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

Agro-Ecological Region: up to 1000 m

A.General information about Agroeco-region

District: Haridwar

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

Main Blocks in Region: Roorkee, Bahadarabad, Narson, Khanpur, Laksar, Bhagwanpur (6)

Main village cluster in blocks: Roorkee-Sabatwali, Narson-Libberhedi, Khanpur-Govardhanpur, Laksar-Alawalpur, Bhagwanpur-Sikroda

Irrigated Clusters: Narson

Rainfed Clusters: -

Existing rain water management facilities:

1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj)
3. Village pond (Taal)
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. Renovation of existing ponds, roof water harvesting and deep ploughing and in summer check dam and bunding in slopy lands must be promoted
2. Poly tank for water storage for scattered fields
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 (Naula)
6. Cost effective lifting devices
7. Roof top water harvesting system

2. Existing practices for soil health improvement

1. FYM 2 to 3 ton per hectare once ina two year
2. Meagre use of biofertilizers
3. Imbalanced nutrient use
4. Meagre green manuring in low land paddy
5. Use of raw/partially decomposed FYM
6. Meagre/ no compost making/recycling of crop residue

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

1. Green manuring (Sasbenia/sunhemp), FYM, Introduction of vermi compost pits, Bio fertilizers and used fertilizers on soil test values.
2. Cereals and oilseeds.
3. 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).
4. Soil test based balanced use of fertilizers in irrigated areas as per recommendation; INM shall be preferred.
5. Green manuring with sesbania in low land paddy.
6. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermi composting.

7. Use of FYM @8-10 t/ha or application of 2.5-3.0 t/ha vermi compost.
8. Pulses and groundnut.
9. Seed with specific *Rhizobium* inoculant and Phosphorus solubilising microbial culture.
10. Use of recommended dose of phosphatic fertilizer.
11. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermi compost.
12. Vegetables and spices.
13. 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).
14. Seedling inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture at transplanting.
15. Soil test based balanced use of fertilizers; INM shall be preferred, Use of FYM @ 4-5 t/ha or application of 2.5-3.0 t/ha vermi compost.

Sugarcane

1. Set inoculation with *Acetobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture.
2. Recycling of sugarcane trash through windrow composting.
3. Soil test based use of balanced fertilizers; INM shall be preferred, Use of FYM @10-12 t/ha or application of 3.0-4.0 t/ha vermi compost.

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

1. Occasional occurrence: Drought, heat wave, cold wave and frost.
2. Rice, wheat and sugarcane are major crops.
3. Most of the cultivated area is irrigated.
4. Growing of vegetables and horticultural crops in very small area.

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

1. The 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. In event of decreased water availability (Approximately 1000 mm rainfall) in rainy season (June-September) the rain water should be properly stored (In polythene, to make bund) and harvested for Kharif season crops.
4. Imbalance use of fertilizer is in practise in Haridwar therefore Site Specific Nutrient management (Precision farming) should be adopted for enhancing Nutrient use efficiency, water use efficiency and crop productivity.
5. Occasionally frost impacts sugarcane crops therefore according to the frost forecast the crop residue should be burnt around the sugarcane field to increase energy level and to create a layer of smog for retardation of outgoing radiation.
6. Due to occasional drought condition, low rainfall during monsoon season and sandy soil, the crop with low water requirements such as groundnut and black gram should be popularized in upland conditions.
7. Salt and flood tolerant rice variety should be taken in low land conditions Paired row sowing of sugarcane in September-October and February-March with intercropping.
8. Crop diversification and protected cultivation.

6 A. Name of Field Crop: Wheat

i. Existing varieties being used: PBW 343, PBW 550,DBW 17, DBW 16, PBW550, DBW-16, HD2932, PBW-343, UP2445, UP-262, PBW-373

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 953, HD 2967, UP 2382, UP 2425, WR 544, HD3086, UP 2628 UP 2554, UP 2526, UP 2565)

iii. Existing package of practices being used:

1. Most of the farmers use to grow rice-wheat-sugarcane cropping pattern.
2. Farmers do not applied proper dose of fertilizers, farmers also not adopting proper plant protection measures and effective herbicide for weed management.
3. Use of un-decomposed FYM.
4. Excess utilization of ground water for irrigation of crops.

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

1. Sowing with ferti seed drill and Zero till ferti seed drill.
2. Timely sowing of crops.
3. Application of proper seeds rate to maintain optimum crop density.
4. Promotion of inter/mix cropping with other crops to minimize the loss of crop failure in case of failure of main crop.
5. Proper weed management, proper monitoring and management of insect and pest.
6. Besides the above measure need to create water saving irrigation facilities to check excess use of ground water.
7. Balanced use of nutrients to be applied in the soil as per the soil testing report.
8. Quality seed of high yielding varieties should be chosen after that seed must be treated with proper fungicide to check the various seed born disease.
9. Promotion of Cluster based farming in integrated approach. Proper Utilization of Fallow land by planting short duration pulse ,vegetable and other horticulture crops

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

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

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

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

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

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

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

vii. Major disease associated with crop: Seed Rots and Seedling Blight, Leaf Rust (*Puccinia triticinia*), Stem Rust (*Puccinia graminis*), Stripe Rust (*Puccinia striiformis*), Loose Smut, Dwarf Bunt and Karnal Bunt

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

Karnal bunt: *Tilletia indica = Neovossia indica*

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

ix. Major weeds associated with crop: *Phalaris minor, Chenopodium album, Chenopodium murale , Melilotus alba*, etc.

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

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

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

Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

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

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

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

Sowing through seed drill must be promoted.

xii. Production constraints in agro-ecological region:

1. Wild animals,
2. Deteriorating soil heath,
3. Resistance in most of the insect pest for pesticides doses,
4. Farmers don't follow proper package of practices,
5. Proper market linkage to sell the produce,
6. Improper use of ground water for irrigation facilities.

6B. Name of Field Crop: Rice

i. Existing varieties being used: Sarbati, PB 112, Sarju 52, HKR 147, Pant dhan-11, Govind, Pant Dhan-6, 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: Rice (PB 1509, PB-1, Pant Basmati 1, Pant Sankar Dhan-3, Pant Dhan-19, HKR-127)

iii. Existing package of practices being used:

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

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

1. Proper application of compost and farm yard manure and green manuring must be followed before two months of planting.
2. Line planting must be done to maintain proper plant-plant and row-row distance,
3. To minimize weed infestation proper management of weed must be done,
4. Incidence of pests and diseases should be taken care properly.
5. SRI technique should be followed.
6. Efficient water application tolls should be used for irrigation and saving of water.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.
8. Quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.

v. Major insect pests associated with crop: Stem borer, leaf folder, green leaf hopper, brown plant hopper, rice hispa, rice bug, thrips, case worm

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

Stem borer:

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

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

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

50 Days within transplating (2 inch water in field)

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

50 Days after tranplanting

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

Bio-insecticides

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

Leaf folder:

Following insecticides may be used to control leaf folders of rice

50 Days within transplating (2 inch water in field)

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 0.4% GR	10000	53

Cartap 4% Gr	18750	
Carbosulfon 6% G	16700	37

50 Days after transplating

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

Bio-insecticides

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

Brown plant hopper: *Nilaparvata lugens*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Buprofezin 25% SC	800	20
Clothianidin 50% WDG	20-24	12
Dinotefuran 20% SG	150-200	10
Flonicamid 50% WG	150	36
Pymetrozin 50% WG	300	19
Imidacloprid 17.8% SL	100-150	40
Imidacloprid 30.5 %SC	60-75	37
Imidaclorpid 70% WG	30-35	7
Acetamiprid 20 %SP	50-100	7
Acephate 75% SP	666-1000	15
Acephate 95 % SG	592	30
Thiamethoxam 25 %WSG	100	14

Monocrotophos 36 %SL	1400	
Fipronil 5 %SC	1000-1500	32
Ethiprole 40%+ Imidacloprid 40% WG	125	15
Chlorpyriphos 20%+ Acetamiprid 0.4%EC	2500	10
Buprofezin 15% + Acephate 35 WP	1250	20
Flubendamide 4%+ Buprofezin 20 SC	175+700	30

Bio- insecticides

Name of the Bio-Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5
Azadirachtin 5% (Neem extract concentrate containing)	375	5
Metarhizium anisopliae 1.15% WP	2500	

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

Rice hispa: *Dicladispa armigera*

Name of the insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Triazophos 20% EC	1250-2500	40
Chlorpyriphos 20 %EC	1250	30
Quinalphos 25 %EC	2000	40

Case worm

Name of the insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Fenthoate 50% EC	500	1000

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

viii. IPM Module for management of disease:

During Nursery Sowing

Deep summer ploughing or soil solarisation

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

Fertilizers

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

Khaira disease: Due to Zinc deficiency)

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

Sheath blight: *Rhizoctonia solani*

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

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

Biofungicides:

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

Rice blast: *Magnaporthe grisea*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Picoxystobin 22.52% SC	600	12
Isoprothiolan 40 %EC	750	60
Tricyclazole 75% WP	300-400	30
Tebuconazole 25% WG	750	10
Idifenphos 50% EC	500-600	21
Carpropamid 27.8 %SC	500	

Cresoczim-methyl 44.3 SC	500	30
Hexaconazole 5% EC	1000	40
Casugamycin 3 %SL	1000-1500	30
Carbendazim 50 %WP	250-500	
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Tebuconazole 50% +Trifloxystrobin 25% WG	200	31
Carbendazim 12%+Mancozeb 63% WP	750	57
Azoxystrobin 18.2% + Difenoconazole 11.4%SC	0.1%	5

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

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

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

Biofungicides

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

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

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

Biofungicides

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

ix. Major weeds associated with crop: Wild rice, broad leaf grasses, annual grasses

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

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

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

		(days)
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Anilofos 18% EC (Transplanted rice)	1660-2500	
Anilofos 2% G (Transplanted rice)	20000-25000	30
Bispyribac Sodium 10% SC (Nursary)	200	
Butachlor 50% EC (Transplanted rice)	2500-4000	90&120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90&120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Cyhalofop butyl 10% EC	750-800	90
2,4-D Ethyl Ester 38% EC	2500	
2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Fenoxaprop-p-ehtyl 9% EC (Transplanted rice)	625	70 Post
Fenoxaprop-p-ehtyl 6.9% EC	812-875	61
Flufenacet 60% DF (Transplanted rice)	200	90-110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiargyl 6% EC (Transplanted rice)	1066	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5% EC (Transplanted & Direct sown)	650-1000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75-90
Anilofos 24%+ 2,4-D ethyl ester 32% EC	1000&1500	90 (Transplanted rice)
Bensulfuron methyl 0.6% + Pretilachlor 6 G	10000	88(Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Cinmethylin 10% EC (Transplanted rice)	750-1000	60
Paraquat dichloride 24% SL (Before sowing)	1250-3500	

Broad leaf grasses

1. Apply Chlorimuron+ Metsulfuron methyl 20%WG @ 0.004 kg a.i/ha or Bispyribac sodium 10%SC @ 0.02 kg a.i/ha at15-20 days after sowing to control annual broad leaf weeds and grasses.

