured pod borer larvae.
4. Erection of bird perches @ 10-12/ha to attract predatory birds for preying on defoliator larvae.

B.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. Spraying of *Bacillus thuringiensis* var. kurstaki @ 0.75 to 1.0 kg/ha for the management of defoliators.
4. The major predators of soybean insect pests are given in the table 2.

Table 2: Major predators of insect pests of soybean

Insect pests attacked	Predator
Lepidopterous caterpillars	Pentatomid bug *Eocanthecona furcellata*
Lepidopterous caterpillars	Spiders: Lynx spider and Orb weaver spider

D.Chemical Control:

4. The control of insects with pesticides/insecticides is known is chemical control.
5. The insecticides are applied only when the population of insect pests crossed the Economic Threshold Level (ETL) (Table 3).
6. 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
Girdle beetle	Flowering	10 % infestation

Table 4: List of insecticides recommended for soybean insect pests

Green semilooper: *Plusia orichalcea*

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

Girdle beetle

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

vii. Major disease associated with crop

YMV, Leaf spot, Blight, Collar rot, Rust

viii. IPM Module for management of disease

Rust: *Phakopsora pachyrhizi*

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

Collar rot: *Sclerotium rolfsii*

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

ix. Major weeds associated with crop

Oxalis latifolia, *Phylanthus nature , Amaranths virilise, Euphorbia hirita*, S*olanam spp., Cyprus* spp.

x. IPM Module for management of weeds

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

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

Metalachlor 50% EC	1000	2000

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

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

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

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

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

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

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

1. Organic cultivation is in practice.
2. Supply of more vermibeds for higher compost production.
3. Adoption of low cost based cultivation practices for higher production.
4. Use of soybean- Wheat/Lentil/Barley for intensification of crops.
5. Contour cultivation and care soil & water conservation measures for maximization of production.
6. Maximum use of value added compost or fortified FYM for higher production.
7. Sale of value added products as organic.

xii. Production constraints in agro-ecological region

1. Non-availability of quality seed for higher production.
2. Less availability of agriculture inputs, use of imbalance and u decomposed FYM needs to be addressed.
3. Wild animal damages are serious.

7E. 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 and PPS-1)

iii. Existing package of practices being used

1. Organic system as mixed farming is prevalent.
2. Old and mixed seed are mostly used.
3. Use of bulk undecompensed FYM 8-10 t/ha in farming.
4. Mixed seeds is used for commercial cultivation

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

1. One deep ploughing followed by 2-3 harrowings and planking are being done.
2. **Sowing time**

   Toria: Last week of September.

   Yellow *sarson*: **S**econd fortnight of October to the first fortnight of November depending on the elevation.

3. **Varieties:**
   Toria: PT-303, Uttara and PT-508.
4. **Seed rate and spacing:**
   ***Toria*:** 4kg/ha about 3-4 cm deep in 30 cm apart rows
5. About 20-25 days after sowing maintaining a plant to plant space of 10 cm.
6. Vermicompost: 5t/ha or FYM: 10-15 t/ha at the time of field preparation about 20 days before sowing.
7. The crop should be harvested when about 75% of the siliquae start turning yellowish brown. After threshing seeds should be stored at about 8% moisture

v. Major insect pests associated with crop

Aphid, saw fly, Hairy caterpillar, White fly

vi. IPM Module for management of insect pests

Cultural, mechanical and biological methods.

vii. Major disease associated with crop

White rust, Powdery mildew, Blight, *Sclerotinia* rot

viii. IPM Module for management of disease

1. For management of *Sclerotinia* rot wider spacing (45x15cm) should be maintained.
2. Apply colonized *Trichoderma* decomposed cow dung/ FYM in the soil, seed treatment with garlic bulb extract (2%) is beneficial.

ix. Major weeds associated with crop

Cyprus spp.,

x. IPM Module for management of weeds

Weeding and hoeing and deep ploughing

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

1. Use of high yielding varieties PT-303 and PT-507.
2. Sowing as sole cropping.
3. Line sowing in proper crop spacing.
4. Seed treatment with bioagent prior to sowing.

xii. Production constraints in agro-ecological region

1. Wild animal problem in areas are serious.
2. Use of less and undecompensed FYM in crop.
3. Poor Irrigation facilities.
4. Inadequate seeds of high quality sarson to farmers.

Mixed farming system reduces the yield potential.

8A. Name of the Fruit crop : Peach

i. Existing varieties being used

Paradelux, July Elberta, Red June.

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

Alxander, Red Globe, Crest heaven, Glo Heaven, Nectarine- Snow Queen

iii. Existing package of practices being used

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

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

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

v. Major insect pests associated with crop

San Jose, Tent Caterpillar, Fruit Borer, Leaf Curl 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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

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

Peach Leaf Curl Aphid:

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

Peach leaf curl aphid

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

Peach Fruit Fly:

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

vii. Major disease associated with crop

Gummosis is major problem

viii. IPM Module for management of disease

1. Use of proper cultural or field operation with minimum damage to the crop
2. Use of borax as spray of soil application
3. Use of antibiotic as prophylactic spray.

ix. Major weeds associated with crop

Chenopodium album, Cyperous rotundus, Cynadon dactyl and Parthenium.

x. IPM Module for management of weeds

Though mechanical, chemical and control.

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

High density plantation with (3x3mts) supplemented with drip irrigation system.

xii. Production constraints in agro-ecological region

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

8B. Name of the Fruit crop : Pear

i. Existing varieties being used

Gola, Victoria, China, Baggugosha, Kashmiri, Thumb pear etc

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

Max Bartlette, Red Bartlette, William and Starkrimson.

iii. Existing package of practices being used

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

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

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

v. Major insect pests associated with crop

Not specific

vi. IPM Module for management of insect pests

San Jose Scale:

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.

4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

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

Peach Leaf Curl Aphid:

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

Peach leaf curl aphid

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

Peach Fruit Fly:

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

vii. Major disease associated with crop

Fruit rot

viii. IPM Module for management of disease

Use of proper cultural or field operation with minimum damage to the crop

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

Introduction of New Strain *viz*. Anjou, Starkrimson in high hills.

xii. Production constraints in agro-ecological region

Availability of quality planting material

8C. Name of the Fruit crop : Plum

i. Existing varieties being used

Santa Rosa, Beauty, Burbank

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

Santa Rosa, Beauty, Burbank and Prunes).

iii. Existing package of practices being used

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

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

High density plantation with drip irrigation system.

v. Major insect pests associated with crop

Leaf Curl Aphid and Fruit Fly.

vi. IPM Module for management of insect pests

San Jose Scale:

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

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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.

6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

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

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

Peach Fruit Fly:

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

vii. Major disease associated with crop

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viii. IPM Module for management of disease

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ix. Major weeds associated with crop

Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium.

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

xii. Production constraints in agro-ecological region

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

9A. Name of the Vegetable crop : Cabbage

i. Existing varieties being used

Pride of India, Golden acre as OP

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

T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole, Green star and Pride of India

iii. Existing package of practices being used

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

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

Promotion of high yielding, round shaped, 100% heading percentage, mature within 90 days.

v. Major insect pests associated with crop

Butterflies , Aphids, *Plutell*a and bugs

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 egg*s* 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 leave.
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.
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.

Dimond back moth: *Plutella Xyllostella*

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

Bioinsecticides

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

Cabbage/cauliflower Aphid

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

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

Painted bug

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

vii. Major disease associated with crop

Stem rot, black rot, black spot on leaf

viii. IPM Module for management of disease

Recommended IPM is being used.

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

ix. Major weeds associated with crop

Parthenium, Chenopodium album, Krishannil and *Oxalis latifolia*.

x. IPM Module for management of weeds

Weeding, hoeing and deep ploughing.

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

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

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

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

Use of hybrid varieties suitable for year round production system for mid hills.

xii. Production constraints in agro-ecological region

1. Less heading percentage in OP varieties.
2. Boron deficiency is becoming serious.
3. Less availability of high quality seeds
4. High prices of hybrid seeds
5. Post-harvest losses are more due to long transport.
6. Lack of knowledge about the cultivation practices
7. Lack of processing facilities.

9B. Name of the Vegetable crop : Cauliflower

i. Existing varieties being used

Unknown varieties available in the market.

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

Early Kunwari, Pusa Kartiki, Pusa Early Synthetic, Pusa Shubhra, Pant Shubhra, Hisar No.1, Snow crown, Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2

iii. Existing package of practices being used

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

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

1. Selection of hybrids as per maturity group of crop
2. Need to develop seed production program in cauliflower.
3. Use of micronutrients especially borax

v. Major insect pests associated with crop

DBM, Aphids are serious problem

vi. IPM Module for management of insect pests

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Hand picking and destruction of cabbage butterfly egg*s* 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 leave.
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.
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.

Dimond back moth: *Plutella Xyllostella*

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

Bioinsecticides

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

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

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

vii. Major disease associated with crop

Black rot and stalk rot are serious problem

viii. IPM Module for management of disease

***Xanthomonas* Black rot:**

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

ix. Major weeds associated with crop

Parthenium, Chenopodium album, *Anagalis arevensis*, *Oxalis latifolia*.

x. IPM Module for management of weeds

Weeding, hoeing and 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. Intercropping with coriander and rye inmid- hills.

xii. Production constraints in agro-ecological region

1. Non availability of suitable varieties as per agro-ecological situation.
2. Buttoning and leafyness are common problem
3. Lack of technical knowledge
4. Less availability of high quality seeds
5. High prices of hybrid seeds
6. High post-harvest losses due to long distance
7. Low prices of farm produce
8. Lack of knowledge about the cultivation practices
9. Lack of processing facilities.

9C. Name of Vegetable crop : Radish

i. Existing varieties being used

Mixture of varieties from unknown source

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

Early Mino, Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant.

iii. Existing package of practices being used

Mixed cropping with other rabi crops.

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

1. Use of long white tapering varieties
2. Line sowing and use of less or non-pithy varieties.
3. Use of round shaped varieties for culinary purpose.
4. The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha.
5. For 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. Depending upon the cultivars, the roots become ready for harvesting in about 25-35 days after sowing. Early and rapid maturing European cultivars reach harvest maturity in 25-30 days after sowing.

v. Major insect pests associated with crop

Aphids are problem

vi. IPM Module for management of insect pests

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

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the numbers considerably.
2. Yellow sticky trap is effective for controlling aphid population.

vii. Major disease associated with crop

White rust

viii. IPM Module for management of disease

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ix. Major weeds associated with crop

Not serious

x. IPM Module for management of weeds

Not applied

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

1. Use of short duration, non pithy, coloured varieties for year round production.
2. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Cauliflower early- Radish- Bottlegourd
   Brinjal -Radish –Chilli
   Bottle Gourd-radish-French bean

xii. Production constraints in agro-ecological region

1. Pithyness or over maturity problem in mid hills.
2. Less availability of high quality seeds.
3. High prices of hybrid seeds.
4. Low prices of farm produce.
5. Lack of knowledge about the cultivation practices.
6. Lack of processing facilities.

9D. Name of the Vegetable Crop : Tomato

i. Existing varieties being used

Non descriptive varieties as open pollinated.

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

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

iii. Existing package of practices being used

1. Without soil and seed treatment, Poorly managed nurseries, Subterranean staking.
2. Generally crop grown in open field condition
3. Sowing time – March-April.
4. Sowing space-(90x30 cm and 60x60 cm) for tall and dwarf varieties.

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

1. Use of indeterminate, round, optimal fruits weight hybrids.
2. Use of Organic manures in cultivation.
3. Special training and pruning techniques, upright stacking and earthling up operation, with standard harvesting techniques and stages.
4. Use Indeterminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition.
5. Crop rotation Tomato-cowpea-Early cauliflower.

v. Major insect pests associated with crop

Fruit borer and white flies in low or mid hills are serious pest

vi. IPM Module for management of insect pests

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

1. Growing trap crop of African tall marigold as border row before 15 days of transplanting is beneficial in reducing egg laying in main crop.
2. Field sanitation and clean cultivation is effective tool to suppress the pest population.
3. Setting of sex pheromone traps @ 5 trap/acre for monitoring is effective.
4. Spray of Ha NPV @ 500 LE/ha mixed with 0.1 per cent UV retardant (Tinopol) and 0.5 per cent jiggery is effective.
5. Use of Bt @ 0.50kg/acre and NSKE 5 per cent to kill early stage larvae. Release of the egg parasitoid, *Trichogramma chilonis* or *T. brasiliensis* @ 1Lakh/ha coinciding with flower initiation at 15 days interval may reduce the pest population.
6. Development of pyridalyl nanocapsule suspension for efficient management of tomato fruit and shoot borer (*Helicoverpa armigera*) is an efficient approach for frequent delivery and effective management.

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

Management strategies (white fly

A. Crop Hygiene

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

B. Other Cultural Control Practices

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

C. Insecticidal Control Practices.

1. Restricted the use of neonicotinoids (imidacloprid or acetamiprid) in the field only during the first six weeks of the crop thus leaving a neonicotinoid-free period at the end of the crops.
2. Use selective rather than broad-spectrum control products where possible to conserve natural

enemies and enhance biological control.
3. Do not apply insecticides on weeds on field perameters. These could kill whitefly natural enemies and, thus, interfere with biological control.
4. Crop rotation is effective tool to prevent pest population.
5. Avoiding of same group of crop in same field for a long time is beneficial.
6. Sticky trap is effective to control whitefly population.

White fly

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

vii. Major disease associated with crop

Buckeye fruit rot is a major serious disease.

viii. IPM Module for management of disease

Buck eye rot:

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

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

ix. Major weeds associated with crop

Trifolium alaxenderinum, Cyperus rotundus, Cynodon dactylon.

x. IPM Module for management of weeds

Cultural practices.

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

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

xii. Production constraints in agro-ecological region

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

9E. Name of the Vegetable Crop : Potato

i. Existing varieties being used

Up-to-date, Kufri Jyoti, Kufri Chandramukhi, Kufri Bahar, K Badshah.

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

Kufri Girriraj, Kufri Chipsona 1, Kufri Chipsona 3, Kufri Jyoti, Kufri Chandramukhi.

iii. Existing package of practices being used

1. Use of big sized tuber or division of tuber (50-60 g)
2. No tuber treatment
3. Use of organic manures and sowing in flat bed.
4. Sowing time is March-April.

5. Limited or no IPM practices
6. Planting time -March
7. Spacing: 50-60 x 15-20 cm
8. Seed rate: 25-30 qt/ha

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

1. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with application of organic manures.
2. Early crop planting time – First fortnight of October
3. Main crop planting time- Second fortnight of October
4. Plant 25-30g seed size potato tuber@ 25-30q/ha.
5. Spacing: 60 x 20 cm
6. Dehaulming practise should be adopted for long duration storage of tubers.

v. Major insect pests associated with crop

Potato tuber moth, Epilachna beetle, Aphids, White grub

vi. IPM Module for management of insect pests

Potato tuber moth: *Phthorimaea operculella*

1. Heaps of green grasses may be kept at suitable interval in infested field during evening and next day early in the morning along with caterpillars to destroy.
2. Clean cultivation and mechanical destruction of caterpillars also help in reducing pest infestation. Irrigation brings on the surface and birds shall predate them.

Epilachna beetle: *Epilachna viginatioctopunctata*

1. Hand picking 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 cakes is efficient in suppressing the pest population.

Aphids: *Myzus persicae*

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

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG (Spray)	100	77
Thiamethoxam 25% WSG (Drenching)	200	77
Dimethoate 30% EC	660	
Oxydemeton-methyl 25% EC	1000	
Carbofuran 3% CG	16600	
Phorate 10% CG	10000	

vii. Major disease associated with crop

Late blight and common scab disease in the crop and tuber.

viii. IPM Module for management of disease

1. Only cultural practices are followed.
2. Use of certified seed / disease free seed.
3. Plant improved/ resistant cultivars like Kufri Khyati, K. Pukhraj, K. Satluj and K. Chipsona-3
4. Regular monitoring of field and rouge the virus affected plants.
5. Stop irrigation before haulm cutting, leave tubers in soil for skin hardening for 10-15 days.