Annual grasses

1. Apply Cyhalofop butyl 10% EC @ 75-80 a.i/ha at 15-20 days after sowing to control annual grasses.
2. Apply Fenoxaprop-p-ethyl 10% EC @ 60.0 g a.i/ha at 25-30 days after sowing to control annual grasses.
3. Apply Azimsulfuron 50% WG @ 0.035 kg a.i/ha at 15-20 days after sowing to control annual grasses.

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

1. Direct seeding may be promoted to cut cost of cultivation
2. Adopting of proper cropping pattern under.
3. Need of agriculture diversification with other commercial 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 crop,
5. Cluster based farming and Inter cropping,
6. Use of modern agricultural machinery for timely completion of field operation.

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 and lack of quality input.

6C. Name of the Field crop: Sugarcane

i. **Existing varieties being used:** COS 767, COS 88230, CoS 8432, CoS 8436

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Co Pant 99214, CO 0238, CoP 5224, CoP 3220

iii. **Existing package of practices being used:** Rice- Wheat-Sugarcane

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

1. Paired row planting of sugarcane in September-October and February- march
2. Intercropping must be followed for better remuneration.

v. **Major insect pests associated with crop:** Early Shoot borer, Stem borer, Top borer, White grub

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

Top Borer: *Scirpophaga excerptalis* wlk.

1. Collecting and destroying egg cluster and affected shoots from March to June.
2. Release of Isotima javensis Rohw. a parasitoid which attacks the larvae and pupae of the pest, is effective.
3. Intercropping with onion, methi, sauf and ajwain reduces the infestation of the pest.
4. Use Tricogramma japonicum @ 50,000 per hectare just after 60 days of planting 4 to 6 times at the interval of 10 days.
5. Intercropping with spices like coriander, onion, garlic, fenugreek,and fennel, and other crops such as wheat, potato and mustardreduces top borer incidence.
6. The economic threshold level of the pest in third brood is 7 percent incidence. So if the incidence of the pest increases more than this, use

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Chlorantraniliprole 0.4% GR	18750	147
Chlorantraniliprole 18.5% SC	375	208
Carbofuran 3% CG	33300	

Early shoot borer: *Chilo infuscatellus*

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Chlorantraniliprole 0.4% GR	18750	147
Chlorantraniliprole 18.5% SC	375	208
Fipronil 0.3% GR	25000-33300	270
Fipronil 5 %SC	1500-2000	270
Monocrotophos 36% SL	1500-2250	
Chlorpyriphos 20% EC	1250-1500	

Sugarcane stalk borer: Chilo auricilius

1. Detrashing autumn planted crop during September-October will expose the infested internodes to the activity of natural enemies. This will enhance the effectiveness of insecticides if applied.
2. Removal of water and late shoots at 15 days intervals during winter.
3. Release of Trichogramma chilonis at 50,000 parasitised Corcyra eggs/ha at 10-15 days interval from July is reported to be useful in reducing the infestation level.
4. The tachinid parasitoid Sturmiopsis inferens naturally parasitizes stalk borer up to 43%. It would be useful to mass multiply the parasitoid for inoculative or augmentative releases.

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Monocrotophos 36% SL	750	1875

White grub: *Holotrichia* spp.

1. Repeated deep ploughing at the time of land preparation.
2. Practicing crop rotation with paddy. Rotation with the non-preferred sunflower is also advisable to break the continuous availability of sugarcane.
3. Ploughing and flooding for 24-48 h of similar fields in February, when planting is taken up during the pest activity period (June September), would be useful in minimizing grub populations of different stages.
4. Mechanical control by collecting the beetles in large numbers at the time of their emergence just after the first shower of rains.
5. Collection of adults by using light trap. The beetles that hit the light source and drop down should be collected in double layered synthetic cement or fertilizer bags and secured tightly after treating with dichlorvos to kill them; alternatively, the beetles may also be killed by drowning them in drums filled with soap water.
6. Timely application of insecticides synchronizing with beetle emergence and period of egg laying.
7. Small neem trees may be sprayed with carbaryl or chlorpyriphos immediately after the first summer rain to kill the adult beetles which congregate on these trees for feeding.
8. Application of following insecticides is effective against subtropical white grubs.

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Fipronil 40+ Imidacloprid 40WG	437.5-500	296
Phorate 10% CG	25000	

Sugarcane root borer: *Emmalocera depressella*

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Fipronil 0.3% GR	25000-33300	270
Fipronil 5 SC	1500-2000	270

vii. Major disease associated with crop: Red rot of sugarcane, grassy shoot disease, ratoon stunting

viii. IPM Module for management of disease:

As most of the important sugarcane diseases such as red rot, grassy shoot (GSD) and ratoon stunting (RSD) are sett transmissible therefore, to overcome the problem follow the following practices.

1. Use only recommended resistant varieties of the zone.
2. Select only healthy cane seed/sett from the disease free field/nursery.
3. Treat/dip sets by carbendazim 50 WP 0.1% solution at least 30 minutes before planting.
4. If possible moist hot air treatment (MHAT) 54^0C for 4 hrs.
5. Ratooning of infected fields should be strictly avoided.
6. Follow proper selection of field and crop rotation.
7. Vectors and weeds should also be control to check the spread of viral/pytoplasmal diseases.

ix. Major weeds associated with crop: Broad leaved and grassy weeds

x. IPM Module for management of weeds:

1. Deep ploughing and use of pre emergence application of Atrazine 2 kg a.i per hectare

2. Apply Atrazine 50%WP @ 2.0 kg a.i/ha or Diuron @ 1.6 kg a.i/ha or Metribuzin 70%WP @ 1 kg a.i/ha at 3-5 days after planting to control broad leaf weeds and grasses.
3. Apply 2,4 Dimethyl Amine Salt 58%SL @ 3.5 kg a.i/ha or 2,4-D Ethyl Ester 38% EC @ 1.2-1.8 kg a.i/ha or Metsulfuron-methyl 20%WP @ 0.006 kg a.i/ha at 30-35 days after planting to control broad leaf weeds.
4. Apply Hexazinone 13.2%+Diuron 46.8% @ 0.264+ 0.936 kg a.i/ha at 20-25 days after planting to control grasses and broad leaf weeds.
5. Apply Paraquat @ 0.5 kg a.i/ha at 4-5 (as pre emergence) or 25-30 (post emergence) days after planting to control all weeds. Irrigate field at 40-45 day stage and do hoeing at this stage fb spray Atrazine @ 2.0 kg/ha or Metribuzine @ 1.0 kg/ha or Pendimethalin @ 1.0 kg/ha at 3-4 days after planting.

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

xii. Production constraints in agro-ecological region: Quality seed

6D.Name of the Field crop: Barley

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

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

iii. Existing package of practices being used:

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

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

1. Sowing should be done in Ist & IInd fortnight of October to proper utilized moisture for seed germination.
2. Application of proper seeds rate to maintain optimum crop density.
3. Proper weed management, proper monitoring and management of insect and pest.
4. Balanced use of nutrients to be applied in the soil as per the soil testing report.
5. Quality seed of high yielding varieties should be chosen after that seed must be treated with proper fungicide to check the various seed born disease.
6. Promotion of Cluster based farming in integrated approach.

v. Major insect pests associated with crop: Aphid

vi. IPM Module for management of insect pests:

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

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

Barley aphid: *Macrosiphum* sp.)

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

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

viii. IPM Module for management of disease:

Yellow rust

Propiconazole fungicide @ 1 ml per liter of water may be applied on need basis.

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

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

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

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

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

x. IPM Module for management of weeds:

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

Wild oat, *Avena fatua* (annual, monocot, narrow leaves, grass)

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

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

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

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

7A. Name of the Pulse crop: Lentil

i. Existing varieties being used: PL-4, PL-5, PM-4, PM-5, 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-8,PL-6, PL-9

iii. Existing package of practices being used:

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

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

1. Balanced use of fertilizer (15-20 kg N, 40-50 kg P_2O_5, 30 kg K_2O)
2. Timely sowing of crop in IInd fortnight of October to Last week of November.
3. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
4. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
5. Sowing in line must be promoted for proper intercultural operations. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly. Arrangement of irrigation facilities in case of drought should be available.
6. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

v. **Major insect pests associated with crop:** Aphid, Pod borer

vi. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Monocrotophos 36 SL @500 ml/ha

vii. **Major disease associated with crop:** Wilt & rust

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

1. Deep ploughing during summer.
2. Select disease resistant/tolerant varieties like PL 5 , PL 6 and PL 7
3. Seed treatment with Carbendazim (1 g) + Thiram (2 g) per kg seed Carboxcin 1 gm + Thiram 2 gm/kg seed. For rust Mancozeb 2 kg/ha in 800 liter water, 2 spray at 10 days interval.

ix. **Major weeds associated with crop:** Bathuwa, Doodhi, wild oats

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

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

Wild oat, *Avena fatua* (annual, monocot, narrow leaves, grass)

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

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

1. Use of HYV, IPM and IPNM,

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

xii. Production constraints in agro-ecological region:

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

7B. Name of Pulse crop: Urd

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

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PU 31, PU 35, PU 40, PU 6

iii. Existing package of practices being used:

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

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

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

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

vi. IPM Module for management of insect pests :

Fruit Borer

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

Bihary Hairy caterpillar

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

White fly

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

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

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

1. Deep ploughing during summer.
2. Select disease resistant/tolerant varieties like Pant Mung 5, Pant Mung 6 , Pant Urd 31 , Pant Urd 35 and Pant Urd 40
3. Rouging of the YMV infected Plants.
4. Application of Imidachloropid 200 ml/ha to control of white fly and crop rotation.
5. For management of blast disease, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.

ix. Major weeds associated with crop: Grassy and broad leaved weeds

x. IPM Module for management of weeds:

1. Pendimethaline @ 1kg ai/ha
2. 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. Seed treatment with Rhizobium culture
2. Sowing of crop in suitable cropping pattern under irrigated condition with proper management of weed, insect pest and diseases

xii. .Production constraints in agro-ecological region:

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

7C. Name of Pulse Crop: Moong

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

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant moong 5, Shweta**,** IPM-02-03

iii. Existing package of practices being used:

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

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

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

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

vi. IPM Module for management of insect pests :

Fruit Borer

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole18.5% SC	100	20
Flubendamide 480% SC	100	11
Lufenuron 5.4% EC	600	10

Thiodicarb 75% WP	625-750	17
Monocrotophos 36 %SL	625	

White fly

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

vii. Major disease associated with crop: Yellow Mosaic, leaf spot Cercospora

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

For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid 200 ml/ha,

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

x. IPM Module for management of weeds:

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

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

Need to grow crop in kharif season as main crop. Cluster based farming, Inter cropping. Proper Plant protection measures.

xii. Production constraints in agro-ecological region:

Farmers don't use as main crop, insect pest infestation.

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

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

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

iii. Existing package of practices being used:

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

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

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

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

vi. IPM Module for management of insect pests :

Pod borer: *Helicoverpa armigera*)

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	29
Chlorantraniliprole 9.3%+ Lambda cyhalothrin 4.6%ZC	200	18
Indoxacarb 14.5% SC	353-400	15
Indoxacarb 15.8% EC	333	12
Thiodicarb 75% WP	625-1000	30

Emamectin benzoate 5% SG	220	14
Flubendamide 480 %SC	100	10
Spinosad 480% SC	125-162	47
Lufenuron 5.5% EC	600	65
Methomil 40% SP	750-1125	7
Lambda cyhalothrin 5% EC	400-500	15
Monocrotophos 36% SL	1250	
Quinalphos 25% EC	1400	

Red gram podfly: ***Melagromyza obtusa***

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

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: Wilt, Yellow Mosaic

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

Yellow mosaic

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

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

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

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

x. IPM Module for management of weeds:

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

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

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Cultivation of crop as main pulse crop,
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables,
4. Oilseeds and pulse crop, Cluster based farming and Inter cropping

xii. Production constraints in agro-ecological region:

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

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

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

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Kabli chana-1, GNG-1969, Aman, GNG-1958, PG-186

iii. Existing package of practices being used:

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.

2. They also do not follow balance use of chemical fertilizers.
3. Due to lack of knowledge, most of the farmers adopt improper plant protection measures.

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

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

v. Major insect pests associated with crop: Pod borer

vi. IPM Module for management of insect pests :

G**ram Pod Borer; *H. armigera***

1. Field sanitation and deep ploughing in the summer
2. Adopt proper crop rotation
3. Weeds like *Melilotus*, *Vicia* and *Chenopodium* should be weeded between 30-40 days after sowing of the crop
4. Intercropping/mixed cropping with coriander, linseed, etc.
5. Early planting during mid- October to mid -November
6. Growing of marigold as trap crop to attract adults for egg laying. Later the trap crop should be removed.
7. Use of light trap for destruction of adult insects.
8. Setup pheromone traps @ 5-6 traps/ha for monitoring of adult of *H. armigera*
9. Conservation of natural enemies like *Campoletis chloridae,* Chrysopid, wasp, and spider
10. Chickpea intercropping with coriander and linseed attract more number of *Campoletis chloridae*.
11. Install bird perches @ 15-20/ha for the increasing bird population like black drongo, king crow, myna, Blue jay which preys upon larvae. But these pirches should be removed from the field at maturity of the crop
12. First spray with biorational insecticides like NPV@ 250 LE/ha /NSKE 5% /B.t. @ 1 kg formulation/ha with 0.1% UV retardant such as (Tinopal and 0.5% jaggery) during initial stages of flowering/ and podding stages of the crop to conserve natural enemies followed by need based, judicious and safe application of following any insecticide viz.

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

Bio-insecticides

Name of the Bio-Insecticides	**(gm/ml)/ha**

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

vii. Major disease associated with crop: Wilt

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

1. Deep ploughing in summer,
2. Crop rotation with paddy,
3. Drenching with Carbendazim 2 gm/liter,
4. Seed treatment with Carbendazim (1gm)+Thiram (2gm) per kg seed

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

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

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

x. IPM Module for management of weeds:

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

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

1. Sowing of crop in suitable cropping pattern under irrigated condition need to grow as main crop during rabi in line of wheat,
2. Inter cropping,
3. Judicious application of fertilizers,
4. Proper insect-pest and weed management

xii. Production constraints in agro-ecological region:

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

7E. Name of oilseed crop: Toria/sarson

i. Existing varieties being used: Rara,Gharia, Daind

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

iii. Existing package of practices being used:

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

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

1. Deep ploughing during summer months
2. **Land preparation:** One ploughing followed by 2-3 harrowings and planking; Using Zero till ferti- seed drill will increase farmers' income reducing the costs of planting and improving productivity.
3. **Sowing time to improve productivity and income:**
   a. ***Toria***: Last week of September.
   b. **Yellow *sarson* & *rai* (Mustard)**: First fortnight of October.
4. **Seed treatment**

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

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

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

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

Aphid *Lipaphis erysimi*

1. Sow tolerant varieties of *B.juncea* such as T6342, B85, RW-29-2.
2. As the cold and cloudy weather favours the pest multiplication, sowing the crop earlier than the normal sowing time escape the pest attack.
3. Removal of affected/ infected branches.
4. Conserve natural predators such as Coccinelid beetles and Syrphid flies

- Timely sowing of crop
- Removal & destruction of Aphid infested twigs at flowering and siliquae formation stages.
- 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

Hairy caterpillar

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

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

Monocrotophos 36 WSC 1250 ml/ha.

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

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

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

Alternaria blight or Leaf spot: ***Alternaria brassicae***

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

White rust : ***Albugo candida***

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

Downy mildew: ***Peronospora parasitica***

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

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

x. IPM Module for management of weeds:

1. Weed control- 1-2 manual weeding will control the weeds. Among the herbicides, Pendithemalin 30 EC @ 3.30 lt/ha at 0-3 DAS will also control the weeds.
2. Pre–emergence application of Pendimethalin @ 1kg *ai*/ha within two days of sowing. About 20-25 days after sowing a hand weeding be done along with the thinning operation to take out the emerged weeds.

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

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Oxadiargyl 6% EC	1500	35

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. Rice/Horsegram/Soybean- Rape seed/ mustard (rainfed),
4. Timely Sowing, Seed treatment,
5. Use of HYV, re sowing
6. Care soil & water conservation measures
7. INM (Maximum use of value added compost/FYM
8. and soluble fertiliser)
9. Integrated weed management and thinning

IPM

xii. Production constraints in agro-ecological region:

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

9F.Name of the oilseed crop: Til

i. **Existing varieties being used:** Type 78

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Shekhar, Pragati, RT-46, RT-351, RT-372, RT-375

iii. **Existing package of practices being used:** No use of fertilizer, Cultivation on marginal land with poor package practice.

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Use of HYV, Balanced use of Fertilizer.

v. **Major insect pests associated with crop:** Leaf roller, Fruit borer

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

Leaf roller

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Quinalphos 25%EC	2000	
Carbaryl 10 DP	25000	21

Fruit borer

Name of the Insecticides	(gm/ml)/ha	Waiting period (days)
Carbaryl 10 DP	25000	21

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

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

1. Sowing should be done at proper time.
2. Burning of infested plants.
3. Application of methyl-o- demeton 25 EC 1 lit./ha at 10-15 days interval.

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. Sowing of til should be done at 1st overnight of the July.
2. Fertilizers:
3. 30 Kg nitrogen
4. 15 Kg Phosphorus
5. 15 Kg Potash

xii. **Production constraints in agro-ecological region:**

1. Farmers don't follow proper package of practices,
2. Improper use of irrigation facilities.

8A.Name of the Fruit crop: Citrus

i. **Existing varieties being used:** Locally seeded variety

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

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

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

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

1. Proper planting distance,
2. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.

3. Use of micronutrients,
4. Need to develop Postharvest management system with minimum losses.

v. Major insect pests associated with crop: Citrus psylla, Lemon butterfly, white fly, leaf minor, scale

vi. IPM Module for management of insect pests:

Citrus psylla

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

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

Lemon butterfly:

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

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

Citrus white flies:

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

Scale insects:

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

Citrus leaf miner: *Phyllocnistis citrella*

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

vii. Major disease associated with crop: Citrus canker, Gummosis, Leaf spot

viii. IPM Module for management of disease:

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

Name of the Fungicides	(gm/ml)/ha
Copper oxychloride 50% WG (per lit)	2.50

Streptocyclin (Spray)	50-100 ppm

Gummosis : *Phytophthora citrophthora, P. palmivora, P. parasitica*

Name of the Fungicides	(gm/ml)/ha	Waiting period (days)
Aureofungin 46.15% SP (Drenching)	1%	30

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

x. IPM Module for management of weeds: Hand weeding

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

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

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

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

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

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

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

1. Proper orchard establishment,
2. Good orchard management liker proper fertilizer application, irrigation, pest and disease control etc.
3. Use of micronutrients,
4. Control of decline,

5. Need to develop Postharvest management system with minimum losses.

xii. Production constraints in agro-ecological region:

1. Availability of quality planting material,
2. Poor orchard management.

8b.Name of the Fruit crop: Mango

i. **Existing varieties being used:** Dashehari, Langra, Chausa, Bombay Green, Amrapalli, Mallika, Pusa Arunima, Ramkela (for pickles)

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

iii. Existing package of practices being used:

1. Traditional germplasm,
2. Application of FYM and fertilizers traditionally,
3. Lack of canopy management,
4. Maximum use of chemical pesticides,
5. Lack of timely application of modules of IPM,
6. Lack of Post Harvest Management practices,

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

1. Soil testing before plantation of orchard,
2. Proper layout and pit digging before establishment of orchard,
3. Introducing of elite quality of planting material with clonal root stock,
4. Adoption of high density plantation,
5. Installation of drip irrigation systems,
6. Scientific approach in nutrient and pest management,
7. Application of FYM, chemical fertilizer, micro nutrients in ring system.

v. Major insect pests associated with crop: Shoot gall psylla, Mango hopper,Mango fruit fly ,Mango mealy bug ,Mango stem borer

vi. IPM Module for management of insect pests :

Mango Hopper:

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

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

Mango mealy bug:

1. Ploughing of orchard in November.
2. Raking of soil around tree trunk to expose the eggs to natural enemies and sun, removal of

weeds.