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

Cyperus spp. and *Chenopodium* etc.

x. IPM Module for management of weeds

1. Mechanical and cultural method.
2. Proper crop rotation
3. Timely hand weeding
4. Winter/ summer ploughing

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

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

10. Medium size whole tuber should be used as planting material.

xii. Production constraints in agro-ecological region

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

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

Chhaya, Kanhaya, Ankur, Navkiran, Brinjal 704 (SunGro Seed), VNR212 (VNR Seed), IndameSupriya (Indo-American), Pant Rituraj, Pant Samrat, Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used

1. Poorly managed nurseries infected with damping off.
2. Over aged or less vital seedling are used.
3. Transplanting is done on or before monsoon shower
4. Round and long purple type varieties are favoured
5. No control measure for shoot and fruit borers and *Phomopsis* blight.

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

1. Availability of purple and round varieties in cropping system.
2. Augmentation of assured irrigation for optimal production.
3. Use of black or plastic mulch in production chain
4. The recommended seed rate of brinjal: Hybrid-250g/ha, Open pollinated-500-600g/ha
5. Transplant seedlings properly as for non spreading type varieties- 60 cmx60cm, spreading type varieties - 75cm x 60cm.
6. Maturity stage of a particular crop so he can harvest the crop as per their object.

v. Major insect pests associated with crop

Shoot and fruit borers

vi. IPM Module for management of insect pests

Brinjal fruit & shoot borer: *Leucinodes orbonalis*

1. The damaged portions of the plants and fruits should be removed and destroyed.
2. Early removal of drooping shoots will reduce the fruit infestation.
3. Proper collection of all the infested flower buds, fruits during harvest.
4. Continuous cultivation of brinjal also favors the pest infestation.
5. Varieties like Punjab Barsati, (moderate resistant cultivar) Pusa purple round, Punjab Neelam found to be resistant to brinjal fruit borer.
6. Biological method recommended by IIHR, Bengaluru involving release of *Trichogramma chilonis* @10 to 15 lakh parasites/ha/season along with 2 sprays of *Bt* formulation found to be economically effective.
7. Installation of BSFB (brinjal shoot and fruit borer) pheromone traps Lucinure @3/ha to monitor and

mass trap the male moths is effective.

8. Neem Seed Kernal Extract (NSKE)5 % per cent at the time of flowering is effective.
9. Prevent continuous growing of same group of crop at same field.
10. Rotate brinjal with cabbage or other crops

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	200	22
Emamectin Benzoate 5% SG	200	3
Thiacloprid 21.7% SC	750	5
Thiodicarb 75% WP	625-1000	6
Lambda cyhalothrin 5% CS	300	5
Cypermethrin 25% EC	150-200	1
Betacyfluthrin 8.49%+ Imidacloprid 19.81% OD	200	7
Triazophos 35% + Deltamethrin 1% EC	1250	3
Pyriproxyfen 5%+ Fenpropathrin15% EC	750	7

vii. Major disease associated with crop

Phomopsis blight is a serious problem in the hills.

viii. IPM Module for management of disease

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

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

ix. Major weeds associated with crop

Euphorbia hirta, *cynadon dactylon*, *Cyprus* and *Oxalis latifolia.*

x. IPM Module for management of weeds

1. Hand weeding only.
2. The field should be kept weed-free, especially in the initial stage of plant growth, as weeds compete with the crop and reduce the yield drastically.
3. Frequent shallow cultivation should be done at regular interval so as to keep the field free from weeds and to facilitate soil aeration and proper root development.
4. Two-three hoeing and the earthing up are required to keep the crop free of weeds.

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

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

xii. Production constraints in agro-ecological region

1. Non-availability of suitable hybrids
2. Wild animals problems
3. Poor technical knowhow

4. Marketing problem in rainy season
5. Less availability of high quality seeds
6. High prices of hybrid seeds
7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities

9G. Name of the Vegetable crop : Chilli

i. Existing varieties being used

Local and non descriptive varieties

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

Agni, Shikha, 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. Traditional seeds, No seed treatment, Poor nursery management, Transplanting on or before rainy or monsoon season, Crop geometry knowledge is poor, Poor dry fruit storage.
2. Growing local varieties.
3. Avoid overaged seedlings and planting of 2 or 3 seedlings at place.
4. Sowing of untreated seed.

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

1. Use of seed treatment like Pant bio-agent 3 for managing seed and soilborne diseases.
2. Earthening up of plants within 45 days after transplantation to get rid off water logging
3. Use of tall and cluster bearing type like local strain Lakhaur mirch.
4. Use of high dose of organic manure *i.e.* 200 q/ha increases productivity and incidence of dieback and anthracnose.
5. Grow high yielding varieties.
6. Adopt soil testing and transplant one seedling at one place.
7. Transplant the seedlings when they attain 5-6 leaf stage.
8. Transplant the seedlings at proper spacing-
9. Dwarf varieties like Kashi Anmol at 45 x 30 cm
10. Tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm.

v. Major insect pests associated with crop

Thrips problem is major problem

vi. IPM Module for management of insect pests

Chilli thrips, *Scirtothrips dorsalis* Hood

1. Thrips *Franklinothrips vespiformis* (Crawford) and *Erythrothrips asiaticus* R. &. M. are predaceous in nature and their population may be encouraged by avoiding chemical sprays.
2. Yellow or blue sticky trap is effective for controlling this pest.
3. If still the population persist spraying of imidacloprid 70% WG @ 0.25ml/l or acetamiprid 20%SP @ 0.2g/l or thiomethoxam 25%WG @ 0.2g/l or metasystox@1.5ml/l is effective.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 30% FS (Seed Treatment)	7/Kg	
Imidacloprid 70% WS (Seed Treatment)	10-15/Kg	
Cyantraniliprole 10.26% OD	600	3
Emamectin benzoate 5% SG	200	3
Spinosad 480% SC	160	3
Acetamiprid 20% SP	50-100	3
Thiacloprid 21.7% SC	225-300	5
Indoxacarb 14.5%+ Acetamiprid 7.7% SC	400-500	5
Flubendamide 19.92%+ Thiacloprid 19.92%	200-250	5

Methomil 40% SP	750-1125	5&6
Lambda cyhalothrin 5% EC	300	5
Ethion 50% EC	1500-2000	5
Fipronil 5% SC	800-1000	7
Imidacloprid 17.8% SL	125-250	40

vii. Major disease associated with crop

Dieback and anthracnose is major disease.

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

ix. Major weeds associated with crop

Euphorbia hirta, cynadon dactylon, cyprus and *oxalis*.

x. IPM Module for management of weeds

Manual weeding

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

1. Use of tall hybrids supplementation of organic packages of practices to be followed
2. Grow high yielding varieties.
3. Adopt soil testing.
4. Transplant one seedling at one place.
5. Transplant the seedlings when they attain 5-6 leaf stage.
6. Transplant the seedlings at proper spacing.

xii. Production constraints in agro-ecological region

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

9H. Name of the Vegetable Crop : Cucumber

i. Existing varieties being used

Local and traditional varieties

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

For open field condition: Pusa Udhay, Pusa Barkha, Shubhangi, Himangi, Punjab Naveen, Tasty, Ruchi.

For protected condition- Hilton, Kian, Isatis, Malini etc.

iii. Existing package of practices being used

1. Use of traditional seeds,
2. Planting in rainy season,
3. Traditional stacking method,
4. Long harvest duration season,
5. Sale at local market
6. Absence of crop rotation.
7. Random selection of varieties (May or may not be suited to Agroeco-region).
8. Untimely sowing / planting of crop.
9. Use of plant protection chemicals having long waiting period.
10. Use of traditional irrigation system.
11. No soil solarisation/ treatment during lean period.

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

1. Glasshouse or polyhouse technology

2. Use of Hybrids or/and pathenocarpic varieties
3. Management of crop geometry.
4. Use of organic manure or fertigation inside polyhouse.
5. Adoption of crop/ soil health related crop rotations.
6. Use recommended spacing eg. 60-200 × 50-100 cm
7. Treating seed before sowing.
8. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
9. Selection of optimum planting period.

v. Major insect pests associated with crop

Leaf miner, White fly, Thrips, Leaf eating caterpillar, Fruit fly, Cut worm, Red pumpkin beetle

vi. IPM Module for management of insect pests

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

Red pumpkin beetle

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

vii. Major disease associated with crop

Wilt, mildew, mosaic.

viii. IPM Module for management of disease

Powdery mildew

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

Downy mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Zineb 75% WP	1500-2000	
Cymoxanil 8%+ Mancozeb 64% WP	1500	10
Azoxystrobin 23% SC	500	7
Amectoctradin+ Dimethomorph 20.27% SC	800-1000	3

ix. Major weeds associated with crop

Trifolium alexenderinum, 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. Polyhouse technology and hybrid cultivars can increase productivity 3-4 times in mid hills.
2. Use of well designed and recommended protected technology suited to area *i.e.* Polyhouses, 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 e.g. 60-200 × 50-100 cm
6. To use sufficient quantity of fully decomposed Farm Yard Manure (two year old)/ vermi compost.
7. To use technology such as soil solarisation.
8. Timely sowing/ transplanting of crop.
9. Use of different protected systems/materials e.g. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
10. Timely harvesting of crop.
11. To save the precious natural resource water, follow micro irrigation technologies (drip irrigation).
12. Use genetically pure & treated seed.

xii. Production constraints in agro-ecological region

1. Lack of plant growing structures.
2. Monkey, baboon, wild pigs are serious threats.
3. Good quality seed is inaccessible.
4. High cost of seed & poor purchasing power of farmers.
5. Water scarcity.
6. Protected cultivation is cost involving technologies.
7. Repair of the poly houses/ micro irrigation structures is a tedious task.
8. Damage of crop / poly houses /micro irrigation structure by wild animals.
9. Unawareness about scientific technologies.
10. Availability of agriculture inputs is not easy.
11. Use of unsafe agro chemicals.
12. Difficult labour availability.
13. Different biotic and abiotic stresses.

9I. Name of the Vegetable Crop : Pea

i. Existing varieties being used

Traditional field pea , Arkel and Azad pea 3

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

PSM-3, PSM-5, Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12, Pusa Pragati

iii. Existing package of practices being used

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

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

1. Use of tall varieties sown in line with effective stacking methods. Management of powdery mildew and *Fusarium* wilt in autumn season and main season.
2. Sowing early maturing varieties at closer spacing (30 cm plant to plant and about 5-10 cm between plants) and higher seed rate (120 kg/ha).
3. Optimal time for pea sowing is Oct and Mid November.
4. Seed rate: 100 Kg/ ha for early cultivation.
5. Water the crop as per need especially during flowering and pod setting.

v. Major insect pests associated with crop

Leaf minor

vi. IPM Module for management of insect pests

Cultural, mechanical, biological methods

vii. Major disease associated with crop

1. Powdery mildew in all agroecological situations
2. *Fusarium* wilt in autumn sown crop

viii. IPM Module for management of disease

1. Use of organic inputs only
2. Use of rust and powdery mildew resistant strains.

Powdery mildew

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

Benomil 50% WP	100	200
Carbendazim 50% WP	150	300

ix. Major weeds associated with crop

Trifolium alexendrinum, Cyperus rotundus, cynodon dactylon, Fagopyrum species.

x. IPM Module for management of weeds

Manual weeding

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

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

xii. Production constraints in agro-ecological region

1. Monkey, baboon, wild pigs are serious threats.
2. Good quality seed is inaccessible.
3. High cost of seed & poor purchasing power of farmers.

C1. Livestock : Buffalo

1.A-Existing breeds available

Mostly non-descriptive breeds

1.B-Specific breeds to be introduced

Murrah, Neeli-ravi.

2.A-Existing feeds being used

Wild grasses, Paddy straw, Wheat straw, Wild dried grasses, Leaves of trees of Oak, Bheemal, Khadeek, Mulberry

2.B-Specific feeds to be introduced / advised

1. UMBB Feed blocks,
2. Use of green fodder maize, multi cut chari, Hybrid napier, Tall fascue, Italian rai, Cox foot, Orchard grass, fodder trees etc.
3. Fortification of local Fodder, use of Chaff cutter.

3.A-Existing health services

State animal husbandry department (Vet. Hospital, LEO Centers) and BAIF.

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

Village level workers for first aid, vaccination and AI

4.A-Existing management practices

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

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

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

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

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

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

Feed and fodder shortage, local breed and low cost of milk.

C2. Livestock : Cattle

1.A-Existing breeds available

Mostly non-descriptive breeds, Badri, Cross bred of Jersey, HF, Sahiwal

1.B-Specific breeds to be introduced

Jersey, HF, Sahiwal

2.A-Existing feeds being used

Wild grasses, paddy straw, wheat straw, dry grasses, Leaves of trees as silver oak, bheemal, khadeek, mostly rearing on grazing

2.B-Specific feeds to be introduced / advised

Fodder maize, multi cut sorgam *chari*, Hybrid Napier, fodder trees, Fodder treatment, Chaff cutter, mangers etc.

3.A-Existing health services

State animal husbandry department and BAIF.

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

Village level workers for first aid, vaccination and AI

4.A-Existing management practices

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

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

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

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

1. Poor breeds.
2. Shortage of feed and fodder.
3. Improper feeding.
4. Poor housing and management of animals.
5. Improper health services.
6. Mostly unproductive animals.

5.B-Specific problems related with AH/ Cattle due to which income is not increasing

Feed and fodder shortage, local breed, low cost of milk

C3. Livestock : Goatary

1.A-Existing breeds available

Mostly non-descript, Chobarkha, Udaipuri

1.B-Specific breeds to be introduced

Barbari

2.A-Existing feeds being used

grazing

2.B-Specific feeds to be introduced / advised

grazing

3.A-Existing health services

State animal husbandry department

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

Village level workers for first aid and vaccination

4.A-Existing management practices

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

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

Development of pasture land, scientific management

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

Lack of range land management

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

1. Lack of range land management,
2. Managemant problems as proper vaccination,
3. Ecto and endo parasite control, breed improvement

C4. Livestock : Poultry

1.A-Existing breeds available

Local, Croiler, RIR, Uttara fowl

1.B-Specific breeds to be introduced

Coiler, Kadaknath, Cob, Cari-Davendra, Cari-Nirbheek

2.A-Existing feeds being used

Kitchen waste

2.B-Specific feeds to be introduced / advised

Starter, grower, finisher feed according to age

3.A-Existing health services

State animal husbandry department.

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

Specific poultry management services

4.A-Existing management practices

Mostly backyard poultry.

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

1. High yielding breeds.
2. Proper feeding and management practices.

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

Poor breed and management

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

Poor breed and management

C5. Fisheries

1.A-Existing breeds available

Local.

1.B-Specific breeds to be introduced

Silver carp, grass carp and common carp

2.A-Existing feeds being used

House hold waste

2.B-Specific feeds to be introduced / advised

Pelleted fish feed having 25-30% protein

3.A-Existing health services

State fisheries dept. (fisheries inspector at district level)

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

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4.A-Existing management practices

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

-

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

-

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

Non availability of quality fish seed is major problem

D. Integrating Farming system

1.A- Existing farming system

Animal husbandry+crop/Vegetable

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

Agri-Hort - Animal-processing based farming system

Activity	**Area**
A. Cropping system:	**8 nali**
Paddy-Cabbage/Pea	
Capsicum-radish-cauliflower	
Paddy-Radish-garden pea-Frenchbean	
B . Horticulture	**8 nali**
Peach, plum apricot and walnut	
C Livestock	**2 nali**
Cow/buffalo	
Backyard poultry	
Goatry	
Fishery	
Beekeeping	
D. Processing	**2 nali**

Washing and cleaning of season vegetables, biogas/vermicompost/biopesticides

Total cost : 50,000.0

Total income : 1.5 lakhs

Net income : 1.00 lakh (Approx.)

E. Reducing post harvest losses and value addition

1.A-Existing grading facilities

Not available in area

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

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 like malta and cucumber and other season vegetables.
2. Size grader for particular commodity for apple and brinjal.
3. Weight grader for particular commodity

4. Colour grader for particular commodity

2A.- Existing processing facilities

Not available in area

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

1. Establishment of minimal processing plants in various location based on crop and area specific.
   Amaranthus - Guptkashi centre
   Barnyard millet – Bangar and Jakholi centre
   Fingermillet- Basukidhar area in mid hills
2. Pre packing and e-Packing for precious commodities at
3. Establishment of small or cottage level processing units for market surplus in Gola Nashpati, Chullu, delicious local malta for food products.
4. Establishment of wine factories for Goal, Chullu, Plum and other forest products. Food processing units of Deptt of Horticulture and Units of some NGOs

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

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

Not available

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

1. A factory based on plastic cartoon, *Kilta (Solta)*, *Dalia* of various grade and size based on weight is needed at least at dist level to meet the requirement of local fruit and seasonal vegetables.