3. Tree banding with 25 cm wide polythene/alkathene sheet (400 gauges) alongwith grease plastering during the first fortnight of December.
4. Releasing 10-15 grubs of coccinellid predator, *Cryptolaemus montrozieri per* tree.
5. Apply insecticides as recommended for mango hopper, if required.

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

Mango shoot gall:

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

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

Mango fruit fly:

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

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

Mango stem borer:

1. Pruning of old infested branches.
2. Scraping the loose bark to prevent oviposition by adult beetles.
3. Insert cotton plug soaked in kerosene or petrol or DDVP into the holes and paste them with mud.

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

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

Powdery mildew: *Oidium mangiferae*

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

Anthracnose: *Colletotrichum gloeosporioids*

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

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

x. IPM Module for management of weeds:

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

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

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

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

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

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

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

In the beginning period of newly established orchard (10yrs), the filler crops like papaya, guava, low chill peaches in plains while cultivation of vegetable crops i.e. potato, peas, urd, moong and beans etc in hills.

xii. Production constraints in agro-ecological region:

1. Old and Senile orchard.
2. Monoculture.
3. Lack of irrigation facilities.
4. Contract farming in fruits (Negligence of orchard by the contractor as well as orchardist)
5. Lack of pollinizers due to injudicious use of insecticides.
6. Poor supply of nutrition in rainfed areas.

7. Poor canopy management.
8. Incidence of Wild Animals.
9. Inter culture implements

8C. Name of the fodder crop: Guava

i. **Existing varieties being used:** Lucknow 49

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 Parbhat, Lalit, Allahabad Safeda, Lucknow-49, Lalit, Sweta and Allahabad Surkha

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

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

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

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

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

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

Guava fruit borer/ castor capsule borer:

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

Guava fruitfly:

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

vii. **Major disease associated with crop:** Anthracnose, Canker, Fruit Rotting, Wilt

viii. **IPM Module for management of disease:** Guava wilt disease in guava was effectively controlled by the application of *Bacillus amyloliquefaciens*, Compost and Pant bioagent-3 (Trichoderma harzianum + Pseudomonas fluorescens) in place of systemic fungicides like Carbendazim + Mancozeb, Propiconazole and Propiconazole + Carbendazim. Orchard Sanitation. Use of COC for Anthracnose and canker. Spraying of di thane M-45, Dithane Z-78 carbendazim etc. for fungal diseases.

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

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

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

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

Metsulfuron methyl 20 %WP	20
Orthosulfamuron 50% WG	150
Bensulfuron methyl 0.6% + Pretilachlor 6% G	10000

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

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

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

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

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

1. Crop regulation practices must be used for quality product
2. Enhancing the productivity by cultivating the filler and other vegetables and legumes crop as inter cropping.
3. HDD to be adopted by all farmers.

xii. Production constraints in agro-ecological region:

1. Orchard implements and labour
2. Lack of QPM.
3. Lack of irrigation facilities.
4. Fruit Fly is a major constraints during rainy season crops

9A. Name of the vegetable crop: Cabbage

i. Existing varieties being used: Pride of India, Golden Acre

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Hybrid 75,Varun, Arun, Krishna, Kaveri, Supreme, Karuna plus and other area specific.

iii. Existing package of practices being used:

1. No proper spacing is maintained during nursery.
2. Traditional nutrient application system.

3. Traditional method of transplanting.
4. Sowing without seed treatment.
5. Lack of irrigation

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

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

v. Major insect pests associated with crop: Diamond back moth, cabbage butterfly, Aphid

vi. IPM Module for management of insect pests :

Before Planting

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

After Planting

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

Dimond back moth: *Plutella Xyllostella*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	50	3
Cyantraniliprole 10.26% OD	600	5
Indoxacarb 14.5% SC	200-266	7
Indoxacarb 15.8% EC	266	5

Spinosad 2.5% SC	600-700	3
Chhlorfenapyr 10% SC	750-1000	7
Emamectin benzoate 5% SG	150-200	3
Flubendamide 480% SC	45-60	7
Flubendamide 20% WG	90-120	7
Chlofluazuron 5.4% EC	1500	7
Diafenthiuron 50% WP	600	7
Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

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

Cabbage/cauliflower Aphid

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

Bioinsecticides

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

vii.Major disease associated with crop: Stem rot, black rot, Downey mildew

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

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

Downy Mildew:

1. Burn the infected crop debris,
2. Spray of mancozeb @ 2.5 gm/litre at initial stage of disease appearance.

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

x. IPM Module for management of weeds:

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

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

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

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

1. Advanced technical package and practises regarding crop.
2. Use of trap crop like radish to attract the cabbage butterfly.

xii. Production constraints in agro-ecological region:

1. Erratic Fertilizer Availability.
2. Inadequate supply of nutrients as per their requirement in the case of hybrid crop.
3. Damaged by wild life animal.
4. Availability of means/market.

9B. Name of the vegetable crop: Cauliflower

i. Existing varieties being used: Snowball 16 , Super snow ball

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Gauri (Hybrid), Himani, Snow crown, Snow white , Padmini, Synthetic 200

iii. Existing package of practices being used:

1. Nursery production.
2. Preparation of field.
3. Transplanting of seedlings.
4. Pest Management.

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

1. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
3. Seed- Farmers should use improved varieties/ hybrids
4. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of

sterilization at low cast.

5. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma Viride 4g/kg before sowing.
6. Seed Rate- It is recommended to use the seed quantity for different as follows-
   Cauliflower (Early)-500-750g/ ha open pollinated.
   Cauliflower (Mid and Late)- 300-350g/ha open pollinated.
   Cauliflower (Hybrid)-250-300g/ha.
7. Varieties- Farmers should select proper variety for suitable sowing time as per maturity group.
8. Transplanting- Farmers should transplant seedlings properly as for early (30x30cm), medium (45x30cm), and late (60 x 45 cm).
9. Manures and fertilizers- Farmers should incorporate well rotten cow dung (15-20tonnes/ha) and NPK (150:80:60) in irrigated, half dose of NPK in un irrigated condition.
10. Irrigation- Farmers should apply water in the field at proper stage of the crop. As critical growing stage such as proper growing stage, curd formation and maturity stages.
11. Weed control- Farmers must know about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically.
12. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

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

vi. IPM Module for management of insect pests :

Before Planting

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

After Planting

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

Dimond back moth: ***Plutella Xyllostella***

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

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

Bioinsecticides

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

Tobacco caterpillar (*Spodoptera litura*)

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 5% (Neem extract concentrate containing)	200	5

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: *Sclerotenia* stem rot, *Xanthomonas* Black rot and Downy Mildew

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

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

Downy Mildew:

1. Burn the infected crop debris,
2. Spray of mancozeb @ 2.5 gm/litre at initial stage of disease appearance.

ix.Major weeds associated with crop: *Parthenium, Chenopodium album*, Krishnil, Teepatiya Captan 75 WP 2-3 gm/kg seed.

x. IPM Module for management of weeds:

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

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

Name of the 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. Advanced technical package and practises regarding crop.
2. Use of trap crop like radish to attract the white butterfly.

xii. Production constraints in agro-ecological region:

1. Inadequate supply of nutrients as per their requirement in the case of hybrid crop.
2. Damaged by wild life animal.
3. Availability of means by market.

9C. Name of the vegetable crop: Tomato

i. Existing varieties being used: Private company varieties like Himsona, Rakshhak etc.

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Available good yielding varieties like Naveen2000+Himsona etc should be used from private sector and varieties like Pusa Sheetal, Pusa Gaurave, Pant T-3 should be used from Government sector.

iii. Existing package of practices being used:

1. FYM manuring.
2. Generally crop grown in open field condition.
3. Sowing time- Oct-Nov. and Jan-Feb.
4. Sowing space-75x60 cm and 75x45 cm.
5. Nursery Management.
6. Preparation of field.
7. Plantation of under field condition on ridges as well as poly houses.
8. Management of wooden stick for stacking.
9. Irrigation through gal and sense with sprinkler.
10. Injudicious use of pesticides.

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

1. Balanced nutrient fertilization, area specific time of planting
2. Use Indeterminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition. Use Zn in deficient soil.
3. Use micronutrient including Ca, B and Mo.
4. Crop rotation Tomato-cowpea-Early cauliflower.

v. Major insect pests associated with crop: Fruit borer and white flies and other sucking insect pest

vi. IPM Module for management of insect pests:

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

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

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

Management strategies(white fly and other sucking pests)

A. Crop Hygiene

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

B. Other Cultural Control Practices

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

C. Insecticidal Control Practices.

1. Restricted the use of neonicotinoids (imidacloprid or acetamiprid) in the field only during the first

six weeks of the crop thus leaving a neonicotinoid-free period at the end of the crops.

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

White fly

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

Leaf miner, *Liriomyza trifoli*

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

Aphid, *Aphis gossypii*

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

Thrips, *Thrips tabaci*

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

vii. Major disease associated with crop: Late blight, Early blight, Buckeye fruit rot is a major serious disease.

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

Buck eye rot:

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

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

Late blight :

1. Burn the infected crop debris,
2. A void excess moisture.

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Famoxadone 16.6%+ Cymoxanil 22.1% SC	500	3
Cymoxanil 8%+ Mancozeb 64% WP	1500	10
Ametoctradin + Dimethomorph 20.27% SC	800-1000	32
Azoxystrobin 23% SC	500	3
Cyazafamid 34.5% SC	200	3-5
Mandipropamid 23.4% SC	0.08%	5

Captan 50% WP	2500	
Copperoxychloride 50% WP	1250	
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Azoxystrobin 18.2%+ Difenoconazole 18.2% SC	0.1%	5

Early Blight :

1. Use of resistant varieties,
2. Burn the weeds & infected crop debris.

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Azoxystrobin 23% SC	500	3
Pyraclostrobin 20% WG	375-500	3
Iprodione 50% WP	1500	15
Kitazin 48% EC	1000	5
Mancozeb 75% WP	1000	5-6
Mancozeb 35% SC	0.5%	10
Metiram 70% WG	2500	6
Metiram 55% + Pyraclostrobin 5% WG	1500-1750	5
Famoxadone 16.6%+ Cymoxanil 22.1% SC	500	3
Zineb 75% WP	1500-2000	
Ziram 80% WP	1500-2000	3
Captan 50% WP	2500	
Copperoxychloride 50% WP	1250	
Azoxystrobin 18.2%+ Difenoconazole 18.2% SC	0.1%	5

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

x. IPM Module for management of weeds:

1. Cultural practices.
2. Through recommended chemicals.

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

1. Grow under naturally ventilated polyhouse by adjusting the time of planting so that crop may get ready during May-August depending upon altitude and climate
2. Reduce number of spray of pesticides.
3. Raise nursery on treated soil.
4. Treat seed with fungicide before sowing.
5. Manage fog during fruiting period.

xii. Production constraints in agro-ecological region:

1. Poor marketing channel. Monkey and wild animal menace, scattered land,
2. Imbalance use of fertilizes.
3. More numbers of pesticides' spray.
4. Increase incidences of Bacterial wilt.
5. Intensive raising of tomato crop which leads inefficient management of nutrition in the soil.

9D. Name of the vegetable crop: Brinjal

i. Existing varieties being used: Kanchan 75, Navkiran

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Navkiran, Brinjal 704 (SunGro Seed),

Navina, VNR212 (VNR Seed), IndameSupriya (Indo-American), Pant Rituraj, Pant Samrat (Pantnagar), Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used:

1. Soil Testing-Farmers do not test their soil.
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Nursery- Nursery soil generally not sterilized by the farmers.
4. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
5. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
6. Sowing time: Dec-Jan, June-July.
7. Transplanting- Farmers practices improper planting distance.
8. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
9. Fertilizers: Farmer use imbalance fertilizer
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control.
12. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

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

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

v. Major insect pests associated with crop: Shoot and fruit 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
11. If still the infestation persist spray following insecticides that are highly effective against borer complex.

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

vii. Major disease associated with crop: Phomopsis blight and leaf curl

viii. IPM Module for management of disease:

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

Blight

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

ix. Major weeds associated with crop: *Euphorbia hirta, Cynadon dactylon*, *Cyperus rotundus, Oxalis*

x. IPM Module for management of weeds:

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

5. Two-three hoeing and the earthing up are required to keep the crop free of weeds.
6. Preemergence application of Fluchloralin (1.5 kg a.i./ha) coupled with one hand weeding 30 days after transplanting is effective for control of weeds

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

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

xii. Production constraints in agro-ecological region:

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

9E. Name of the vegetable crop: Chilli

i. **Existing varieties being used:** Local, Andhara Jyoti, LCA-206

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Kashi Anmol, Pant C-1, Tajwasni, Pusa Sadabhar, Punjab Lal, Panjab Surkh, CH-1 and CH-3

iii. Existing package of practices being used:

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

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. Transplant the seedlings when they attain 5-6 leaf stage with proper spacing.
4. Dwarf varieties like Kashi Anmol at 45 x 30 cm.
5. Tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm and cluster bearing type like local strain Lakhaur mirch.
6. Use of high dose of organic manure i.e. 200 q/Ha increases productivity and incidence of dieback and Anthracnose.
7. Apply recommended dose of fertilizer (15-20 t FYM + 120: 60:60NPK/ha) after soil test in irrigated condition, whereas under un irrigated condition apply half dose of recommended NPK.

v. Major insect pests associated with crop: Thrips problem is major problem, Aphids, White fly

vi. IPM Module for management of insect pests:

Management strategies sucking pests

A. Crop Hygiene

1. Field hygiene should be a high priority and should be included as an integral part of the overall strategy for managing whitefly populations, Tomato yellow leaf curl virus (TYLCV) incidence,

and insecticide resistance.

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

B. Other Cultural Control Practices

Use proper pre-planting practices.

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

Use proper post-planting practices.

1. Apply an effective insecticide to kill whitefly adults prior to cultural manipulations such as pruning, tying, etc.
2. Plants should be treated for whitefly adults prior to rouging and, if nymphs are present, should be removed from the field, preferably in plastic bags, and disposed of as far from production fields as possible.
3. Manage weeds within crops to minimize interference with spraying and to eliminate alternative whitefly and virus host plants.
4. Destroy old crops within 5 days after harvest, destroy whitefly infested abandoned crops.

Chilli thrips, *Scirtothrips dorsalis* Hood

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

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

Aphid

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

White fly

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

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

viii. IPM Module for management of disease:

Dieback

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

Anthracnose

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

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

x. IPM Module for management of weeds: Manual weeding

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

1. Grow high yielding varieties.
2. Treat the seed with copper containing fungicides before sowing.
3. Adopt soil testing.
4. Transplant one seedling at one place.
5. Transplant the seedlings when they attain 5-6 leaf stage.
6. Transplant the seedlings at proper spacing.

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.

9F. Name of the vegetable crop: Capsicum

i. Existing varieties being used: Local

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:
Yellow Wonder, Pusa Dipti, Bharat, Indira, Aasha

iii. Existing package of practices being used:

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

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

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

vi. IPM Module for management of insect pests:

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

vii. Major disease associated with crop: Anthracnose, Wilt, Leaf sopts

viii. IPM Module for management of disease:

Seed treatment with bavistin @ 2.5 gm./kg. And spray of crops with Streptocyclim @ 150 mg./litt.

Dead crop residues should be burnt

ix. Major weeds associated with crop: Seasonal weeds

x. IPM Module for management of weeds:

1. Manual weeding.
2. Seed treatment with bavistin @ 2.5 gm./kg. And spray of crops with Streptocyclim @ 150 mg./lit.
3. Dead crop residues should be burnt.

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

1. Use of high yielding varieties grown under ventilated polyhouse using standardized technology with fertigation technology in capsicum can enhance the productivity of capsicum manifold.
2. Polyhouse technology is a boon for small and marginal farmers with fragmented holdings.

xii. Production constraints in agro-ecological region:

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

9G. Name of the vegetable crop: Cucumber

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

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Saira, Kareena, Pant hybrid 1, Kamini, Nandini

iii. Existing package of practices being used:

1. Nursery Management.
2. Preparation of field.
3. Earthing of plant.
4. Plant protection measures.
5. Irrigation through gal and sense with sprinkler.
6. Injudicious use of pesticides

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

1. Use of area specific high yielding hybrid varieties.
2. Intervention of INM/IPM.
3. Use of poly houses / poly tunnel.
4. Intervention of organic intervention i.e. pesticides, organic nutrient, vermin compost.
5. Installation of sprinkler, Drip for irrigation.
6. Installation of pheromone traps to monitor the incidence of borer..

v. Major insect pests associated with crop: Red spider mite, Leaf miner, aphid, 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.

Aphid

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Imidacloprid 70% WG	35	5

Jassid

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Imidacloprid 70% WG	35	5

Red pumpkin beetle

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

Dichlorovos 76% SC	500	627

vii. Major disease associated with crop: Leaf spot, Wilt, Mildew, Mosaic

viii. IPM Module for management of disease:

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

Leaf spot

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

Downy mildew

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

Powdery mildew

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

ix. Major weeds associated with crop: *Trifolium alexenderium, 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. Intervention of improved varieties,
2. Advanced plant protection measures,
3. Reduce the pesticide loads to innovative interventions,
4. Use of organic nutrients.

xii. Production constraints in agro-ecological region:

1. Lack of irrigation.
2. Lack of marketing.
3. Lack of FYM and nutrients.
4. Lack of mechanization.
5. Small and scattered land holdings.
6. Rainfed cultivation.

9H. Name of the vegetable crop: Pumpkin

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

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Kashi Harit, Pusa Vikash, Punjab Samrat, BBS-750, BSB-950, VNR-14, Sonia F_1, Yuvraj, F_1-PU-1296, F_1 Banarasi, Surya, Mehek etc.

iii. Existing package of practices being used:

1. Absence of crop rotation.
2. Random selection of variety (May or may not be suited to Agroeco-region).
3. Untimely sowing / planting of crop.
4. Use of untreated seed.
5. Unbalanced use of fertilizers.
6. Use of plant protection chemicals having long wetting period.
7. Use of traditional irrigation system.

8. No soil solarisation/ treatment during lean period.

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

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

v. Major insect pests associated with crop: Red pumpkin beetle, caterpillars, fruit fly

vi. IPM Module for management of insect pests:

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

Red pumpkin beetle

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

vii. Major disease associated with crop: Powdery Mildew, Downy Mildew

viii. IPM Module for management of disease:

Downy mildew

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

Powdery mildew

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

ix. Major weeds associated with crop: *Cyperus rotundus,* Local weeds

x. IPM Module for management of weeds: Manual weeding.

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

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

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

1. Use of well designed and recommended protected technology suited to area i. e poly houses,

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

xii. Production constraints in agro-ecological region:

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

9I. Name of the vegetable crop: Pea

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

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VL Ageti Matar 7 and VL Matar 10

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

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

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. Treating the seed with 2 g Thiram /kg of seed and rhizobium culture if being sown in field for first time and sow in the month of March.
4. If available, at least one ton of farmyard manure per ha should be incorporated in the soil at the

time of land preparation.