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Small LDPE and HDPE polybags for particular commodity
3. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
4. Paperboard boxes for particular commodity
5. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops.

4.A- Existing storage facilities

At present no storage facilities are available in the distt.

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

1. A warehouse for hill potato is required at Agastymuni and Tilwara.

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 mid hills.

F. Waste land development and waste water

1.A- Existing practices of soil water conservation

1. Using indigenous technology use for water conservation includes formations of bund,
2. Growing of Napier and other perennial grasses,
3. Multiple forest species as per need are requirement.

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

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

2.A- Existing plantation

Toon, shirish, Bheemal, Kachnar, Kharik, shisham in low and mid hills Utis, banj, chhanchru, leucinia, Mulberry

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

1. Morus, Shirish, Kharik, Bheemal, Kachnar, Vilyati khair etc are useful as dual purpose species to meet fodder, firewood and other requirement of the farmers. Sufficient plants are available at forest nurseries for plantations.
2. Rejuvenation/repair of faulty/abandoned terraces;
3. Stabilization of eroded land using biological/engineering measures;
4. Plantation of suitable trees/brushes in waterlogged and eroded areas;
5. All agricultural operations should be done on contours i.e. across the existing land slope.
6. 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.
7. 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.
8. Diversion of runoff through ditches from upper slopes to safer places.
9. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
10. 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.
11. Contour trenching (staggered/continuous).
12. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
13. Industrial wastewater must be purified by the concerned industries at their factory level, and

should not be thrown into the streams/rivers.

14. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
15. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone

3.A- Existing fodder production

Crop stobbers, wild grasses, Forest leaves etc.

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

Medium and high Hills;

Rye grass (*Lolium* perenne), Brome grass (Bromus inermis), Cox Foot grass/Guchhi grass (Dactylis gloemrata), Timothi grass (Helum pratense), White clover (Trifolium repens)
Red clover (Trifoliun pretense))

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. Irrigation management- Crop must be irrigated after each cut provided water is available
5. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

Timothi grass

1. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
2. Irrigation management- Crop must be irrigated after each cut provided water is available
3. 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. Irrigation management- Crop must be irrigated after each cut provided water is available
5. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

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. Irrigation management- Crop must be irrigated after each cut provided water is available
   Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

4.A- Type of waste water

Home and kitchen waste

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. Multistage filtration unit should be established to recycle the waste water for multiple purposes.
2. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
3. Industrial wastewater should not be used for irrigation directl and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.

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

G. Reduced cultivation cost

1.A- Existing inputs being given

1. Traditional and unprocessed inputs are used in agricultural practices.
2. Drudgery prone implements/tools are in practice for various operations.

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

Application of nutrients based on soil test basis as major and micro elements.

2.A- Existing mechanization

1. Limited use of power driven implements in land preparation.
2. Small tools like sickle, hand hoe etc are being adopted by progressive farmers.

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

1. Power tiller, power weeder, and shrub cutter, multiple crops threshers are becoming popular and are available in pockets.
2. Old wooden based impelements are being replaced with iron/alloy (Plough, Danalla,) based tools are available.

3.A- Existing collective inputs

1. Community pasture land
2. Service bulls
3. Irrigation channel and source
4. Irrigation tanks

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

1. Custom hiring energy based implements viz. Small tractor, tiller, Power sprayers and Mandua thresher.
2. Hydrum irrigation can reduce the cost of cultivation along with reduction of farm labour.

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

1. Labour cost
2. High hybrid seed cost
3. No storage facilities for perishable product
4. No chilling plant for milk

H. Off-farm income

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

ATI, ATMA, CHIRAG, AAJIVIKA, NABARD, Hill Valley development

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

As per requirement and vaialability of various produce, following groups are formed:

1. Gola Nashpati group
2. Malta collection and procurement group
3. Cheura collection and extraction group
4. Milk collection and chilling group
5. Wool collection and sale group
6. 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.
7. 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.
8. Imparting the information to the groups about various govt. schemes regarding loan, trainings and

marketing of the product.

9. 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.
10. 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.
11. Loan procedure should be made more flexible with less interest rate.
12. 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.
13. 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.
14. 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.
15. Enterprises need to be identified depending upon local resources- human and material.
16. Market linkages need to be developed so that people can sell their produce gainfully.
17. To encourage SHG's better planning; training and sustained efforts on long term basis are required.
18. 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. Young people do not stay in villages and move to other areas or take up other profession such as tourism, transport and hospitality.

2.A- Existing Micro-entrepreneur employment

Five groups are working for collection of small fruits for juice preparation in mid hills.

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

1. Garwali food products for religious tourism
2. Mushroom production and processing units at *Bheeri.*
3. Honey and honey products unit at *Chaumasi*
4. Milk and milk products shops at *Guptkashi.*

3.A- Existing skill development facilities

Extension training institute at *Rudraprayag*.

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

1. Mushroom production and training facilities
2. Development of advanced horticultural handling units
3. Fish ponds
4. Dairy/Poultry/ gottary units
5. Value addition and food chain centre
6. Storage, grading and Packaging centre

7. Silk worm based skill development units
8. Bio-agant and bio-fertilizers production lab
9. Tissue culture lab for massive production of elite planting material

4.A- Existing women skilling facilities

Not Available

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

1. Khadi and Kargha training for women skill
2. Drugery reduction practices for high efficiency
3. Herbal dye based skill training and skill for local textiles.
4. Value addition skill for women.

5.A- Existing youth skilling facilities

Extension training institute

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

1. Mushroom production and training facilities
2. Development of advanced horticultural handling units
3. Dairy/Poultry/ goatary units
4. Value addition and food chain centre
5. Storage, grading and Packaging centre
6. Silk worm based skill development units
7. Bio-agent t and bio-fertilizers production lab
8. Tissue culture lab for massive production of elite planting material.

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* sp. 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 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

I. Enabling Policies

1.A- Existing policies related with agriculture and animal husbandry

Subsidies and incentives are given on all agricultural inputs. More than 50% subsidies are granted on all inputs and implements.

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

1. Section of crop and area specific crop production program
2. Timely and assured supply of agricultural inputs to farmers at door.
3. Popularization of polyhouse technology for vegetables and flower production
4. Inclusion of hybrid seed program for crop production.
5. Establishment of seed production units for temperate crops.
6. Need to establish more food processing units.
7. Availabilities of credit at minimum rate.
8. Assured buyback policy for agricultural produce.

2.A- Existing Institutions

ICAR Institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK,NGOs

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

1. Establishment of food processing units at dist level to procure and marketing of surplus.
2. Need to develop or establish animal breeding program
3. Testing of new crops in non-traditional areas for doubling the crop production.

3.A- Existing Incentives

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

1. An assured bonus to farmers to grow new crop or higher production potential.
2. Selection of farmers at village for trendsetter for dissemination of technical knowledge and technology may be awarded.
3. Free access to library and one institute at least once in a year.

4.A- Existing risk coverage facilities

Crop and Animal Insurance Schemes.

4.B- Risk coverage facilities to be suggested for doubling income in the specific agro-ecological region

1. Risk coverage may be applicable for all agricultural products and animals
2. Declaration and minimum support price be fixed well in time

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

1.A- Existing marketing facilities

One mandi samiti office is established

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

Contractual farming, linkages with MNCs and NCs, Mahila hat, local hat, weekly bazaar, local mandi, AC van.

2.A- Existing grading facilities

Nil

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

For grains:

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

For horticultural crops:

1. Sorter for particular commodity

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

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

For grains:

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

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

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

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities.
2. Small LDPE and HDPE polybags for particular commodity.
3. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers).
4. Paperboard boxes for particular commodity
5. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops.

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

Food and canning units at Nala and Basukidhar.

K. Online Management and Evaluation

1.A- Existing online management structure available

Internet and social media.

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

Each village should be connected by Internet facility with proper device, awareness about internet user.

2.A- Existing evaluation procedure

Manual

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

GPS, e-mail, Whattsapp, ITC tools

3.A- Existing monitoring system

Physical

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

Regular visits and online report submission, farmer feed back

4.A- Existing feedback system

Manually

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

region of district

Internet and proper software for evaluating ongoing activities

5.A- Existing reading system

Literature, Booklets, Hindi Extension Journals etc

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

Farm advisory portal, online helpdesk services

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

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 and UP 2572)
2. Promotion of high yielding varieties of Paddy (Irrigated - VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85*; Rainfed- Chatki Dhan- VL Dhan 208, VL Dhan 209; Jethi dhan –Vivek Dhan 154, VL Dhan 157, VL Dhan 156 and VL Dhan 158).
3. Promotion of high yielding varieties of specialty corn (CMVL Sweet Corn 1, CMVL Baby Corn 2).
4. Promotion of high yielding varieties of Finger millet (, VL Mandua 324, and VL Mandua 352, PRM 1)
5. Promotion of high yielding varieties of Barnyard Millet (PRJ-1,VL Madira 172 and VL Madira 207)
6. Promotion of high yielding varieties of Horsegram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19)
7. Promotion of high yielding varieties of Lentil (PL-4, PL-7, PL-8, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL Masoor 514)
8. Promotion of high yielding varieties of Toria/Sarson (PT-303, 507,Uttara and PPS-1)
9. Promotion of high yielding varieties of Urd (U-31, PU-35)
10. Promotion of high yielding varieties of Arhar (Pant Arhar-291, VL Arhar 1, Pant Arhar-3).
11. Promotion of high yielding varieties of Tomato (VL Tamatar 4, Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852)
12. Promotion of high yielding varieties of Potato (Kufri Girriraj, Kufri Chipsona 1, Kufri Chipsona 3, Kufri Jyoti, Kufri Chandramukhi)
13. Promotion of high yielding varieties of vegetable pea (PSM-3, PSM-5, Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12, Pusa Pragati), french bean (VL Bauni Bean 1 and VL Bean 2,), VL Shimla Mirch 3, Onion (VL Piaz 3), Garlic (VL Garlic 1 and VL Lahsun 2).
14. Recommended package and practices will be followed for the above said crop varieties

Introduction, validation, adoption and pomotion of hybrids varieties in vegetable in valley and low hills areas.

1. Promotion of high yielding varieties of French bean (Pant Anupama, Pusha, Himlata, Swarna Lata, Laxmi, VL Lata Bean-17, Pusha Parvati, Pant bean-2, VL Bony-1, Arka Anoop, Arka Bold).
2. Promotion of high yielding varieties of Cauliflower (Early Kunwari, Pusa Kartiki, Pusa Early Synthetic, Pusa Shubhra, Pant Shubhra, Hisar No.1, Snow crown, Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2).
3. Promotion of high yielding varieties of Cabbage (T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole, Green star and Pride of India).
4. Promotion of high yielding varieties of Capsicum (Yellow Wonder, Pusha Dipti, Bharat, Indira, Aasha, Orobelle, Natasha, Swarna)
5. Promotion of high yielding varieties of Radish (Early Mino, Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant).
6. Promotion of high yielding varieties of chilli (Agni, Shikha, Kashi Anmol, Pant C-1, Tajwasni, Pusa Sadabhar, Punjab Lal, Panjab Surkh, CH-1 and CH-3)
7. Promotion of high yielding varieties of peach (Alxander, Red Globe, Crest heaven, Glo Heaven,

Nectarine- Snow Queen)

8. Promotion of high yielding varieties of Plum (Santa Rosa, Beauty, Burbank and Prunes).

Introduction of new plant variety or type in non –conventional areas.

Low chill varieties of apple in above 2000 mts,

Replacement of traditional stone fruit crop with kiwi or strawberry for high productivity in Khumera and Shisi clusters.

Introduction of exotic vegetables like Asparagus, Globe artichoke, Tulsi Thyme and others crops in cropping system in *Rudrapryag and Tilwara* clusters.

Adoption of high yielding varieties and hybrids in vegetable crops.

Construction of water harvesting tank in mid hills/mountain region.

1. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
2. Creation of trenches for high percolation of water in Khhat, Rabigaon, Mayali, Chirbatia, Tulanga, Raunlak, Mansuna, Rampur, Badasu, cluster of this region.
3. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in all the blocks of this region.
4. Strenghening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.

Timely supply of seed and other inputs

1. Sufficient and assured supply of HYV Millets, seed and inputs in all nyaypanchyat /CD store of Agriculture Deptt.
2. Supply of reliable planting material of temperate and subtropical plants to farmers.
3. Use of IPM modules as per area and crop specific in field and vegetables.

Application of modern techniques in crop production *viz.*

1. Drips irrigation,
2. Sprinklers and drip tapes
3. Protected cultivation and structures.

Canopy management in higher plants in apple, malta and peaches in Basukidhar and Rampur and Chopta areas of the distt.

Rejuvenation of old and senile orchards in Malta in *Ukhimath, Guptkashi, Raunlack and whole Madmaheshwar valley of Ukhimath*.

Strengthening of traditional water storage structure.

Recharging of old and traditional structure chaal, khaal and local structure for lean season demand in Bangar and remote areas.

Adoption of cluster approach for holistic development

1. Rejuvenation of existing senile orchards of peach, plum in Devar*, Bansu, Basukidhar* cluster of the region.
2. Top working of local wild pear replaced with improved pear type in *Lohara, Tulanga* clusters.
3. Cultivation of Cinnemon (Tejpatta) plants at Rampur*, Shirsi and Nyalsu* and masta cluster.
4. Promotion of ginger, turmeric cultivation to ward off attack of wold animals in *Jakholi and Ukhimath* block.
5. Promotion of off season vegetables cultivation Rasi*, Kotma and Lohara* cluster of this region.
6. Promotion of protected cultivation at Nyaypanchayat level.
7. Encouragenent of plantation of forest plants like *Bhimal, Khadik, Mulberry, Kachnar* at the ridges of field for fodder purpose.

Management of wild animal problem

1. Promotion of cultivation of garlic, ginger and turmeric in all three blocks.
2. Popularization of hill lemon and lime to get rid off animal problems.
3. Promotion of cultivation of Kafal, Hishalu and other wild fruits in different pockets in forest areas for wild animals.

4. Enacting legislative measures for protection of crop from wild animals.

Adoption of Farm mechanisation (Power tiller, thresher etc)

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

Adoption of efficient irrigation techniques

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

Management of soil health in low or valley areas

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

Others

1. Cluster approach for holistic development
2. Soil health improvement practices
3. Selection of right crop & variety
4. Timely and recommended cultural practices for higher production. timely
5. Use of only well decomposed FYM/ value added compost
6. Seed treatment through bio agent/ chemical means strictly in the cluster
7. Focus on timely weed management
8. Take care of IPM techniques
9. Adoption of Farm mechanisation(Power tiller, thresher etc).

Strategy 2 : Livestock: Goatry, Poultry, Fisheries

1. Establishment of service bulls at block and nyaypanchayt for improvent of breed in cattles.
2. Gadi breed for meat purpose in goat. Merino cross in Sheep.
3. Growing of MPT and fast growing green grasses rich in digestible proteins viz. Bhemal, Utees and Oak in perennial trees and Napier as grass for lean season.
4. More AI centre for breed improvement viz. Chandrapuri and Ukhimath.
5. Availability of poultry feed with low prices.
6. There is need to establish more of hatchery for chicks at Ukhimath and Guptkashi
7. Timely health check-ups of animals.
8. Regular Vaccination and medicine management against FMD and other parasitic pests in cattles.

Strategy 3 : Integrated Farming system

1. Promotion of different Integrated Farming System modules such as :
2. Protected cultivation + Composting + Goatry/ backyard poultry
3. Fodder production + Mini dairy + Composting+ Protected cultivation
4. Seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea)+ Planting material supply + Mushroom

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of small processing units for Juice and pickle making of limited or heterogeneous stocks at Ukhimath, Chandranagar and Chaumasi.
2. Establishment of mini grading fruit plant for malta at Ukhimath, Rampur and Banasur valley and klimath valley area.
3. Pickle making of wild Aonla in Food and processing units at Nala, Kherakhal and Mandakini valley.
4. Cluster approach is useful for small and marginal farmers to procure input and disposal of surplus in areas.