5. Add fertilizers containing NPK as 30: 70: 50 kg/ha all apply as basal dose.
6. Water the crop as per need especially during flowering and pod setting. Use Pendamethaline @ 1kg ai/ ha as pre-emergence and one hoeing 25-30 days after sowing

v. Major insect pests associated with crop: Leaf miner , stem fly

vi. IPM Module for management of insect pests:

Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing. Spray of Dimethoate 0.01% or Imidacloprid 1 ml/lit.

vii. Major disease associated with crop: Powdery mildew in all agroecological situations
Fusarium wilt in autumn sown crop

viii. IPM Module for management of disease:

1. Use of oganic inputs only
2. Use of rust and powdery mldew resistant strains.
3. Use TH colonized compost.

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: Seasonal weeds

x. IPM Module for management of weeds:

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

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

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

xii. Production constraints in agro-ecological region:

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

10A.Name of the fodder crop: Berseem

i. Existing varieties being used: Mescavi, Vardan

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Ludhiana Berseem-1 (BL-1), BL-10, BL-22, JB-1, JB-2, JB-3, IGFRI-99

iii. Existing package of practices being used: Not any

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

1. Soil : loam to clay soil
2. Field preparation: 3-4 Harrowing + Leveling the field.
3. HYVS. – Mescavi, Vardan. BL-10, 22,42, 180, Pusa Gaint & Bundel Berseem 243
4. Seed rate: 25-30 kg/ha
5. Sowing method:
   a. Wet method-like rice in puddled field
   b. Dry method: Without puddled.
6. Broad casting
7. Sowing time: First an week of October
8. Fertilizer: 30:60:70:: N:P2O5 K2O kg/ha
9. Irrigation: Field should remain at field capacity throughout the crop period after germination.
10. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.

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

v. Major insect pests associated with crop: Black Ants, Surface Grass Hoppers, Gram caterpillar

vi. IPM Module for management of insect pests:

Black Ants: To destroy mix 5% Malathion dust @25kg/ha

Surface Grass Hoppers: Spray of 1250 ML of Malathion 50 EC in 750 litre of water

Gram caterpillar: Triazophos 40 EC @ 2.5 ml/lit

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

viii. **IPM Module for management of disease:** 0.4% solution of Brasicol (4 g/liter water)

ix. Major weeds associated with crop: Nil

x. IPM Module for management of weeds: Nil

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

xii. Production constraints in agro-ecological region: Wild animal menace

10B.Name of the fodder crop: Maize

i. **Existing varieties being used:** Shankar, Naveen

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

iii. Existing package of practices being used: Mixed cropping

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

1. Soil: Well drained alluvial soil with soil PH 5.5-7.5.
2. Field preparation: 4-5 harrowing + leveling
3. HYVS: African Tall, J-1006. Pratap Makka Chari-b.
4. Seed rate: 50kg/ha
5. Spacing : 30-45 cm (row to row distanced)
   10-15 cm (plant to plant)
6. Sowing time
   Rainfed: Onset of monsoon
   Irrigated : Feb to July
7. Sowing method : Line sowing is proposed over broadcasting
8. Fertilizer : 100-120 : 60:40: 20::: P2O5 : K2O: ZnSo4 kg/ha
9. Irrigation : Fodder maize grown under irrigated condition should be irrigated at 20 days interval. Spring/summer crop requires 5-6 irrigations.
10. Weed control: Pendimethalin @ 0.75 kg ai/ha (PE) application.
11. Harvesting: The crop should be harvested at tasseling /silling stage or 50-55 days after sowing.
12. Yield: Green fodder : 350-450q/ha.

v. Major insect pests associated with crop: Stemborer, shootfly

vi. IPM Module for management of insect pests: Stemborer: Carbofuran 3G 33 kg/ha, Fly: Monocrotophos 36 SL 625 ml/liter

vii. Major disease associated with crop: Leaf blight, seedling blight

viii. IPM Module for management of disease:

Mancozeb 75WP @ 1.5-2.0 kg/ha,

Seed treatment with thiram 75 WS @ 2.5-3.0 gm/kg

ix. Major weeds associated with crop: Seasonal weed

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

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

Use of Balanced Fertilizers,
Use of Improved seed

xii. Production constraints in agro-ecological region:
Non availability of improved seeds.

10C.Name of the fodder crop: Oat

i. Existing varieties being used: Kent

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: UPO212

iii. Existing package of practices being used:

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

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

v. Major insect pests associated with crop:

vi. IPM Module for management of insect pests:

vii. Major disease associated with crop:

viii. IPM Module for management of disease:

ix. Major weeds associated with crop: Local weeds

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

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Use of balanced fertilizers, use of improved seed, Line sowing.

xii. Production constraints in agro-ecological region: Non availability of improved seeds.

10D.Name of the crop: Sorghum

i. **Existing varieties being used:** Local, MP chari

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

iii. Existing package of practices being used: Broadcasting without fertilizers

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

1. Soil : Loam Soil
2. Field Preparation: 2-3 harrowing followed by leveling
3. High Yielding Varieties
   Single cut- Pusa Chari- 1, 6,423, Pant Chari- 3,4,7 &8
   Multi cut- SSG-59-3, PCH-106,Safed Moti, PC-5,COFS-29 CSH 20MF, CSH 24MF, Harasona
4. Seed rate: 10 kg/ha
5. Spacing : 30-45 cm line to line
6. Sowing time:
   June-July- Rainfed condition
   Feb-July- Irrigated condition
7. Fertilizer: 100-120: 60:40::N:P_2O_5 : K_2O kg/ha
8. Irrigation:
   Rainfed: Not required
   Irrigated: 20-25 days interval
9. Cutting management :
   Single cut: At 50% flowering stage

Multi cut- 45 days after sowing first cut & subsequent cutting at 25-30 days interval. Total 2-3 cutting are taken

Note: After each cut, crop should be top dressed with 30 kg/N/ha after irrigation

v. **Major insect pests associated with crop:** Early shoot borer

vi. **IPM Module for management of insect pests:** *Beauvaria basiana* @ 5gm/liter, Apply Neem Oil

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

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

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

x. **IPM Module for management of weeds:** Nil

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Use of Balanced Fertilizers, Use of Improved seed.

xii. **Production constraints in agro-ecological region:** Absence of local pharmaceutical production.

11A. Name of the Medicinal crop: Tejpatta

i. **Existing varieties being used:** Hybrid Napier 3

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Hybrid Napier-5, Hybrid Napier-6

iii. **Existing package of practices being used:** Sowing at field boundaries without sowing at use of fertilizer.

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

1.Soil : Loam soils to clay soil

2.Field preparation : 2-3 Harrowing + leveling

3. HYVS: Phule Jaywant, NB-37, CO-3, BAIF-10, PBN-83, PBN 233, Hybrid-3 Napier.

4.Seed rate: 40000 rooted slips or stem cutting (3 buds)/ha

5.Spacing : 75 cm x 50cm

6.Sowing time: Onset of monsoon or month of February

7. Fertilizers: 60kg/ha + 60 kg P2O5 + 40kg K2O/ha at sowing time followed by 30kgN top dressing after each cut.

8. Irrigation: Irrigate crop after each 20-25 days interval during summer season. Normally irrigation is not required during rainy season.

9. Cutting management: First cut after 50-55 days of sowing and subsequent cuttings are taken after 30 days interval.

10.Yield: 1500-2000q/ha green forage

vi. **Major insect pests associated with crop:** Stemborer, shootfly, earhead catter pillar

vii. **IPM Module for management of insect pests:** Cabofuran 3G 10 kg/ha, Imidacloprid WS 10gm/kg seed treatment

viii. **Major disease associated with crop:** Red leaf spot, leaf blight and seedling blight

ix. **IPM Module for management of disease:** Mancozab 75WP @ 1.5-2.0 kg/ha

x. **Major weeds associated with crop:**

xi. **IPM Module for management of weeds:**

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

xiii. **Production constraints in agro-ecological region:** Absence of local pharmaceutical production.

11B. Name of the Medicinal crop: Pili satavar

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

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** CIM Sunhari and local planting material
iii. **Existing package of practices being used:** No proper management
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
1. Viability of seed should be ensured.
2. Duration of the crop should be maintained at least for two year.
3. Earthing up is one of the important practice for increasing productivity of crop.
4. Intercropping of shallow rooted crops/vegetable is advisable during 1st year of crop cultivation

v. **Major insect pests associated with crop:**
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:**
ix. **Major weeds associated with crop:**
x. **IPM Module for management of weeds:**
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Natural reserves and wild nurseries to retain the medical efficacy of plants in their natural habitats
xii. **Production constraints in agro-ecological region:** Absence of local pharmaceutical production.

11C. Name of the Medicinal crop: Aloevera

i. **Existing varieties being used:** Local, *Aloe barbedensis*
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** CIM Sheetal / local collection
iii. **Existing package of practices being used:** No proper management
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
1. Preferable crop for water logging conditions.
2. Water logging should be avoided and light textured soils be preferred for better growth and productivity.
3. The crop should be protected from frost conditions by application of irrigation as and when required.
4. To get quality produce (Gel) post harvest arrangement before or just after harvest need to be ensured.

v. **Major insect pests associated with crop:**
vi. **IPM Module for management of insect pests:**
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:**
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Natural reserves and wild nurseries to retain the medical efficacy of plants in their natural habitats
xii. **Production constraints in agro-ecological region:** Absence of local pharmaceutical production.