5. Establishment of minimal processing plants in various location based on crop and area specific. Barnyard millet – Bangar and Jakholi centre , Fingermillet- Basukidhar area in mid hills.
6. Establishment of small or cottage level processing units for market surplus in Gola Nashpati, Chullu, delicious local malta for food products. Establishment of wine factories for Goal, Chullu, Plum and other forest products. Food processing units of Deptt of Horticulture and Units of some NGOs
7. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling at Guptkashi.
8. Mobile seed processing unit at village level for particular commodity
9. Canning unit at Tulanga and Lohara areas for peaches.

Strategy 5 : Waste land development and waste water

1. Construction of storage of wastewater by using low cost water harvesting technology as *kuchha* and *Pucca* tank. Polytank can be constructed as (5x3x2m) capacity to meet the lean season demand of seasonal vegetables and for non agricultural use also.
2. In wasteland, a wide scope of fodder plantation of *Morus*, *Chhanchru*, *Melilotus* spp. can be utilized. In dry and unirrigated situation there is scope of bael, amla can be included. There is need to put fodder crops in wasteland.
3. In a slope of more than 40% slope, plantation of Mulberry plants, Wild fruit plants, Fodder trees (Bheemal, *Alnus*, *Celtis*, Kachnar) may be promoted.
4. Use of soil bunds to save excessive loss of nutrients in wasteland
5. Use of trenches or silages for percolation of water to avoid surface run off.
6. Construction check dam and artificial structure to maximize water percolation rate in marginal and denudated areas.
7. Avenue plantation and development of shelterbelts in low areas.
8. Popularization of trenches for percolation of water to avoid surface run off in all the blocks of this region in Rabigaon, Phata and Bangar clusters.
9. Construction of check dam and artificial structure in all the blocks of this region to maximize water percolation rate.
10. Construction of tank for storage of water for lean season at Nyaypanchayat area of all the blocks of this region.
11. Creation of rain water harvesting structure in all the blocks of this region.
12. Plantation of suitable trees/brushes in waterlogged and eroded areas viz. Badasu, Raunlak and Rasi.
13. All agricultural operations should be done on contours i.e. across the existing land slope.
14. 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.
15. 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.
16. Diversion of runoff through ditches from upper slopes to safer places.
17. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
18. 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.
19. Contour trenching (staggered/continuous).
20. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens in all blocks.
21. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
22. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
23. 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.

24. Multistage filtration unit should be established to recycle the waste water for multiple purposes.
25. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
26. Industrial wastewater should not be used for irrigation direct and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.
27. Sewage water from cities should be treated by municipal corporations or other agencies.
28. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Use of standard and time testing technology for higher yield and income.
2. Adoption of mechanization techniques in land preparation , inter cultural operations.
3. Encourages use of well decomposed FYM or vermicompost, biofertilizers and avoid or minimum use of chemical fertilizers.
4. Avoid broadcasting of seeds and fertilizers in crop production program
5. Need based application of pesticides, preferably use bioagents.
6. Encourages optimum and recommended seed rate at optimum spacing and depth.
7. Encouraging for use of hand tools in agricultural and horticultural operations.
8. Use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers
9. Use of mulch (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.

Strategy 7 : Off-farm income

1. As per requirement and vaialability of various produce, following groups are formed: Gola Nashpati group at Agastymuni, Malta collection and procurement group, Raulak, Guptkashi, Cheura collection and extraction group, Sansari, Milk collection and chilling group, Guptkashi and Wool collection and sale group at Rassi.
2. Scope or potential of subsidiary occupation like silkworm in Guptkashi and bansbeeda, bee keeping at Chaumasi and Tulanga and Bangar will harness the potential of new or improved technology in farming occupation.
3. Emphasis on promotion of religious tourism for panch kedar yatra to serve organic and local delicacy.
4. Promotion of mushroom and bee keeping centre at Agastymuni to meet the requirement of compost and spawn.
5. Adoption of new cultural practices for cultivation of medicinal plants at Basukidhar and Gaid cluster.
6. Dingri and button mushroom for small land holders at Bheeri, Raulack.
7. Promotion of Farmers participatory approach model for crop production techniques under rained or hilly agricultural system.

Strategy 8 : Enabling Policies

1. Institutional support in the form of subsidises and incentives can raise the farm production and income in larger interest of farm.
2. Declaration of minimum support price and crop insurance policy incentives is known on or before sowing season to avoid glut or deficiency.
3. Mandatory meterological/ observatory at block level to get first hand information of climatic changes.
4. Use of crop insurance scheme for more crops including hail storm attack in stone and pome fruits.
5. Labelling of organic inputs and certification mechanism for more number of crops.
6. Expand application scientific methods and mechanized cultivation
7. Establishment of wood bank at Dunagiri to meet the present and future demad of germplasm in

horticultural crops.

8. Effective and workable Nursery act to avoid spurious or unreliable planting material in the state.
9. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
10. Soil health card scheme be effective for each farmers.

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

1. eMarketing of apple and amaranths in Triyuginarayan areas.
2. Establishment of mandis for temporary storage and sale of commodities at Agastymuni.
3. Direct linkages with food processing industries may be established for better prices.
4. To establish strong linkages with various stackholders to furnish information of crop produce and surplus.
5. Procurement and collection centre at Nyaypanchyat level for agricultural suprlus with proper lebelling.

Strategy 10 : Online Management and Evaluation

1. Mobile apps/ software for online management and evaluation at Distt level.
2. E Marketing and kiosk at distt level to have information of surplus commodities at block level.
3. Monthly review meeting at distt level for market surplus and situation of hill agriculture.
4. Use of radio, TV talks and use of Whatsapp, FB user for effective implementation of program.

Agro-Ecological Region - Region C (1500-2400)

A. General information about Agroeco-region

District : Rudraprayag

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

Main Blocks in Region : Ukhimath and Jakholi

Main village cluster in blocks : 35

Irrigated Clusters : Nil

Rainfed Clusters : 35

Existing rain water management facilities :

1. Diversion of perennial springs and streams through guhls
2. Water storage tanks/hauj is available in a fes farmers.
3. Village pond (Taal and Chaal)
4. Collection from hill slope (Khaal)
5. 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. Water storage of roof harvesting water.
2. Poly tank for water storage for multiple uses.
3. Low cost lining material to check seepage.
4. Efficient water application systems (sprinkler and drip).
5. Rejuvenation and popularisation of traditional water harvesting systems.

2. Existing practices for soil health improvement

1. Use of undecomposed farmyard manure/compost.
2. Use of legume crop in mixed farming.
3. Meagre/ no use of bio-fertilizers
4. Imbalanced 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

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. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost
4. Distribution of soil health cards to each and every farmer along with nutrient recommendation for different crops
5. Establishing soil testing labs for major and micro plant nutrients at Block level
6. Capacity building for scientific use of organic manures, Integrated Nutrient Management, use of bio-fertilizers, different soil amendments, vermicomposting, etc.
7. Organization of camps for general awareness regarding harmful effect of burning crop residues
8. Popularization of legume-cereal rotation for improving the soil fertility in the region
9. Availability of all inputs *viz.*, fertilizers, micro nutrient, bio-fertilizers at Nyaypanchayat level

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

1. Alternative strategies are adopted based on available resources.
2. Occasional Occurrence: Frost, Drought, Cold wave.
3. Almost 87% agriculture is rainfed, which requires robust strategies of rainwater conservation and harvesting.
4. Soil erosion due to steep slopes and rainfall is quite high.
5. Field crops such as rice, wheat, barley, mandua, jhangora are major crops of the region.
6. Vegetables and horticultural crops are being grown over very small area, except Apple, which is being grown over relatively 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 by making bunds) and harvested for Kharif season crops.
3. Soil erosion triggered by higher slope gradient is the major issue of Rudraprayag. Therefore water and soil conservation techniques like terrace farming, bunding etc should be encouraged.
4. The area of off season vegetable like vegetable pea 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 climatic conditions, slope gradients and soils are suitable for sub tropical (in Valley region Citrus fruits, Malta and orange) and Temperate fruits (Apple, pear, peach, Apricot, Walnut, Almond).
9. Due to increasing temperature the new orchards should be developed at higher altitudes to meet out the chilling requirement and to maintain quality of the fruits. Replacement of low chill varieties in temperate fruits (Apple, pear peach, pear, Apricot).
10. Delayed sowing of barnyard millet in Month of May/June.
11. Establishment of new crops like pomegranate, persimmon and kagzi lime in non conventional areas.
12. Expansion of apple growing areas in snowline areas.
13. Introduction of high chill pears in high hill areas of Triyuginaryan, Kedarnath, Lincholi, Ransi, Khedakhal and Chaumasi areas.

14. Sowing of horse gram in non-traditional areas.
15. Introduction of kiwi and strawberries in new and marginal areas.
16. Cultivation of off season vegetable
17. Adoption of new site for crop production of Amaranths

6A. Name of Field Crop : Wheat

i. Existing varieties being used

Mundaria, Lal Mishri, VL-738, VL-616

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 832 and HPW 155, HS 365 and UP 2572

iii. Existing package of practices being used

1. Preparation of land- 1 or 2 ploughing with local plough no definite depth
2. Seed rate and seed sowing -150-175 kg/ha, Broad casting
3. Manure and fertilizer-
4. Irrigation-usually maximum area is rain fed and in valley condition 1 or 2 irrigation

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

1. Preparation of land with 2 ploughing + 1 harrowing with mould bold plough up to 10-15 cm
2. Seed rate and seed sowing @ 100-125kg/ha, line sowing 18-21 cm apart
3. Manure and fertilizer 10-15 t/ha.

v. Major insect pests associated with crop: Aphids

vi. IPM Module for management of insect pests

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	

vii. Major disease associated with crop

False smut, Rust, Loose smut

viii. IPM Module for management of disease

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

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

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

Biofungicides

Name of the Herbicides	(gm/Kg) /ha	Treatment

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

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

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

ix. Major weeds associated with crop

Anagalis arvensis, Asphodelus tenuifolius, *Avena fatua*, *Chenopodium album*, *Phalaris minor*

x. IPM Module for management of weeds

Cultural & mechanical methods

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

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

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

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

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

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

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

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

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

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

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

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

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

specific agro-ecological region

1. Organic cultivation,
2. Adoption of low cost based cultivation practices,
3. Wheat-Horse gram/Soybean.
4. Timely Sowing, Seed treatment, Use of HYV
5. Contour cultivation and care soil & water conservation measures
6. Maximum use of value added compost/FYM
7. Sale of value added products

xii. Production constraints in agro-ecological region

1. Less availability of agriculture inputs
2. Use of imbalance and undecomposed FYM,
3. Wild animal damages, Non availability of active family labour, migration.
4. SAAR practice (Shifting area practice)

6B. Name of Field Crop : Rice

i. Existing varieties being used

China-4, Lal Dhan, Lal – Safed Rikhua, Saket 4

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

VL 85, VL 81, VL 86, and VL 62, Rained Chaiti Dhan -VL 206, VL 207, VL 208, Jethi Dhan – VL 154

iii. Existing package of practices being used

1. Preparation of land with 1 or 2 ploughing with local plough no definite depth and manual puddling.
2. Use of seed rate of 150 kg/ha in direct seeding rice and in transplanting 60-70 kg/ha.
3. More than 45 days seeding used.
4. Manure and fertilizer- use of undecomposed FYM (FYM 75-100 q/ha).
5. Irrigation-usually maximum area is rain fed and in valley condition as availability of irrigation roaster of village.

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

1. Preparation of land with 1 or 2 ploughing with local plough.
2. High seed rate of 100-125 kg/ha in direct seeding rice.
3. Manure and fertilizer- 15 t/ha FYM for rainfed

v. Major insect pests associated with crop

Stemborer, Rice leaf folder, gallmidge rice bugs and thrips.

vi. IPM Module for management of insect pests

Stem borer:

1. In the stem borer endemic area raise the nursery away from light source.
2. Raise nursery in narrow strip and mechanically destroy egg masses and moths
3. Remove seedling with Stem borer eggs before transplanting.
4. Use nitrogenous fertilizer moderately and split the application of it over three growth stages to reduce the damage.
5. For the monitoring install the pheromone traps in the field at the rate of 3 trap per acre at a distance of 60 m in a triangular pattern and record the males trapped daily to access the peak population.
6. For the management of yellow stem borer through pheromone mediated mass trapping of male install the pheromone trap in field at the rate of 20 traps/ha in rows maintaining a distance of 20 and 25 meters between traps and rows, respectively. The traps in the first rows are installed 10 m inside from the boundary of the field. The traps are tied on 1.25-1.5m long straight bamboo sticks or poles with the help of jute or plastic strings.The lures containing 3 and 5 mg pheromone are changed after 3 and 4 week, respectively, whereas 10 mg lure work for whole season. Adjust the trap height at 0.5 m and 1.0 m in the early vegetative and reproductive stage of crop, respectively, or 30 cm above

crop canopy in all the stages of the crop.To check the escape of trapped males put a tea spoonful insecticidal dust in the polythene sleeve of dry sleeve trap. Dust is not required in funnel type trap. To Ascertain the quality use lures supplied by 2-3 manufacturers in alternate traps initially and after recording their performance replace the ineffective lures by highly effective lure. Relocate the traps displaced in bad weather and replace the polythene sleeve damaged by weather or animals.

7. Mass rearing and release of some parasitoids such as different species of *Trichogramma* have not been found useful in the rice ecosystems in so many countries including India which are inhabited by *Telenomus* and *Tetrastichus* species. Use of trichocard, therefore, increases the cost of cultivation without any gain. The conservation of *Telenomus* and *Tetrastichus* species is self sufficient to naturally reduce the stem borer population.
8. To increase the effectiveness of parasitoides and predators in the rice field
9. Conserve and enhance the natural enemies which are already present in the field.
10. Create favourable condition for natural enemies.
11. Always leave a pest residue in the field at non-economic level, for natural enemy.
12. Reduce the harmful effect of pesticides on natural enemy by:

I. Apply insecticide only when necessary, not regularly.
II. Apply insecticide only when the pest population reaches Economic Threshold Level.
III. Applying a selective insecticide which is less toxic to natural enemy.
IV. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.
V. Use selective formulation and application method.
VI. Application of granular formulation is less harmful to natural enemy

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

50 Days within transplating (2 inch water in field)

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

50 Days after tranplanting

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5 %SC	150	47
Fipronil 5% SC	1000-1500	32
Fipronil 80 %WG	50-62.5	19
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75 %SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20% WG	125	30
Thiacloprid 21.7 %SC	500	30
Acephate 75% SP	666-1000	15
Acephate 95 %SG	592	30
Chromafenozide 80% WP	94-125	32
Monocrotophos 36% SL	1400	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40

Carbosulfon 25 %EC	800-1000	14
Chlorpyriphos 20% + Acetamiprid 0.4% EC	2500	10
Phosphamidon 40% + Imidachlorpid 2 %SP	600-700	22
Flubendamide 4%+ Buprofezin 20% SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bio-insecticides

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

Leaf folder:

Following insecticides may be used to control leaf folders of rice

50 Days within transplating (2 inch water in field)

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 0.4% GR	10000	53
Cartap 4% Gr	18750	
Carbosulfon 6% G	16700	37

50 Days after transplating

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

Bio-insecticides

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

Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5
Azadirachtin 0.03% EC (Neem oil based)	2500-5000	5
Azadirachtin 5% (Neem extract concentrate containing)	375	5
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	1500	
Beauveria bassiana 1.15%WP Strain BB-ICAR-RJP	2500	
Beauveria bassiana 1.15%WP Strain ICAR	2500	

Thrips

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

Rice bug: *Leptocorysa acuta*

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

Biological control

Parasitoids:

Gryon flavipes, attacking: eggs

Predators:

Micraspis discolor, attacking: nymphs, adults

Neoscona theisi, attacking: nymphs, adults

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

Orthetrum sabina, attacking: nymphs, adults

Pathogens:

Beauveria bassiana, attacking: nymphs, adults

vii. Major disease associated with crop

Khaira, Riceblast, Brown spot, leaf blight, False smut

viii. IPM Module for management of disease

During Nursery Sowing

Deep summer ploughing or soil solarization

During transplanting

1. Drenching of PsF (10g/lt. of water) in 1sqm in nursery soil one day before uprooting of seedling.
2. Do not planting under full or partial shade to avoid bacterial blight (BLB) infection.
3. Transplant 2-3 seedling
4. Row to row spacing 20 cm and plant to plant spacing 10 cm.

During Nursery Sowing

Deep summer ploughing or soil solarisation

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

Fertilizers

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

Khaira disease: Due to Zinc deficiency)

Name of the Fungicides	**(gm/ml) /ha**
Zinc sulphate (Apply in soil at the time of plot preparation)	25000

Zinc sulphate spray (2.5 Kg Quick lime & 20 Kg Urea in 1000 lit. water	5000

Rice blast: *Magnaporthe grisea*

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

Bacterial leaf blight: *Xanthomonas oryzae*

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

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

Biofungicides

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

Brown leaf spot: *Cochiobolus miyabianus*

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

Biofungicides

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

ix. Major weeds associated with crop

Oxalis latifolia , *Cyperus* spp., *Echinocloa* sp, *Chenopodium album*, *Cynodon* spp, *Digitaria sanguinales*, *Eleusine* spp

x. IPM Module for management of weeds

Rice Nursery:

Summer ploughing of main field to destroy weeds and expose soil and wet bed method for raising rice nursery.

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

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Anilofos 18% EC (Transplanted rice)	1660-2500	
Anilofos 2% G (Transplanted rice)	20000-25000	30
Bispyribac Sodium 10% SC (Nursary)	200	
Butachlor 50% EC (Transplanted rice)	2500-4000	90&120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90&120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Cyhalofop butyl 10% EC	750-800	90
2,4-D Ethyl Ester 38% EC	2500	
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Fenoxaprop-p-ehtyl 9% EC (Transplanted rice)	625	70 Post
Fenoxaprop-p-ehtyl 6.9% EC	812-875	61
Flufenacet 60% DF (Transplanted rice)	200	90-110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiargyl 6% EC (Transplanted rice)	1066	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90

Anilofos 24%+ 2,4-D ethyl ester 32% EC	1000&1500	90 (Transplanted rice)
Bensulfuron methyl 0.6% + Pretilachlor 6 G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Cinmethylin 10% EC (Transplanted rice)	750-1000	60
Paraquat dichloride 24% SL (Before sowing)	1250-3500	

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

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

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

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

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

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

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

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Azimsulfuron 50% DF (Transplanted & Direct sown)	70	59
Bensulfuron methyl 60%DF (Preemergence)	100	88
Bensulfuron methyl 60%DF (Postemergence)	100	71
Bispyribac Sodium 10% SC (Transplanted rice)	200	78
Butachlor 50% EC (Transplanted rice)	2500-4000	90-120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90-120
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 %WDG (Transplanted rice)	83.3-100	110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75&90
Bensulfuron methyl 0.6% + Pretilachlor 6% G	10000	88 (Transplanted rice)

Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Metsulfuron methyl 10%+ Chlorimuron ethyl 10% WP	20	90(Transplanted rice)

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

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

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

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Jethirice- Wheat/Lentil/Barley or Rice- Wheat /onion
4. Timely Sowing and seed treatment with bioagent enhances production in direct seeded rice cultivation.
5. Contour cultivation and care soil & water conservation measures, maximum use of value added compost/FYM
6. Sale of value added products.

xii. Production constraints in agro-ecological region

1. Less availability of agriculture inputs.
2. Use of imbalance and undecomposed FYM and climate changing.
3. Wild animal damages, are serious.
4. Issue of migration is becoming serious to meet family labour demand.
5. Poor Irrigation facilities.

6C. Name of Field Crop : Finger millet

i. Existing varieties being used

Band muthi (*Muthinda*) , Khuli muthi(Jhampa)

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

PRM 1 and VL Mandua 352

iii. Existing package of practices being used

Traditional seed variety, undecomposed FYM 75-100 q/ha with 1-2 weedings.

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

1. Preparation of land with 1 or 2 ploughing.
2. Seed rate and seed sowing with 14-16kg/ha.
3. Application of manure @ 10 t/ha.
4. Irrigation-usually maximum area is rain fed.

v. Major insect pests associated with crop

Stem borer

vi. IPM Module for management of insect pests

Cultural, mechanical and biological control

vii. Major disease associated with crop

Blast

viii. IPM Module for management of disease

1. Grow resistant variety such as VL 149.
2. 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, Euhorbia hirata*, S*olanum* sp, *Cyprus* sp

x. IPM Module for management of weeds

Weeding and hoeing and deep ploughing

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

1. Organic cultivation.
2. Adoption of low-cost based cultivation practices,
3. Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley.
5. Use of HYV, Gap filling/Transplating
6. Contour cultivation and care soil & water conservation measures
7. Maximum use of value added compost/FYM in crop production.
8. Good storage condition
9. Sale of value added products.

xii. Production constraints in agro-ecological region

1. Less availability of agriculture inputs,
2. Use of imbalance and undecomposed FYM, climate changing and white grubs problems.
3. Wild animal damages
4. Migration and poor irrigation facilities.

6D. Name of the Field Crop : Barnyard Millet

i. Existing varieties being used

Non described (Dwarf 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

PRJ-1,VL Madira 172 and VL Madira 207

iii. Existing package of practices being used

Traditional seed variety, un decomposed FYM 75-100 q/ha with 1-2 inter culture operations.

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

1. Preparation of land- with 1-2 ploughing.
2. Seed rate and seed sowing of 14-16kg/ha.
3. Application of 10 t/ha as per availability.
4. Irrigation-usually maximum area is rain fed.

v. Major insect pests associated with crop

Stem borer

vi. IPM Module for management of insect pests

Cultural, mechanical and biological control

vii. Major disease associated with crop

Blight & smut

viii. IPM Module for management of disease

Grow resistant variety like PRJ 1.

ix. Major weeds associated with crop

Oxalis latifolia, *Phylanthus niruri , Amaranthus viridis, Euhorbia hirata*, S*olanum* sp, *Cyprus* sp

x. IPM Module for management of weeds

Weeding and hoeing, Deep ploughing

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/
4. Timely Sowing and seed treatment with bioagent may increase the production.
5. Use of high yielding varieties.
6. Contour cultivation and care soil & water conservation measures.
7. Maximum use of value added compost/FYM in crop production.

xii. Production constraints in agro-ecological region

1. Less availability of agriculture inputs, use of imbalance and un decomposed FYM, climate changing.
2. High wild animal damages in crop are serious.
3. Migration especially from border area is main focus of the high hill areas.
4. Poor Irrigation facilities.

7A. Name of the Pulse Crop : Lentil

i. Existing varieties being used

Chhota masur, Lal masur, VL-125, PM-4, PM-5, VL-103, PL-406

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

PL-4, PL-7, PL-8

iii. Existing package of practices being used

1. Use old and traditional seed variety.
2. Application of fresh or undecomposed FYM 75-100 q/ha with 1-2 inter culture operation.
3. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
4. Lack of knowledge, most of the farmers adopts improper plant protection measures.

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

1. Preparation of land with 1 or 2 ploughings.
2. Seed rate and seed sowing at rate of 20-25kg/ha with spacing 30x10cm.
3. Application of 10 t/ha of FYM in field.
4. Irrigation-usually maximum area is rain fed.

v. Major insect pests associated with crop

White fly, Fruit borer, Thrips

vi. IPM Module for management of insect pests

Cultural, mechanical, biological control

vii. Major disease associated with crop

Wilt , Yellow Mosaic, Blast

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.

ix. Major weeds associated with crop

Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Weeding and hoeing and deep ploughing

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. Use of HY, Contour cultivation and care soil & water conservation measures.
5. Maximum use of value added compost/FYM
6. Good storage condition.
7. Sale of value added products.

xii. Production constraints in agro-ecological region

1. Availability of high yielding varieties of Lentil.
2. Lack of quality seed.
3. Poor awareness of seed treatment.
4. Poor weed management.
5. Lack of awareness about pest and disease management among farmers.
6. Difficulties to use heavy modern agriculture implement due to hilly terrain.
7. Proper marketing of agriculture produce is not available.
8. Crop damaged by wild animals.
9. Agriculture depends on rain, scattered agriculture land, migration and lack of interest in field activities.

7B. Name of 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

U-31, PU-35

iii. Existing package of practices being used

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

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

1. Timely sowing of crop in IInd fortnight of month May to first week of July.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and PSB.
4. 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.

v. Major insect pests associated with crop

White fly, Fruit borer and Thrips.

vi. IPM Module for management of insect pests

Cultural, mechanical and biological control

Fruit Borer

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

White fly

Name of the Insecticides	(gm/ml) /ha	
Phorate 10% CG	10000	

vii. Major disease associated with crop

Yellow Mosaic, Blast

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds

Weeding, hoeing and deep ploughing.

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

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

xii. Production constraints in agro-ecological region

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment.
3. Poor weed management.
4. 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.
7. Crop damaged by wild animals are serious.
8. Agriculture depends on rain, scattered agriculture land, migration and lack of interest.

7C. Name of Pulse Crop : Soybean

i. Existing varieties being used

Kala bhat (Oval)

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

VLS-56,VLS-4, PS-1092, PS 1092, PRS 1, VLS 21, VLS 47, VLS 59, VLS 63

iii. Existing package of practices being used

Traditional seed variety , undecomposed FYM 75-100q/ha, 1-2 weeding

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

1. Preparation of land with 1 or 2 ploughings.
2. Seed rate and seed sowing with 100-125kg/ha.
3. Application of well rotton FYM @ 10 t/ha of FYM
4. Use of bio-fertilizers as seed and soil treatment.

v. Major insect pests associated with crop

Semilooper,Jassids, tobacco caterpillar, Girdle beetle, white fly, jassid, stem fly, pod borer etc.

vi. IPM Module for management of insect pests

Cultural practices:

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

3. 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.
4. Optimal fertilizer dose of NPK and S @ 20:60-80: 30-40:20 kg/ ha should be applied.
5. Application of excessive dose of nitrogen fertilizer causes the infestation of all insect pests on soybean.
6. Crop rotation with non-leguminous plants is recommended for the management of leaf miner.
7. 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.
8. 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.
9. 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.

C.Physical control:

1. Reduction of pest population by using device which affect them physically or alter their physical environment.
2. Manipulation of temperature, humidity, light is used for this purpose.
3. This includes the following:
4. Light traps should be placed at ground level early in the season for collection and destruction of the leaf-miner moths.
5. Installation of light traps in the field for monitoring and collection of adult moths.

D.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

D.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

Tobacco caterpillar: *Spodoptera litura*

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

Green semilooper: *Plusia orichalcea*

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

Leaf eating caterpillar

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

White fly : *Bemisia tabaci*

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

Jassids

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

Stem fly

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Thiamethoxam 30% FS (Seed Treatment/Kg)	10	
Chlorantraniliprole 18.5% SC	150	22
Indoxacarb 15.8% EC	333	31
Lambda cyhalothrin 4.9% CS	300	31
Profenophos 50% EC	1500	30

Girdle beetle

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	150	22

Thiacloprid 21.7% SC	750	17
Triazophos 40% EC	625	30
Profenofos 50% EC	1000	40
Profenofos 50% EC	1500	30

vii. Major disease associated with crop

YMV, leaf spot, blight, Collar rot, rust

viii. IPM Module for management of disease

Rust: *Phakopsora pachyrhizi*

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

Collar rot: *Sclerotium rolfsii*

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

ix. Major weeds associated with crop

Oxalis latifolia, *Phylanthus niruri , Amaranthus viridis, Euphorbia hirata*, S*olanum* sp, *Cyprus* sp

x. IPM Module for management of weeds

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

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

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

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

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

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

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

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

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

1. Organic cultivation.
2. Adoption of low cost based cultivation practices.
3. Soybean- Wheat/Lentil/Barley for high production.
4. Use of High yielding varieties.
5. Contour cultivation and care soil & water conservation measures.
6. Use of compost/fortified manure for high production.
7. Sale of value added products

xii. Production constraints in agro-ecological region

1. Less availability of agriculture inputs,.
2. Uuse of imbalance and undecomposed FYM, climate changing.

3. Wild animal damages are serious.
4. Serious migration problem creating labour scarcity.
5. Poor Irrigation facilities

8A. Name of the Fruit Crop : Apple

i. Existing varieties being used

Royal Delicious, Red Delicious, Rymer, Sweet Banana, Kings Orange Pippins etc

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

Red Chief, Walspur, Oregon spur, Red spur, Early Red one, Washington spur Pink Lady, Oregon spur, Super chief and other new stains.

iii. Existing package of practices being used

1. Use of old and traditional varieties
2. Less use of pollinizer cultivars
3. Use of high density plantation system without irrigation
4. Less or no use of mulch for water conservation
5. High incidence of wooly aphis
6. Use of organic manures
7. High stem and barky cankers
8. No use of IPM
9. No Grading or packing system or facilities
10. No facilities for under sized or culled fruits

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

1. Use of low chill cultivars like Red Velox, Washington spur, Pink Lady, Super chief, Red spur, Walspur with suitable pollinizers arrangement for apple.
2. Use of assured irrigation facilities like drip system for higher productivity in apple.
3. Use of high density plantation in apple (3x3 m) production as enhances production 10 times as compared to traditional system.
4. Use of intercrop in juvenile apple orchard with growing of Horsegram and lentil.
5. Mechanical sorter be replaced with machine.

v. Major insect pests associated with crop San jose scale, tent caterpillar, coddling 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

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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

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

vii. Major disease associated with crop: Canker, collar rot, Powdery mildew, apple scab, leaf fall disease.

viii. IPM Module for management of disease-

ix. Major weeds associated with crop

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

x. IPM Module for management of weeds

Though mechanical and cultural methods.

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

Use of high yielding cultivars with and suitable placement of pollinizer in high density plantations with sufficient irrigation facility as drip for establishment of model and commercial orchards.

xii. Production constraints in agro-ecological region

1. Availability of elite planting material
2. Irrigation facility are missing
3. Poor knowledge of canopy management in apple
4. Lack of technical knowhow in apple cultivation

8B. Name of the Fruit Crop : Peach

i. Existing varieties being used

Paradelux, July Elberta, Red June

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

Alxander, Red Globe, Crest heaven, Glo Heaven, Nectarine- Snow Queen.

iii. Existing package of practices being used

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

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

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

v. Major insect pests associated with crop

Leaf Curl Aphid and Fruit Fly.

vi. IPM Module for management of insect pests

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 varieties like 16-33 and Florida- Sun and Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.

vii. Major disease associated with crop

Gummosis is major problem.

viii. IPM Module for management of disease

Use of proper cultural or field operation with minimum damage to the crop.

ix. Major weeds associated with crop

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

x. IPM Module for management of weeds

Though mechanical and cultural methods.

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

High density plantation with (3x3mts) supplemented with drip irrigation system.

xii. Production constraints in agro-ecological region

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

8C. Name of the Fruit Crop : Pear

i. Existing varieties being used

Gola, Victoria, China, Baggugosha, Kashmiri, Thumb pear etc

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

Max Bartlette, Red Bartlette, William and Starkrimson

iii. Existing package of practices being used

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

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

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

v. Major insect pests associated with crop: Fruit fly

vi. IPM Module for management of insect pests

Peach Fruit Fly:

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

vii. Major disease associated with crop

Fruit rot

viii. IPM Module for management of disease

-

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

Introduction of New Strain *viz*. Anjou, Starkrimson in high hills.

xii. Production constraints in agro-ecological region

Availability of quality planting material

8D. Name of the Fruit Crop : Plum

i. Existing varieties being used

Santa Rosa, Beauty, Burbank

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

Santa Rosa, Beauty, Burbank and Prunes

iii. Existing package of practices being used

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

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

High density plantation with drip irrigation system.

v. Major insect pests associated with crop

Leaf Curl Aphid and Fruit Fly.

vi. IPM Module for management of insect pests

Peach Leaf Curl Aphid:

1. Keep plant healthy..
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:

Hoe the orchard (May- June) 4-6 cm deep.

vii. Major disease associated with crop

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viii. IPM Module for management of disease

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ix. Major weeds associated with crop

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

xii. Production constraints in agro-ecological region

Non-availability of reliable and elite planting material

Poor technical knowledge

9A. Name of the Vegetable Crop : Cabbage

i. Existing varieties being used

Pride of India, Golden acre as OP

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

T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole, Green star and Pride of India

iii. Existing package of practices being used

1. Use of organic manures
2. No knowledge of crop geometry

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

Promotion of high yielding, round shaped, 100% heading percentage, mature within 90 days.

v. Major insect pests associated with crop

Butterflies , Aphids, *Plutell*a and bugs in seeds

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 egg*s* 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.

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.
6. Spray Dipel 8 SP (Bt var. *kurstaki*) @ 0.2% at 15 days interval after 22-25 DAT to manage DBM.