12A. Name of the Floriculture crop: Gerbera

i. **Existing varieties being used:** Commercial varieties available with private companies
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Commercial varieties available with private companies but always include 4-5 different coloured varieties to meet the diverse

demand of market[May be procured from KF Bioplants Pvt Ltd. Bangalore/ Sheel Biotech, New Delhi

iii. **Existing package of practices being used:** Raising crop in Poly house with package of practice provided by private firms who supply planting material

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

1. Soil test based micronutrient application, 50% shade net to be used for better quality and yield,
2. Soil sterilization with formaldehyde (2%),
3. Depth of planting should ensure 25% collar portion to be above soil,
4. Drip system of irrigation

v. **Major insect pests associated with crop:** White fly, Leaf minor, Roof Knot Nematode

vi. **IPM Module for management of insect pests:** Diamethoate @ 0.1%, Mocap @ 400-800 ppm

vii. **Major disease associated with crop:** Root rot, Foot rot

viii. **IPM Module for management of disease:** Seed sterilization with vapam @100 ml/m^2

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

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

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

1. Clubbing of 4-5 different coloured varieties,
2. Drip irrigation,
3. Soil test based fertilizer application,
4. Uprooting and division of clumps of 3-year-old plantation and their replanting for rejuvenation of crop and reduced cost of planting material.

xii. **Production constraints in agro-ecological region:**

1. High cost of planting material and high initial cost of poly house/ net house,
2. Heavy feeder and labour intensive crop,
3. Problem of thrips and mites bother the farmers.

12B. Name of the Floriculture crop: Rose

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

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

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

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

1. Plant density 6-9 plants per square meter area in polyhouse.
2. Soil test based micronutrient application,
3. soil sterilization with formaldehyde (2%).

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

vi. **IPM Module for management of insect pests:** Imidacloprid 17.8 @ 6 ml/10 liter

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

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

1. Cutting of infected branches and borer,
2. Spray of Dithane M 45 @20 gm/10 litre water at thrice at 15 days interval.

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

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

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

1. Clubbing of 4-5 different coloured varieties,

2. Drip irrigation,
3. Soil test based fertilizer application,

xii. Production constraints in agro-ecological region:

1. High cost of planting material and high initial cost of poly house/ net house,
2. Heavy feeder and labour intensive crop,
3. Problem of thrips and mites bother the farmers.

12C. Name of the Floriculture crop: Marigold

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

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

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

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

1. Soil test based micronutrient application,
2. soil sterilization with formaldehyde (2%).

v. Major insect pests associated with crop: Red spider mite

vi. **IPM Module for management of insect pests:** Kalthane @ 2 ml/liter

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

viii. IPM Module for management of disease: Sulfex @ 3gm/liter

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:
Soil test based fertilizer application,

xii. Production constraints in agro-ecological region: Problem of thrips and powdery mildew bother the farmers

C1. Livestock: Cattle

1.A Existing breeds available: Sahiwal ,Red Sindhi, Badri, Jersy cross

1.B Specific breeds to be introduced: Rathi , Jersy

2.A Existing feeds being used: Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)

2.B Specific feeds to be introduced / advised:

Green fodder

UMMB (qtl),

3.A Existing health services:

Diseases covered under vaccination: FMD, BQ and HS

Deworming schedule: As such no schedule is followed (lack of awareness)

Other Disease Control Programs/ Health Camps (criteria, target): Camps organised for treatment of infectious, metabolic & deficiency diseases from time to time

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

One camp at each Veterinary Hospital/Pashu Sewa Kendra/month

4.A Existing management practices:

Housing, hygiene, drainage: Conventional housing made up mostly of Bricks with uneven floors and no proper ventilation/drainage leading to poor hygiene

Feeding & watering practice: No proper mangers or waterers and other equipments

Welfare aspects: Rearing animal without proper facilities.

Leaving animals free in the streets daily , capturing for getting production , leaving free to suffer whole day and night also exposed to heavy traffic many times get injured.

Leaving Free male calves for ever to suffer.

Unhygienic animal rearing exposure to multiple infection, lower the immunity of animals resulting into illness.

Sometimes Offences or cruelty against animals also occurs.

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

1. Promotion of well equipped large dairy farms.
2. Specific dairy zone must be developed somewhat far from dense residential areas.
3. Modern scientific management practices should be promoted in the zone
4. All the dairy farmers must be registered with concerned department.
5. Non acceptance of disease prevention and control
6. Activities of concerned department must be punishable in practically implementable manner.
7. Proper drainage, hygiene, sanitation and regular disinfection must be legal compulsion for all the members.
8. Milk quality and purity diagnostic kit must be made easily available to general public at nominal cost to discourage an illegal parallel fraudulent milk market, ultimately protecting pure milk produces from undue low milk prices.
9. Development of a fair price marketing channel available to animal farmers has a great potential to increase farmer income.

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: At present most of the animals in all the three regions suffer from internal and external parasites, bacterial and viral infection as well as infertility problem i.e. repeats breeding, dystocika, retention of placenta.

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of local available good quality grains without socking in water to decrease the digestibility of the concentrate

C2. Livestock: Buffalo

1.A Existing breeds available: Non-Descript, Murrah cross ,Murrah

1.B Specific breeds to be introduced: Strengthening toward more pure Murrah

2.A Existing feeds being used: Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)

2.B Specific feeds to be introduced / advised:

Green fodder,
Dry fodder,
Complete feed blocks (qtl),
UMMB (qtl),

3.A Existing health services:

Diseases covered under vaccination: FMD, BQ and HS

Deworming schedule: As such no schedule is followed (lack of awareness)

Other Disease Control Programs/ Health Camps (criteria, target): Camps organised for treatment of infectious, metabolic and deficiency diseases from time to time

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

One camp at each Veterinary Hospital/Pashu Sewa Kendra/month

4.A Existing management practices:

Housing, hygiene, drainage: Conventional housing made up mostly of Bricks with uneven floors and no proper ventilation/drainage leading to poor hygiene

Feeding & watering practice: No proper mangers or waterers and other equipments

Welfare aspects: Rearing animal without proper facilities.

Leaving animals free in the streets daily , capturing for getting production , leaving free to suffer whole day and night also exposed to heavy traffic many times get injured.

Leaving Free male calves for ever to suffer.

Unhygienic animal rearing, exposure to multiple infection, lower the immunity of animals resulting into illness. Sometimes Offences or cruelty against animals also occurs

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

1. Promotion of well equipped large dairy farms.
2. Specific dairy zone must be developed somewhat far from dense residential areas.
3. Modern scientific management practices should be promoted in the zone.
4. All the dairy farmers must be registered with concerned department.
5. Non acceptance of disease prevention and control.
6. Activities of concerned department must be punishable in practically implementable manner.
7. Proper drainage, hygiene, sanitation and regular disinfection must be legal compulsion for all the members.
8. Milk quality and purity diagnostic kit must be made easily available to general public at nominal cost to discourage an illegal parallel fraudulent milk market, ultimately protecting pure milk produces from undue low milk prices.
9. Development of a fair price marketing channel available to animal farmers have a great potential to increase farmer income

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: At present most of the animals in all the three regions suffer from internal and external parasites, bacterial and viral infection as well as infertility problem i.e. repeats breeding, dystocika, retention of placenta.

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of local available good quality grains without socking in water to decrease the digestibility of the concentrate

C3. Livestock: Sheep

1.A Existing breeds available: - Non Descript

1.B Specific breeds to be introduced: Nil

2.A Existing feeds being used: Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)

2.B Specific feeds to be introduced / advised:

Green fodder,

Dry fodder,

3.A Existing health services:

Housing, hygiene, drainage: No seperate barn (house)is their, kept along with large animal.

Feeding & watering practice: Stall-fed and intensive production system. Semi-intensive production system , both the system of rearing are practised

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

Diseases covered under vaccination: PPR and FMD

Deworming schedule: As such no schedule is followed (lack of awareness)

Other Disease Control Programs/ Health Camps (criteria, target): Treatment Camps Organised Under Ahilya Bai Holker Scheme

4.A Existing management practices:

Housing, hygiene, drainage: Conventional housing made up mostly of Bricks with uneven floors and no proper ventilation/drainage leading to poor hygiene

Feeding & watering practice: No proper mangers or waterers and other equipments

Welfare aspects: Offences or cruelty against animals is not common

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

1. Promotion of well equipped large dairy farms.

2. Specific dairy zone must be developed somewhat far from dense residential areas.
3. Modern scientific management practices should be promoted in the zone.
4. Proper drainage, hygiene, sanitation and regular disinfection must be legal compulsion for all the members.

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: At present most of the animals in all the three regions suffer from internal and external parasites, bacterial and viral infection.

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of local available good quality grains without socking in water to decrease the digestibility of the concentrate

C4. Livestock: Goat

1.A Existing breeds available: Non-Descript, BARBERI, Sirohi

1.B Specific breeds to be introduced: Jamunapari and beetal

2.A Existing feeds being used: Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)

2.B Specific feeds to be introduced / advised:

Green fodder,

Dry fodder,

3.A Existing health services:

Diseases covered under vaccination: PPR, FMD, Pneumonia, ecto and endo parasitic diseases

Deworming schedule: -

Other Disease Control Programmes/ Health Camps: Treatment camps organised under Ahilya Bai Holker scheme

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

4.A Existing management practices:

Housing, hygiene, drainage: Conventional housing made up mostly of Bricks with uneven floors and no proper ventilation/drainage leading to poor hygiene

Feeding & watering practice: No proper mangers or waterers and other equipments

Welfare aspects: Offences or cruelty against animals is not common

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

1. Promotion of well equipped large dairy farms.
2. Specific dairy zone must be developed somewhat far from dense residential areas.
3. Modern scientific management practices should be promoted in the zone.
4. Proper drainage, hygiene, sanitation and regular disinfection must be legal compulsion for all the members.

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: At present most of the animals in all the three regions suffer from internal and external parasites, bacterial and viral infection.

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of local available good quality grains without socking in water to decrease the digestibility of the concentrate

C5. Livestock: Pig

1.A Existing breeds available: Non Descript , white Yorkshire

1.B Specific breeds to be introduced: white Yorkshire on large scale

2.A Existing feeds being used: Feed on waste food

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

3.A Existing health services:

Diseases covered under vaccination: Swine farming training

Deworming schedule: Available at hospital on demand

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

region: Starting regular vaccination programme registeration of swine farmers

4.A Existing management practices:

Housing, hygiene, drainage: unplanned or self estimated by uneducated pg farmers Feeding & watering practice: non scientific manner of feeding

Welfare aspects: Unorganised meat shops do the practice in an unhygienic way

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

Proper drainage, hygiene, sanitation and regular disinfection must be legal compulsion for all the members.