Dimond back moth: *Plutella Xyllostella*

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

Bioinsecticides

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

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

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

Painted bug

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

vii. Major disease associated with crop

Stem rot, black rot, and black spot on leaf.

viii. IPM Module for management of disease

Recommended IPM is being used.

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

ix. Major weeds associated with crop

Parthenium, Chenopodium album, Krishanneel, Oxalis *latifola.*

x. IPM Module for management of weeds

Weeding, hoeing and deep ploughing.

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

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

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

Use of hybrid varieties suitable for year round production system for high hills.

xii. Production constraints in agro-ecological region

1. Less heading in open pollinated cabbage.
2. Less availability of high quality seeds.
3. High prices of hybrid seeds
4. Post-harvest losses are more due to long distance.
5. Low prices of farm produce
6. Lack of knowledge about the cultivation practices
7. Lack of processing facilities.

9B. Name of the Vegetable Crop : Cauliflower

i. Existing varieties being used

Unknown varieties available in market.

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

Early Kunwari, Pusa Kartiki, Pusa Early Synthetic, Pusa Shubhra, Pant Shubhra, Hisar No.1, Snow crown, Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2

iii. Existing package of practices being used

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

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

1. Selection of hybrids as per maturity group of crop
2. Need to develop seed production program in cauliflower.

v. Major insect pests associated with crop

DBM, Aphids are serious problem

vi. IPM Module for management of insect pests

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. 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. Hook out the head borer and destroy mechanically.
3. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT. Spray Dipel 8 SP (Bt var. *kurstaki*) @ 0.2% at 15 days interval after 22-25 DAT to manage DBM.

Dimond back moth: *Plutella Xyllostella*

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

Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

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

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

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

Dimond back moth: *Plutella Xyllostella*

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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
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Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500	

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

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

Dimond back moth: *Plutella Xyllostella*

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

Bioinsecticides

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

Cabbage/cauliflower Aphid

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Cyantraniliprole 10.26% OD	600	5
Tolefenpyrad 15% EC	1000	5
Acetamiprid 20% SP	75	7
Fenvalerate 20% EC	300-375	7

Bioinsecticides

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

vii. Major disease associated with crop

Black rot and stalk rot are serious problem

viii. IPM Module for management of disease

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

ix. Major weeds associated with crop

Parthenium, Chenopodium album, Krishanneel, *Oxalis latifolia*

x. IPM Module for management of weeds

Weeding, hoeing and deep ploughing.

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

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

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

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

xii. Production constraints in agro-ecological region

1. Non availability of suitable varieties as per agro-ecological situation.
2. Buttoning and leafyness are common problem

3. Lack of technical knowledge
4. Less availability of high quality seeds
5. High prices of hybrid seeds
6. High post-harvest losses due to long distance
7. Low prices of farm produce
8. Lack of knowledge about the cultivation practices
9. Lack of processing facilities.

9C. Name of the Vegetable Crop : Radish

i. Existing varieties being used

Mixture of varieties from unknown source

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

Early Mino, Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant

iii. Existing package of practices being used

Mixed cropping with other rabi crops.

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

1. Use of long white tapering varieties
2. Line sowing and use of less or non-pithy varieties
3. Use of round shaped varieties for culinary purpose.
4. The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha.
5. For 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. Depending upon the cultivars, the roots become ready for harvesting in about 25-35 days after sowing. Early and rapid maturing European cultivars reach harvest maturity in 25-30 days after sowing.

v. Major insect pests associated with crop

Aphids are problem

vi. IPM Module for management of insect pests

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

1. Conservation of Coccinellids and syrphids that are found to feed on the aphids will reduce the numbers considerably.
2. Yellow sticky trap is effective for controlling aphid population.

vii. Major disease associated with crop

White rust

viii. IPM Module for management of disease

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ix. Major weeds associated with Crop: Local weeds

x. IPM Module for management of weeds: Hand weeding

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

1. Use of short duration, non pithy, coloured varieties for year round production.
2. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Cauliflower early- Radish- Bottlegourd
   Brinjal-Radish –Chilli
   Bottle Gourd-radish-French bean

xii. Production constraints in agro-ecological region

1. Less availability of high quality seeds
2. High prices of hybrid seeds
3. Low prices of farm produce

4. Lack of knowledge about the cultivation practices
5. Lack of processing facilities.

9D. Name of the Vegetable Crop : Tomato

i. Existing varieties being used

Pant T3, Naveen 2000, Manisha, Himsona.

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

VL Tamatar 4 upto 1800m amsl, Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852

iii. Existing package of practices being used

1. Without soil and seed treatment, Poorly managed nurseries, Subterranean staking.
2. Generally crop grown in open field condition
3. Sowing time- April-May
4. Sowing space-(90x30 cm and 60x60 cm)

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

1. Use of indeterminate, round, optimal fruits weight hybrids,
2. Use of Organic manures.
3. Special training and pruning techniques.
4. Upright stacking and earthling up operation, with standard harvesting techniques and stages.
5. Use Indeterminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition.
6. Crop rotation Tomato-cowpea-Early cauliflower.

v. Major insect pests associated with crop

Fruit borer and white flies in low or mid hills are serious pest

vi. IPM Module for management of insect pests

Management strategies (white fly and other sucking 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 jaggery is effective.
5. Use of Bt @ 0.50kg/acre and NSKE 5 per cent to kill early stage larvae. Release of the egg parasitoid, *Trichogramma chilonis* or *T. brasiliensis* @ 1Lakh/ha coinciding with flower initiation at 15 days interval may reduce the pest population.
6. Development of pyridalyl nanocapsule suspension for efficient management of tomato fruit and shoot borer (*Helicoverpa armigera*) is an efficient approach for frequent delivery and effective management.

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

Management strategies (white fly

A. Crop Hygiene

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

B. Other Cultural Control Practices

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

C. Insecticidal Control Practices.

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

White fly

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

vii. Major disease associated with crop

Buckeye fruit rot is a major serious disease.

viii. IPM Module for management of disease

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

ix. Major weeds associated with crop

Trifolium alaxenderium, Cyperus rotundus, Cynodon dactylon.

x. IPM Module for management of weeds

Through cultural and mechanical methods.

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

specific agro-ecological region

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

xii. Production constraints in agro-ecological region

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

9E. Name of the Vegetable Crop : Potato

i. Existing varieties being used

Up-to-date, Kufri Jyoti, Kufri Chandramukhi, Kufri Bahar, K Badshah.

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

Kufri Girriraj, Kufri Chipsona 1, Kufri Chipsona 3, Kufri Jyoti, Kufri Chandramukhi

iii. Existing package of practices being used

1. Use of big sized tuber or division of tuber (50-60 g)
2. No tuber treatment.
3. Use of organic manure and sowing in flat bed.
4. Sowing time is March-April.
5. Limited or no IPM practices
6. Spacing: 50-60 x 15-20 cm.
7. Seed rate: 25-30 qt/ha.

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

1. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with application of organic manures.
2. Early crop planting time – First fortnight of October
   Main crop planting time- Second fortnight of October
3. Plant 25-30g seed size potato tuber@ 25-30q/ha.
4. Spacing: 60 x 20 cm
5. Dehaulming practise should be adopted for long duration storage of tubers.

v. Major insect pests associated with crop

Potato tuber moth, *Epilachna* beetle, Aphids and White grubs

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.

Epilachna beetle: *Epilachna viginatioctopunctata*

1. Hand picking 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 cakes is efficient in suppressing the pest population.

Aphids: *Myzus persicae*

1. Conservation of the coccinellids and syrphids that are found to feed on the aphids will reduce the

numbers considerably without any insecticidal spray.

2. Yellow sticky trap is effective for controlling aphid population. Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha.

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG (Spray)	100	77
Thiamethoxam 25% WSG (Drenching)	200	77
Dimethoate 30% EC	660	
Oxydemeton-methyl 25% EC	1000	
Carbofuran 3% CG	16600	
Phorate 10% CG	10000	

vii. Major disease associated with crop

Late blight and common scab disease in the crop and tuber.

viii. IPM Module for management of disease

1. Only cultural practices are followed.
2. Use Certified seed/ disease free seed.
3. Plant improved/ resistant cultivars like Kufri Khyati, K. Pukhraj, K. Satluj and K. Chipsona-3
4. Regularly monitor the field and rouge the virus affected plants.
5. Stop irrigation before haulm cutting, leave tubers in soil for skin hardening for 10-15 days.

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

Cyperus sp and *Chenopodium* etc.

x. IPM Module for management of weeds

1. Mechanical and cultural method.
2. Proper crop rotation
3. Timely hand weeding
4. Winter/ summer ploughing.

Cyperus* sp and *Chenopodium

1. Apply Pendimethalin 30 EC @ 1 kg a.i/ha or Metribuzin 70% WP @ 0.350 kg a.i/ha or Oxyflurofen 23.5 % EC @ 0.1-0.2 kg a.i/ha within 3 days after planting to control grassy and non grassy weeds.
2. Apply Paraquat dichloride 24% SL @ 0.5 kg a.i/ha at 5% germination of potato

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

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

xii. Production constraints in agro-ecological region

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

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

Chhaya, Kanhaya and Ankur,Navkiran, Brinjal 704 (SunGro Seed), VNR212 (VNR Seed), IndameSupriya (Indo-American), Pant Rituraj, Pant Samrat, Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used

1. Poorly managed nurseries infected with damping off.
2. Over aged or less vital seedling utilization.
3. Transplanting is done on or before monsoon shower
4. Round and long purple type varieties are favoured
5. No control measure for shoot and fruit borers and *Phomopsis* blight.

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

1. Availability of purple and round varieties in cropping system.

2. Augmentation of assured irrigation for optimal production.
3. Use of black or plastic mulch in production chain
4. The recommended seed rate of hybrid-250g/ha, Open pollinated-500-600g/ha
5. Transplant seedlings properly as for non spreading type varieties- 60cmx 60cm, spreading type varieties - 75cm x 60cm.
6. Maturity stage of a particular crop can be standardized as per as per their object.

v. Major insect pests associated with crop

Shoot and fruit borers

vi. IPM Module for management of insect pests

Brinjal fruit & shoot borer: *Leucinodes orbonalis*

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

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Chlorantraniliprole 18.5% SC	200	22
Emamectin Benzoate 5% SG	200	3
Thiacloprid 21.7% SC	750	5
Thiodicarb 75% WP	625-1000	6
Lambda cyhalothrin 5% CS	300	5
Cypermethrin 25% EC	150-200	1
Betacyfluthrin 8.49%+ Imidacloprid 19.81% OD	200	7
Triazophos 35% + Deltamethrin 1% EC	1250	3
Pyriproxyfen 5%+ Fenpropathrin15% EC	750	7

vii. Major disease associated with crop

Phomopsis blight is a serious problem in the hills.

viii. IPM Module for management of disease

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

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

ix. Major weeds associated with crop

Euphobia hirta, C*ynadon dactylon*, *Cyprus* and *Oxalis*

x. IPM Module for management of weeds

1. Hand weeding only.
2. The field should be kept weed-free, especially in the initial stage of plant growth, as weeds compete with the crop and reduce the yield drastically.
3. Frequent shallow cultivation should be done at regular interval so as to keep the field free from weeds and to facilitate soil aeration and proper root development.
4. Deep cultivation is injurious because of the damage of roots and exposure of moist soil to the surface. Two-three hoeing and earthing up are required to keep the crop free of weeds.

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

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

xii. Production constraints in agro-ecological region

1. Non-availability of suitable hybrids
2. Wild animals problems
3. Poor technical knowhow
4. Marketing problem in rainy season
5. Less availability of high quality seeds
6. High prices of hybrid seeds
7. Lack of knowledge about the cultivation practices
8. Lack of processing facilities.

9G. Name of the Vegetable Crop : Chilli

i. Existing varieties being used

Local and non descriptive varieties

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

Pusa Sadabhar, Punjab Lal, Panjab Surkh, CH-1 and CH-3

iii. Existing package of practices being used

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

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

1. Use of seed treatment like Pant bio-agent 3 for managing seed and soilborne diseases.
2. Earthening up of plants within 45 days after transplantation to get rid off water logging.
3. Use of tall and cluster bearing type like local strain Lakhaur mirch.
4. Use of high dose of organic manure i.e. 200 q/ha increases productivity and incidence of dieback and anthracnose.
5. Grow high yielding varieties.
6. Treat the seed with copper containing fungicides before sowing.
7. Adopt soil testing and transplant one seedling at one place.
8. Transplant the seedlings when they attain 5-6 leaf stage.

9. Transplant the seedlings at proper spacing.
10. Dwarf varieties like Kashi Anmol at 45 x 30 cm and tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm respectively.

v. Major insect pests associated with crop

Thrips problem is major problem

vi. IPM Module for management of insect pests

Chilli thrips, *Scirtothrips dorsalis* Hood

1. Thrips *Franklinothrips vespiformis* (Crawford) and *Erythrothrips asiaticus* R. &. M. are predaceous in nature and their population may be encouraged by avoiding chemical sprays.
2. Yellow or blue sticky trap is effective for controlling this pest.
3. If still the population persist spraying of imidacloprid 70% WG @ 0.25ml/l or acetamiprid 20%SP @ 0.2g/l or thiomethoxam 25%WG @ 0.2g/l or metasystox@1.5ml/l is effective.

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Thiamethoxam 30% FS (Seed Treatment)	7/Kg	
Imidacloprid 70% WS (Seed Treatment)	10-15/Kg	
Cyantraniliprole 10.26% OD	600	3
Emamectin benzoate 5% SG	200	3
Spinosad 480% SC	160	3
Acetamiprid 20% SP	50-100	3
Thiacloprid 21.7% SC	225-300	5
Indoxacarb 14.5%+ Acetamiprid 7.7% SC	400-500	5
Flubendamide 19.92%+ Thiacloprid 19.92%	200-250	5
Methomil 40% SP	750-1125	5&6
Lambda cyhalothrin 5% EC	300	5
Ethion 50% EC	1500-2000	5
Fipronil 5% SC	800-1000	7
Imidacloprid 17.8% SL	125-250	40

vii. Major disease associated with crop

Dieback and anthracnose is major disease.

viii. IPM Module for management of disease

Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.**ix. Major weeds associated with crop**

Euphorbia hirita, Cynadon dactylon, Cyprus and O*xalis latifolia.*

x. IPM Module for management of weeds

Manual weeding

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

1. Use of tall hybrids supplementation of organic packages of practices to be followed
2. Grow high yielding varieties.
3. Adopt soil testing.
4. Transplant one seedling at one place.
5. Transplant the seedlings when they attain 5-6 leaf stage.
6. Transplant the seedlings at proper spacing.

xii. Production constraints in agro-ecological region

1. High incidence of flower and fruit drop in chillies
2. Fruit losses due to high incidence of dieback and anthracnose.
3. Non availability of quality seed.
4. Less irrigation facilities.
5. High cost of hybrid seeds.\

6. Unaware about the insect-pest management

9H. Name of the Vegetable Crop : Cucumber

i. Existing varieties being used

Local and traditional varieties

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

For protected condition- Hilton, Kian, Isatis and Malini

iii. Existing package of practices being used

1. Use of old and traditional seeds,
2. Planting in rainy season,
3. Traditional stacking method,
4. Long harvest duration season,
5. Absence of crop rotation.
6. Random selection of variety (May or may not be suited to Agroeco-region).
7. Untimely sowing / planting of crop.
8. Use of traditional irrigation system.
9. No soil solarization/ treatment during lean period.

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

1. Glasshouse or polyhouse technology.
2. Use of Hybrids or/and pathenocarpic varieties
3. Management of crop geometry.
4. Use of organic manure or fertigation inside polyhouse.
5. Adoption of crop/ soil health related crop rotations.
6. Use recommended spacing e.g. 60-200 × 50-100 cm
7. Treating seed before sowing.
8. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
9. Selection of optimum planting period.

v. Major insect pests associated with crop

Leaf miner , white fly, trips, leaf eating caterpillar, fruit fly, cut worm, red pumpkin beetle

vi. IPM Module for management of insect pests

Red pumpkin beetle

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

vii. Major disease associated with crop

Wilt, mildew, mosaic.

viii. IPM Module for management of disease

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

Powdery mildew

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

Downy mildew

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Zineb 75% WP	1500-2000	
Cymoxanil 8%+ Mancozeb 64% WP	1500	10
Azoxystrobin 23% SC	500	7
Amectoctradin+ Dimethomorph 20.27% SC	800-1000	3

ix. Major weeds associated with crop

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

x. IPM Module for management of weeds

Manual weeding in high hills.

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

1. Polyhouse technology and hybrid cultivars can increase productivity 3-4 times in mid and high hills.
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 e.g. 60-200 × 50-100 cm
6. To use sufficient quantity of fully decomposed Farm Yard Manure (two year old)/ vermi compost.
7. To use technology such as soil solarisation.
8. Timely sowing/ transplanting of crop.
9. Use of different protected systems/materials e.g. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
10. Timely harvesting of crop.
11. To save the precious natural resource water, follow micro irrigation technologies (drip irrigation).
12. Use genetically pure & treated seed.

xii. Production constraints in agro-ecological region

1. Lack of plant growing structures.
2. Monkey, baboon, wild pigs are serious threats.
3. Good quality seed is inaccessible.
4. High cost of seed & poor purchasing power of farmers.
5. Water scarcity.
6. Protected cultivation is cost involving technologies.
7. Repair of the poly houses/ micro irrigation structures is a tedious task.
8. Damage of crop / poly houses /micro irrigation structure by wild animals.
9. Unawareness about scientific technologies.
10. Availability of agriculture inputs is not easy.
11. Difficult labour availability.
12. Different biotic and abiotic stresses.

9I. Name of the Vegetable Crop : Pea

i. Existing varieties being used

Traditional field pea and 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

Vivek Matar 10, Vivek Matar 11 for main season and VL Ageti Matar 7 for August sowing

iii. Existing package of practices being used

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

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

region

1. Use of tall varieties sown in line with effective stacking methods. Management of powdery mildew, *Aschochyta* blight and other diseases and *Fusarium* wilt in autumn season
2. Sowing early maturing varieties at closer spacing (30 cm plant to plant and about 5-10 cm between plants) and higher seed rate (120 kg/ha).
3. Oct & Mid Nov is sowing time for pea.
4. Seed rate: 100 Kg/ ha.
5. Water the crop as per need especially during flowering and pod setting.

v. Major insect pests associated with crop

Leaf miner

vi. IPM Module for management of insect pests

Cultural, mechanical, biological methods

vii. Major disease associated with crop

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

viii. IPM Module for management of disease

1. Use of organic inputs only
2. Use of rust and powdery mildew resistant strains.

Powdery mildew

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

ix. Major weeds associated with crop

Trifolium alexendrinum , 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. Increasing crop intensity, Line spacing
2. Use of tall cultivars in cropping system
3. Standardization of time for seed sowing in pea viz. September sowing in high hills, Mid Nov sowing time for high hills.

xii. Production constraints in agro-ecological region

1. Increasing crop intensity, Line spacing
2. Use of tall cultivars in cropping system

Standardization of time for seed sowing in pea viz. September sowing in high hills, Mid Nov sowing time for high hills can enhance productivity.

C1. Livestock: Buffalo

1.A-Existing breeds available

Mostly non-descriptive breeds.

1.B-Specific breeds to be introduced

Murrah and Neeli-ravi.

2.A-Existing feeds being used

Wild grasses, paddy straw, wheat straw, wild dried grasses, Oak, Khadeek, Mulberry

2.B-Specific feeds to be introduced / advised

1. UMBB Feed blocks,
2. Use of green fodder maize, multi cut *chari*, Hybrid Napier, Tall fascue, Italian rai, Cox foot, Orchard grass fodder trees etc
3. Fortification of local Fodder and use of Chaff cutter.

3.A-Existing health services

State animal husbandry department (Vet. Hospital, LEO Centers) and BAIF.

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

Village level workers for first aid, vaccination and AI

4.A-Existing management practices

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

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

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

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

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

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

Feed and fodder shortage, local breed, low cost of milk

C2. Livestock : Cattle

1.A-Existing breeds available

Mostly non-descriptive, Cross bred of Jersey, HF, Sahiwal

1.B-Specific breeds to be introduced

Jersey, HF, Sahiwal.

2.A-Existing feeds being used

Wild grasses, paddy straw, wheat straw, dry grasses, Oak, Khadeek, mostly rearing on grazing.

2.B-Specific feeds to be introduced / advised

Fodder maize, multi cut sorgham (chari), hybrid Napier and Fodder trees. Fodder treatment, Chaff cutter, mangers etc.

3.A-Existing health services

State animal husbandry department, BAIF.

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

Village level workers for first aid, vaccination and AI

4.A-Existing management practices

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

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

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

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

Poor breeds, shortage of feed and fodder, improper feeding, poor housing and management of animals,

Improper health services, mostly unproductive animals.

5.B-Specific problems related with AH/ Cattle due to which income is not increasing

Feed and fodder shortage, local breed, low cost of milk.

C3. Livestock : Goatary

1.A-Existing breeds available

Mostly non-descriptive and Chobarkha

1.B-Specific breeds to be introduced

Barbari

2.A-Existing feeds being used

grazing

2.B-Specific feeds to be introduced / advised

grazing

3.A-Existing health services

State animal husbandry department.

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

Village level workers for first aid, vaccination

4.A-Existing management practices

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

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

Development of pasture land, scientific management

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

Lack of range land management

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

1. Lack of range land management,.
2. Managemant problems as proper vaccination,
3. Management of ecto and endo parasite control
4. Breed improvement

C4. Livestock : Sheep

1.A-Existing breeds available

Mostly non-descriptive, Gaddi and Black sheep

1.B-Specific breeds to be introduced

Gaddi and selective breeding of local breed

2.A-Existing feeds being used

grazing

2.B-Specific feeds to be introduced / advised

grazing

3.A-Existing health services

State animal husbandry department.

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

Village level workers for first aid, vaccination

4.A-Existing management practices

1. Improper and unhygienic housing,
2. Improper and inadequate feeding management,
3. Shortage of feed and fodder,

4. Improper vaccination, long calving interval, inbreeding

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

Development of pasture land, scientific management

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

Lack of range land management

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

1. Lack of range land management,
2. Managemant problems as proper vaccination,
3. Ecto and endo parasite control, breed improvement

C5. Livestock : Poultry

1.A-Existing breeds available

Poultry: Local, Croiler, RIR and Uttara fowl

1.B-Specific breeds to be introduced

Poultry: Coiler, Kadaknath, Cob, Cari Davendra, Cari-Nirbheek

2.A-Existing feeds being used

Kitchen waste

2.B-Specific feeds to be introduced / advised

Starter, grower, finisher feed according to age

3.A-Existing health services

State animal husbandry department.

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

Specific poultry management services

4.A-Existing management practices

Mostly backyard

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

High yielding breeds, proper feeding and management practices

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

Poor breed and management

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

Poor breed and management

C6. Fisheries

1.A-Existing breeds available

Non descriptive and Cold water fisheries

1.B-Specific breeds to be introduced

Cold water species.

2.A-Existing feeds being used

House hold waste

2.B-Specific feeds to be introduced / advised

Pelleted fish feed having 25-30% protein

3.A-Existing health services

State fisheries dept. (fisheries inspector at district level)

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

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4.A-Existing management practices

-

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

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

-

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

Non availability of quality fish seed is major problem

D. Integrating Farming system

1.A- Existing farming system

Silvi-Agri-Hort- pastoral system

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

Agri-HortAnimal- farming system

Activity	**Area**
A. Cropping system:	**8 nali**
Fingermillet-Cabbage/Pea	
Barnyardmillet - radish- Fallow	
Amaranthus -Radish-Frenchbean	
B . Horticulture	**8 nali**
Apple and walnut	
C Livestock	**2 nali**
Goatary	
Sheep rearing	

Total cost : 30,000.0

Total income : 2.0 lakhs

Net income : 1.70 lakh (Approx.)

E. Reducing post harvest losses and value addition

1.A- Existing grading facilities

Not available in area

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

For grains:

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity
4. For horticultural crops:
5. Sorter for particular commodity
6. Size grader for particular commodity
7. Weight grader for particular commodity

2.A- Existing processing facilities

Not available in area

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

1. Establishment of minimal processing plants in various location based on crop and area specific.
2. Amaranthus - Rassi centre
3. Barnyard millet – Mansuna centre
4. Fingermillet- Chaumasi high hills
5. Pre packing and e-Packing for precious commodities at
6. Establishment of small or cottage level processing units for market surplus in Gola Nashpati, Chullu, delicious local Malta for food products.

7. Establishment of wine factories for Gola, Chullu, plum and other forest products. Food processing units of Dept of Horticulture and Units of some NGOs

For grains:

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

For horticultural crops:

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

3.A- Existing packing facilities

Not available

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

A factory based on plastic cartoon, *Kilta*, *Dalia* of various grade and size based on weight of the fruit is needed at least at dist level to meet the requirement of apple and seasonal vegetables.

For grains:

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Small LDPE and HDPE polybags for particular commodity
3. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
4. Paperboard boxes for particular commodity
5. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
6. Shrink and wrapping packaging for fresh and minimal processed

4.A- Existing storage facilities

At present no storage facilities are available in the distt.

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

A warehouse for hill potato is required at *Agastymuni* and *Tilwara*.

For grains

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

F. Waste land development and waste water

1.A- Existing practices of soil water conservation

Using indigenous technology use for water conservation includes formations of bund, growing of Napier and other perennial grasses, multiple forest species as per need are requirement.

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

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

2.A- Existing plantation

Toon, shirish, Bheemal, Kachnar, Kharik, shisham in low and mid hills Utis, banj, chhanchru, leucinia, Mulberry

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

1. Morus, Shirish, Kharik, Utis, Oak, Kachnar, Vilyati khair etc are useful as dual purpose species to meet fodder, firewood and other requirement of the farmers. Sufficient plants are available at forest nurseries for plantations.
2. Rejuvenation/repair of faulty/abandoned terraces;
3. Stabilization of eroded land using biological/engineering measures;
4. Plantation of suitable trees/brushes in waterlogged and eroded areas;
5. All agricultural operations should be done on contours i.e. across the existing land slope.
6. 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.
7. 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.
8. Diversion of runoff through ditches from upper slopes to safer places.
9. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
10. 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.
11. Contour trenching (staggered/continuous).
12. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
13. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
14. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
15. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

3.A- Existing fodder production

Crop stobbers, wild grasses, Forest leaves etc.

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

Tall fescue (*Festuca arundinacea*), Rye grass (*Lolium perenne*), Brome grass (*Bromus inermis*), Cox

Foot grass/Guchhi grass (*Dactylis gloemrata*), Timothi grass (*Helum pratense*), White clover (*Trifolium repens*), Red clover (*Trifolium pretense*)

Tall fescue

1. Sowing time- Onset of monsoon (rainfed).
2. Irrigation management- Crop must be irrigated after each cut provided water is available
3. 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)
4. Irrigation management- Crop must be irrigated after each cut provided water is available
5. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

Timothi grass

1. Sowing time- Onset of monsoon (rainfed).
2. Irrigation management- Crop must be irrigated after each cut provided water is available
3. 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).
4. Irrigation management- Crop must be irrigated after each cut provided water is available
5. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

Red clover

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

4.A- Type of waste water

Home and Kitchen waste

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. Multistage filtration unit should be established to recycle the waste water for multiple purposes.
2. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
3. Industrial wastewater should not be used for irrigation directly; and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.
4. Sewage water from cities should be treated by municipal corporations or other agencies.

G. Reduced cultivation cost

1.A- Existing inputs being given

1. Traditional and unprocessed inputs are used in agricultural practices.
2. Drudgery prone implements/tools are in practice for various operations.

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

Application of nutrients based on soil test basis as major and micro elements.

2.A- Existing mechanization

1. Limited use of power driven implements in land preparation.
2. Small tools like sickle, hand hoe etc are being adopted by progressive farmers.

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

1. Power tiller, power weeder, and shrub cutter, multiple crops threshers are becoming popular and are available in pockets.
2. Old wooden based impelements are being replaced with iron/alloy (Plough, Danalla,) based tools are available.

3.A-Existing collective inputs

Community pasture land, Service bulls, Irrigation channel and source, Irrigation tanks.

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

Custom hiring energy based implements viz. Small tractor, tiller, Power sprayers, Mandua thresher; Hydrum irrigation can reduce the cost of cultivation along with reduction of farm labour.

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

1. Labour cost
2. High hybrid seed cost
3. No storage facilities for perishable product
4. No chilling plant for milk

H. Off-farm income

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

ATI, ATMA, CHIRAG, AAJIVIKA, NABARD, Hill Valley development

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

1. Various collection and procurement group [present in the dist.
   Rajmash collection and procurement group
   Marchha/Amaranthus collection group
   Gola Nashpati group
   Malta collection and procurement group
   Cheura collection and extraction group
   Milk collection and chilling group
   Sheep and goat production group
   Wool collection and sale group
2. 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.
3. 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.
4. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
5. 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.
6. 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.

7. Loan procedure should be made more flexible with less interest rate.
8. 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.
9. 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.
10. 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.
11. Enterprises need to be identified depending upon local resources- human and material.
12. Market linkages need to be developed so that people can sell their produce gainfully.
13. To encourage SHG's better planning, training and sustained efforts on long term basis are required.
14. 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

Five groups are working for collection of small fruits for juice preparation.

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

1. Garwali food products for religious tourism
2. Mushroom production and processing units
3. Honey and honey products unit
4. Milk and milk products shops

3.A- Existing skill development facilities

Extension training institute

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

1. Mushroom production and training facilities
2. Development of advanced horticultural handling units
3. Fish ponds
4. Dairy/Poultry/ goatary units
5. Value addition and food chain centre
6. Storage, grading and Packaging centre
7. Silk worm based skill development units

8. Bio-agant and bio-fertilizers production lab
9. Tissue culture lab for massive production of elite planting material
10. Medicinal plant growing and processing units
11. Development of rosary and extraction units

4.A- Existing women skilling facilities

Not Available

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

1. Khadi and Kargha training for women skill
2. Drudgery reduction practices for high efficiency
3. Herbal dye based skill training and skill for local textiles.
4. Value addition skill for women.

5.A- Existing youth skilling facilities

Extension training institute

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

1. Development of advanced horticultural handling units.
2. Dairy/Poultry/ goatary units
3. Value addition and food chain centre
4. Bio-agent and bio-fertilizers production.
5. Medicinal plant growing and processing units

Mushroom cultivation

The shrinking land, demand for functional foods, priorities for recycling agricultural residues and changing trades in view of globalization are going to play an important role in the agricultural scenario, and secondary agriculture is likely to play a pivotal role. Our country can emerge as a major player in mushroom production in wake of availability of plenty of agricultural residues and labour. To remain competitive it will be important to harness science and modern technologies for solving the problems of production and bio-risk management. Mushroom being an indoor crop, utilizing vertical space offers solution to shrinking land and better water utility. Packages and practices of mushroom cultivation in Almora is as follow:

1. **White Button Mushroom (*Agaricus bisporus*)**

Button mushroom scientifically known as *Agaricus bisporus* and has he widest acceptability. Cultivation of this mushroom is a complex process and requires two different temperature i.e. 22-26^{0}C for spawn run and 14-24^{0}C for fruit body formation. Besides specific temperature, it require proper humidity (80-90%) and enough ventilation during fruit body formation.

Steps of cultivation process

Compost preparation: Compost is an artificially prepared growth medium from which mushroom is able to derive important nutrients required for growth and fructification. Cemented floors and shade over the floor are required for making good quality compost. There are two main methods for compost preparation:

Long method of composting: This is an outdoor process and takes around 28 days in its completion with a total of seven turnings. The following materials are required for long method of compost:

Wheat straw	1000 Kg	Urea	10 kg
Wheat bran	50 kg	Gypsum	100 kg
Ammonium sulphate or calcium ammonium nitrate	30 kg	Furadan	500 g
Super phosphate	10 kg	B.H.C.	500 g
Muriate of Potash	10 kg		

Before making compost, wheat straw is spread on cemented floor and is turned many times with water being sprayed at regular intervals.

Day 0: At the stage, there should be around 75% humidity content in the wheat straw, to which wheat bran, calcium ammonium nitrate, urea, murate of potash, and super phosphate are mixed thoroughly and evenly. The material is then piled 1.5m thick x1.25m high with the help of wooden rectangular block. The blocks are removed. Once the entire material has been stacked up or piled up. Water is sprayed twice or thrice to keep the substrate moist. Temperature should be in the range of 70-750C.

1st turning Day 6: On the sixth day first turning is given to the stack. The purpose of turning is that every portion of the pile should get equal amount of aeration and water. If the turnings are not given, then anaerobic condition may prevail which may lead to the formation of non-selective compost. In the stack, the central zone is fermenting at its peak and has maximum temperature rest of the portion is either not at all fermented or ferments improperly. The correct method of turning is as: Removing about 15cm of compost from the top and spread it on one side of the floor, the rest part of compost on the other side of the floor. Now turning is done by shaking the outer (top most) part and the inner part of the compost, first separately and then missing them altogether thoroughly with the help of wooden buckets.

2nd turning (Day 10): On the tenth day, again the top most part and the inner part of the compost is separated, water is sprayed on the top part. Again the two parts are piled up together in such a way that now the top part is inside and the inner part is on the top of the stack.

***3rd turning (day 13)*:** it is also done in the same way as described earlier and required quantity Gypsum mixed at this stage.

***4th turning (day 16)*:** The same process of turning is followed. The required quantity of furadan & lindane are added during this turning.

***5th turning (day 19)*:** The compost is turned in the same manner.

***6th turning (day 22)*:** The same process of turning is followed. The required quantity of furadan and lindane are added during this turning.

***7th turning (day 25)*:** The compost is turned in the same manner

8th *turning (day 28)*: if no ammonia persists in the compost, spawning is done.

Short method of composting : Compost prepared by short method of composting is superior in production quality and the chances of infection and disease is quite low. Composting by this method requires special infrastructures, equipments etc. that initial cost is to high, therefore, the farmers can purchase the readymade compost from the authentic composting units. The compost when ready for spawning should have the following characteristics:

Moisture	About 68%	**Ammonia**	Below 0.006%
pH	7.2-7.5	**Nitrogen**	Around 2.5%
Fire fangs (Actinomycetes)	Excellent growth		

Proper timing for cultivation: Feb.-Nov. (03 crops)

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

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

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

is prepared from the following ingredients.

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

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

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

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

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

2. **Oyster mushroom**

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

Steps of cultivation process

Substrate and its preparation

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

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

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

Proper timing for cultivation May- Aug. (02 crops)

Cultivated spices: *P. sajor-caju, P. florida, P. sapidus, P. eryngii, P. cornucopiae, P. flabellatus, P. djmore, P. eous, P. ostreatus*

Spawning and crop management : Oyster mushroom spawn should be about 15-20 days old when mycelium has formed complete coating around the grain. The normal rate of spawning in a pasteurized substrate is 2-3% of the wet substrate. The spawning is usually done by mixing the spawn throughout substrate. Before filling the substrate in polythene bags, holes of about 1 cm diameter are made at 10-15 cm distance all over the surface for free diffusion of gases and heat generated inside. The optimum temperature for growth of mycelium is 23 ±2^{o}C. Relative humidity in growing room should be range between 85-90% during spawn-run. Spawn run usually takes about 15-20 days. After complete spawn run, polythene removed completely with help of sharp knife carefully. Usually 3-4

days after opening the bags, mushroom primordial (pin heads) begin to form. After opening the bags water should be sprayed 2-3 time per day regularly.

Harvesting and yield: Mature mushrooms become ready for harvesting in another 2-3 days. An average biological efficiency (fresh weight of mushrooms harvested divided by dry substrate weight x 100) can range between 70-80% and sometimes even more. To harvest the mushrooms, they are grasped by the stalk and gently twisted and pulled. A knife should not be used.

I. Enabling Policies

1.A - Existing policies related with agriculture and animal husbandry

Subsidies and incentives are given on all agricultural inputs. More than 50% subsidies are granted on all inputs and implements.

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

1. Section of crop and area specific crop production program
2. Timely and assured supply of agricultural inputs to farmers at door.
3. Popularization of polyhouse technology for vegetables and flower production
4. Inclusion of hybrid seed program for crop production.
5. Establishment of seed production units for temperate crops.
6. Need to establish more food processing units.
7. Availabilities of credit at minimum rate.
8. Assured buyback policy for agricultural produce.

2.A- Existing Institutions

ICAR Institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK, NGOs

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

1. Establishment of food processing units at district level to procure and marketing of surplus.
2. Need to develop or establish animal breeding program
3. Testing of new crops in non-traditional areas for doubling the crop production.

3.A- Existing Incentives

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

1. An assured bonus to farmers to grow new crop or higher production potential
2. Selection of farmers at village for trendsetter for dissemination of technical knowledge and technology may be awarded
3. Free access to library and one institute at least once in a year.

4.A- Existing risk coverage facilities

Crop and Animal Insurance Schemes

4.B- Risk coverage facilities to be suggested for doubling income in the specific agro-ecological region

1. Risk coverage may be applicable for all agricultural products and animals
2. Declaration and minimum support price be fixed well in time

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

1.A- Existing marketing facilities

One mandi samiti office is established

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

Contractual farming, linkages with MNCs and NCs, Mahila hat, local hat, weekly bazaar, local mandi, AC van.

2.A- Existing grading facilities

Nil

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

For grains:

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

For horticultural crops:

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

2.C- Processing facilities to be created for better marketing and value addition in the 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. Pearler, grader, miller and packaging unit for millets
5. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity

For horticultural crops:

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

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

For horticultural crops:

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Small LDPE and HDPE polybags for particular commodity
3. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
4. Paperboard boxes for particular commodity
5. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops.

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

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K. Online Management and Evaluation

1.A- Existing online management structure available

Internet etc.

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

Each village should be connected by Internet facility with proper device, awareness about internet user.

2.A- Existing evaluation procedure

Manual

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

GPS, Email, Whattsapp, ITC tools

3.A - Existing monitoring system

Physical

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

Regular visits and online report submission, farmer feed back

4.A- Existing feedback system

Manually

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

Internet and proper software for evaluating ongoing activities

5.A- Existing reading system

Literature, Booklets, Hindi Extension Journals etc

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

Farm advisory portal, online helpdesk services

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

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 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)).
2. Promotion og 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 millet (PRM 1, and VL Mandua 352 upto 2000m amsl)
4. Promotion of high yielding varieties of Barnyard Millet (PRJ-1,VL Madira 172 and VL Madira 207 upto 2000m amsl)
5. Promotion of high yielding varieties of Lentil (PL-4, PL-7, PL-8)
6. Promotion of high yielding varieties of Urd (U-31, PU-35)
7. Promotion of high yielding varieties of Arhar (Pant Arhar-291, Pant Arhar-3).
8. Promotion of high yielding varieties of Tomato (VL Tamatar 4 upto 1800m amsl, Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852)
9. Promotion of high yielding varieties of cucumber (For protected condition- Hilton, Kian, Isatis and Malini.)
10. Promotion of high yielding varieties of Potato (Kufri Girriraj, Kufri Chipsona 1, Kufri Chipsona 3, Kufri Jyoti, Kufri Chandramukhi)
11. Promotion of high yielding varieties of Pea (PSM-3, PSM-5, Pusa Pragati, Vivek Matar 11 for main season & VL Ageti Matar 7 for August sown)
12. Promotion of high yielding varieties of Pea (Vivek Matar 10, Vivek Matar 11 for main season and VL Ageti Matar 7 for August sowing); Onion (VL Piaz 3 upto 1800m amsl); Capsicum (VL Shimla Mirch 3 upto 1800m amsl); French bean (VL Bean 2) and garlic (VL Lahsun2).

Introduction, validation, adoption and pomotion of hybrids varieties in vegetable in High hills.

1. Promotion of high yielding varieties of French bean (Pant Anupama, Pusha, Himlata, Swarna Lata, Laxmi, Pusha Parvati, Pant bean-2, VL Bean 2, Arka Anoop, Arka Bold).
2. Promotion of high yielding varieties of Cauliflower (Early Kunwari, Pusa Kartiki, Pusa Early Synthetic, Pusa Shubhra, Pant Shubhra, Hisar No.1, Snow crown, Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2).
3. Promotion of high yielding varieties of Cabbage (T-621, Pragati, Indica,Varun, Pusa Mukta , Sri Ganesh Gole, Green star and Pride of India).
4. Promotion of high yielding varieties of Capsicum (VL Shimla Mirch 3 upto 1800m amsl, Yellow Wonder, Pusha Dipti, Bharat, Indira, Aasha, Orobelle, Natasha, Swarna), Onion (VL Piaz 3 upto 2000m amsl), Garlic (VL Lahsun 2).

5. Promotion of high yielding varieties of Radish (Early Mino, Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant).
6. Promotion of high yielding varieties of chilli (Agni, Shikha, Kashi Anmol, Pant C-1, Tajwasni, Pusa Sadabhar, Punjab Lal, Panjab Surkh, CH-1 and CH-3).
7. Recommended package and practices will be followed for the above said crop varieties

Introduction, validation, adoption and promotion of temperate plants and nuts at high hills.

1. Promotion of high yielding varieties of apple (Red Chief, Walspur, Oregon spur, Red spur, Early Red one, Washington spur Pink Lady, Oregon spur, Super chief and other new stains.)
2. Promotion of high yielding varieties of pear (Max Bartlette, Red Bartlette, William and Starkrimson)
3. Promotion of high yielding varieties of peach (Alxander, Red Globe, Crest heaven, Glo Heaven, Nectarine- Snow Queen).
4. Promotion of high yielding varieties of Plum (Santa Rosa, Beauty, Burbank and Prunes).

Cluster approach for holistic development in Horticultural sector and traditional millets and grains

1. Repalcement of traditional grains and millets with improved cultivars in *Gondar, Gadgoo* and other high elevation areas.
2. Promotion of Spur and colour mutatnts in apple in high hills in Chaumasi and Gaid areas.
3. Replacement of traditional millets with new types developed at VPKAS Almora.
4. Encouraging garlic production in *Mohankhal, Bhanj* and *Chandranagar* areas.
5. VL chau 44 hold promise for high hills.
6. Timely supply of seed and other inputs
7. Sufficient and assured supply of HYV Millets, seed and inputs in all nyaypanchyat /CD store of Agriculture Deptt.
8. Supply of reliable planting material of temperate and subtropical plants to farmers.
9. Use of IPM modules as per area and crop specific in field and vegetables.

Management of wild animal problem

1. Limited management through legislative control of wild boar in field crops.
2. Use of ITK in management of monkey, porcupines, baboon and others.
3. Availability of manures and use of fertiliser in cropping system
4. Use of NADEP, Heap method, Vermicomposting and vermiwash techniques for manure results in doubling of agricultural productivity.
5. Timely and judicious use of fertilizers based on LCC, soil and water testing reports, based on cropping system can enhance productivity in low hills and limited irrigated Sera areas.
6. Conservation and water harvesting techniques
7. Use of mulch in fruit crops in juvenile stage.
8. Construction of small plastic sheet tank (5x3x2mts) for water storage.
9. Small sprinkler and drips for small and large land holding.

Adoption of Farm mechanisation (Power tiller, thresher etc)

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

Adoption of efficient irrigation techniques

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

Management of soil health in high hills

1. Promotion of vermi compost unit in each village to meet demand of compost.
2. Organic cultivation of local grain and millets in different blocks of this region.

Others

1. Seed treatment through bio agent/ chemical means strictly in the cluster
2. Judicious use of fertiliser
3. Moisture conservation practices
4. Focus on timely weed management
5. Take care of IPM techniques
6. Adoption of Farm mechanisation (Power tiller, thresher etc)

Strategy 2 : Livestock: Goatry, Poultry, Fisheries

1. Replacement of local breeds with high milch breeds viz. Cross bred jersey in cattle.
2. Gaddi and Barbari breed for meat purpose in goat and Merino cross and Gaddi in high hills hold high income.
3. Growing of MPT and fast growing green grasses rich in digestible proteins *viz.* Utees and Oak in perennial trees and Napier as grass for lean season.
4. Availability of poultry feed with low prices.
5. Timely health check-ups of animals.

Strategy 3 : Integrated Farming system

1. Protected cultivation+ Composting+Goatry/backyard poultry
2. Fodder production+ Mini dairy+Composting+ Protected cultivation
3. Seed production (Amaranthus or Kuttu)+ Planting material supply

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of small processing units for local milk at *Badula and Jaggi bagwan.*
2. Grading and packing units for apple and other temperate fruits at *Triyuginaryan and Chaumasi.*
3. Establishment of wine factory at *Tilwara*.
4. Potato storage at *Makkumath.*
5. Ropeway for distant location in gaid and Gondar areas of the distt.

Strategy 5 : Waste land development and waste water

1. Plantation of Mulberry plants in high hills to meet fodder and alternative off income.
2. Wild fruit plants like Bhamora, chestnut, hazelnut and black walnut to meet future needs in Kotma valley.
3. Use of soil bunds to save excessive loss of nutrients in wasteland
4. Use of trenches or silages for percolation of water to avoid surface run off.
5. Construction check dam and artificial structure to maximize water percolation rate in marginal and denudated areas.
6. Avenue plantation and development of shelterbelts in low areas.
7. Popularization of trenches for percolation of water to avoid surface run off in all the blocks of this region in Rabigaon, Phata and Bangar clusters.
8. Construction of check dam and artificial structure in all the blocks of this region to maximize water percolation rate.
9. Construction of tank for storage of water for lean season at Nyaypanchayat area of all the blocks of this region.
10. Creation of rain water harvesting structure in all the blocks of this region.
11. Plantation of suitable trees/brushes in waterlogged and eroded areas viz. Badasu, Raunlak and Rasi.
12. All agricultural operations should be done on contours i.e. across the existing land slope.
13. 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.
14. 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.
15. Diversion of runoff through ditches from upper slopes to safer places.

16. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
17. 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.
18. Contour trenching (staggered/continuous).
19. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens in all blocks.
20. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
21. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
22. 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.
23. Multistage filtration unit should be established to recycle the waste water for multiple purposes.
24. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Encourages use of well decomposed FYM or vermicompost, biofertilizers and avoid or minimum use of chemical fertilizers.
2. Avoid broadcasting of seeds and fertilizers in crop production program
3. Need based application of pesticides, preferably use bioagents.
4. Encourages optimum and recommended seed rate at optimum spacing and depth.
5. Encouraging for use of hand tools in agricultural and horticultural operations.
6. Use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Wheel Hand hoe, Manual/ power operated Wheat.
7. Use of mulch (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.

Strategy 7 : Off-farm income

1. Wool and Kargha business hold in high hills like Kham bugiyal, Chaumasi, Rassi and Unniyana of Ukhimath Block.
2. Collection of milk and saling at Kedarnath at high price is highly remunerative business of Rampur, Badasu and Nyalsu areas of Kedarnath belts for farm women.
3. The encouragement to existing SHSs for collective farming, opening small scale enterprise like honey collection.
4. Collection and domestication of medicinal plants at Chaumasi, Nrayankoti and Chirang areas is becoming popular.
5. Collection and selling of Jangora to Food industries at exorbitant price is off farm income.
6. Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. may be provided for better performance.
7. New SHGs may also be created other villages of the distt.

Strategy 8 : Enabling Policies

1. Extending MSP for number crops including all millets, Malta, spice crops and other crops. A separate provision of fund and identification of agency to procure and disposal of surplus produce to stackholder.
2. Mandatory meterological/ observatory at block level to get first hand information of climatic changes.
3. Use of crop insurance scheme for more crops including hail storm attack in stone and pome fruits.
4. Labelling of organic inputs and certification mechanism for more number of crops.
5. Expand application scientific methods and mechanized cultivation
6. Issueing up of Udyan and Kisan Cards for widespread use of Govt. incentives/subsidies to farmers.

7. Effective and workable Nursery act to avoid spurious or unreliable planting material in the state.
8. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
9. Soil health card scheme be effective for each farmers.
10. Institutional support in the form of subsidises and incentives can raise the farm production and income in larger interest of farm.
11. Declaration of minimum support price and crop insurance policy incentives is known on or before sowing season to avoid glut or deficiency.

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

1. Laisoning/linkages of various line departments to furnish information of crop produce and surplus.
2. eMarketing of apple and amaranths in *Triyuginarayan* areas
3. Establishment of mandis for temporary storage and sale of commodities at *Agastymuni*

Strategy 10 : Online Management and Evaluation

1. Mobile apps/ software for online management and evaluation at Distt level.
2. E Marketing and kiosk at distt level to have information of surplus commodities at block level.
3. Monthly review meeting at distt level for market surplus and situation of hill agriculture.
4. Use of radio, TV talks and use of Whatsapp, FB user for effective implementation of program.