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: At present most of the animals in all the three regions suffer from internal and external parasites, bacterial and viral infection.

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of local available good quality food

C6. Livestock: Poultry

1.A Existing breeds available: Non-Descript, Kroiler and broiler

1.B Specific breeds to be introduced: Kroiler & Broiler

2.A Existing feeds being used:

2.B Specific feeds to be introduced / advised:

3.A Existing health services:

3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region: Routine Schedule as proposed should be followed

4.A Existing management practices:

Housing, hygiene, drainage: Lack of proper housing

Feeding & watering practice: Non scientific and irrational feeding and watering patterns are prevalent in the area

Others: Intensive poultry farming advance training must be given before starting enterprises

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

1. Feeding good quality feed.
2. Early weight gain more profit,
3. Better hatching capacity.
4. Maintaining proper floor space and housing of the chicks.

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: At present most of the animals in all the three regions suffer from internal and external parasites, bacterial and viral infection

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Lack of local available good quality food

C7. Livestock: Fisheries

1.A Existing breeds available: Rohu

1.B Specific breeds to be introduced: Hybrid of Indian major carp *Pangasius* spp

2.A Existing feeds being used: Rice bran and oil cake

2.B Specific feeds to be introduced / advised: Extruded feed

3.A Existing health services: -

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

4.A Existing management practices: Extensive, semi extensive temperate fish culture

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Intensive, super intensive and integrated fish culture

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:

Vet. Health services

Resouces		Manpower							Infrastructure		
		No.	V. O.	LEO	Pharmacist	Lab. Tech.	Livestock Assistant	Para vets	Buildings	Equipments	Others
Vety. Hospitals	Existing	16	12		14	-	38		16		
	Proposed	46	49		20	-	51		46		
Mobile Vety. Unit	Existing	01	-	-	01	-	1				
	Proposed	07	07	-		-	14				
Vety. Dispen.	Existing	1+6AMBU.			07						
	Proposed	17 53	12 53		15 27		39 65				
AI centres	Existing	53	53		27		65				
	Proposed	-	-	18	-	-	00		31		
Disease Diag. Labs	Existing	-	-	53	-	-	12		52		
	Proposed	38	-	-	-	-	-				
Polyclinic	Existing	61	-	-	-	-	-				
	Proposed	-	-	-	-	-	-				
Ambu. Clinics	Existing	1	-	-	-	-	-				
	Proposed	-	-	-	-	-	-				

Problems of Animal Husbandry

Specific problems due to which income is not increasing	Poor accessibility	Uneducation,poor infrastructure
	Water scarcity	Scarcity of drinking water for livestock in some pockets
	Natural disasters	Some areas are prone to flood / Natural disasters
	Wild life conflicts	frequently prevalent
	Marketing of animals	local and from outside both
	Marketing of products	very much underdeveloped village markets resulting into insufficient pricing of hard earned products .
	Budget	Insufficient
	Manpower shortage	because of nearby industrial areas scarcity of labour is the major problem in the district
	Capacity building	More trainings required
	Equipment & Implements (old/ shortage, etc.)	Lack of local availability and reluctance to adopt the use of equipments
	Mobility	Poor rural infrastructure has adverse effect on livestock mobility.
	Risk cover (Insurance)	Subsidised insurance facilities available through national livestock mission
	Relook to policies	Uneducation,poor infrastructure

D. Integrating Farming system

1.A Existing farming system: Crop + Dairy

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

Crop + Horticulture + Dairy + Mushroom + Fishery + Agro-forestry

a. **Cropping System**

Crop	Area (mt. Sq.)

Sugarcane (spring)+ Onion-Ratoon	2000
Basmati Rice (PB 1509)-Mustard/Wheat	1500
Basmati Rice (PB 1509)-Potato-Urdbean	1500
Maize (cobs)-Arhar-Wheat	1100
Sorghum-Oat+Barseem+Mustard-Maize (fodder)	900

b. Horticulture/Agroforestry/Apiculture

High density Guava+Papya+Napier/Karonda at Boundaries	2000
Dairy 2 cows	600
Vermicompost	150
Apiculture (5 boxes)	-
Backyard poultry (20No)	100
Mushroom cultivation	150

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: Manual operations are common

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

For grains:

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

For horticultural crops:

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

2.A Existing processing facilities: Processing facilities are available for fruits and vegetables, mushrooms regarding pre-cooling, IQF and processing.

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

RTS beverages unit should be set up with state of the art equipment

For grains:

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

For horticultural crops:

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

3.A Existing packing facilities: Limited Puckaa houses

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

For grains:

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

For horticultural crops:

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

4.A Existing storage facilities: Cold storage

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

1. Farm level storage solutions (CA store, reefers, pre cooling solutions at farm level)
2. Energy efficient technologies
3. New and high tech technology in Cold storage, CA storage, Reefers, IQF, Ripening Chambers etc.

For grain:

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

For Horticultural crop:

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

F. Waste land development and waste water

1.A Existing practices of soil water conservation: A few check dams/ trenches are constructed.

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

Adoption of practices developed by institutes like IISWC, Dehradun

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

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

1. Plantation of suitable trees/brushes in waterlogged and eroded areas.
2. Rejuvenation/repair of faulty/abandoned terraces.
3. Stabilization of eroded land using biological/engineering measures.
4. All agricultural operations should be done on contours i.e. across the existing land slope.

5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
7. Diversion of runoff through ditches from upper slopes to safer places.
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
10. Contour trenching (staggered/continuous).
11. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
12. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
13. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
14. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

3.A Existing fodder production: Natural fodder available

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

Guinea grass (*Panicum maximum*),

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

Setaria grass (*Setaria anceps*)

1. Seed rate(Kg/ha)- 1.5 2.0
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 100:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available.
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

Spear grass (*Hetropogon contortus*)

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

Rhode grass (*Chloris gayana*)

1. Seed rate(Kg/ha)- 3-5

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

Marvel grass (*Dicanthium annulatum*)

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

Packages of practices to be advised for waste land development

1. Rejuvenation/repair of faulty/abandoned terraces,
2. Stabilization of eroded land using biological/engineering measures,
3. Plantation of suitable trees/brushes in waterlogged and eroded areas,
4. All agricultural operations should be done on contours i.e. across the existing land slope,
5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials,
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical,
7. Diversion of runoff through ditches from upper slopes to safer places,
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection,
9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall,
10. Contour trenching (staggered/continuous).

Waste water management

1. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
2. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
3. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.

Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

4.A Type of waste water:

1. Effluent from kitchen and bathroom
2. Effluent from industries
3. Sewage water from cities being discharged into surface and groundwater resources.

4.B Existing treatment facilities: NA

4.CTreatment facilities to be advised/ developed for waste water treatment and utilization in the agro-ecological region of district:

1. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
2. Industrial wastewater should not be used for irrigation directly and must be treated by the

concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.
3. Sewage water from cities should be treated by municipal corporations or other agencies

G. Reduced cultivation cost

1.A Existing inputs being given:

Rice-wheat,Rice-Sugarcane-Ratoon-wheat/Maize/Groundnut/Mustard/Toria/Lentil/Urd

1. Annexure–II is enclosed for N,P and K.
2. In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn) /ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop.
3. Foliar spray of 1% $FeSO_4$ in rice nursery and maize.
4. In Cu deficient soils, application of 4-5 kg $CuSO_4$/ha or foliar spray of 0.25% $CuSO_4$ + 0.1% lime in standing crop.
5. In Mn deficient soils, application of 30 kg $MnSO_4$/ha, if Mn deficiency exist in field or two foliar spray of 0.5% $MnSO_4$ + 0.25% lime before first irrigation and one month after.

Mango/Litchi/Jackfruit

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

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

If required then deficit fertilizers and micronutrients may be provided

2.A Existing mechanization:

Sugarcane

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

Wheat

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

Paddy

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

Rapeseed - Mustard

1. Conventional tillage using disc harrow and planker,
2. Sowing by manual broadcasting,
3. Chemical weed control & plant protection using manually operated sprayers/ dusters,

4. Manual harvesting,
5. Manual threshing / tractor treading.

Soybean

1. Seedbed preparation using disc harrow followed by planker,
2. Manual sowing,
3. Manual intercultural and earthing-up of plants,
4. Manually operated sprayers for weed control and plant protection.,
5. Manual harvesting,
6. Manual threshing / multi-crop power threshers.

Pea

1. Seedbed preparation using disc harrow followed by planker.
2. Sowing by conventional tractor drawn seed drill.
3. Chemical weed control and plant protection using high pressure tractor operated sprayers.
4. Manual picking of vegetable pea.
5. Manual harvesting for seed production.
6. Threshing by multi-crop thresher.

Management of Orchards

1. Manual digging of holes for sapling planting,
2. Manual watering of plants,
3. Manual interculture operations,
4. Manual pruning of branches,
5. Manual plant protection,
6. Manual picking of fruits,
7. Manual grading.

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

Sugarcane

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

Wheat

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

Paddy

1. Transplanting by self-propelled transplanter and mat type nursery raising,
2. Seedbed preparation by rotavator/ conventional disc harrow,
3. Puddling by rotavator / peg type puddler,
4. Cono-weeder / powered paddy weeder for weed control,
5. Promotion of Direct Seeded Rice using DSR Seed drill,

6. Promotion of rice drum seeder for sowing of pre-germinated rice,
7. Chemical weed control using high capacity power sprayers in DSR / drum seeded rice,
8. Harvesting by self-propelled combine harvester,
9. Harvesting by tractor / power tiller operated vertical conveyer reaper windrower,
10. Threshing by axial flow thresher,
11. To avoid paddy straw burning and its useful application recovery of paddy straw using tractor drawn baler.

Rapeseed - Mustard

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

Soybean

1. Seedbed preparation using rotary plough / rotavator / disc harrow followed by planker,
2. Sowing by FIRB planter,
3. Weed control by powered rotary weeder,
4. Harvesting and threshing by soybean combine,
5. Harvesting by tractor drawn soybean reaper,
6. Threshing by multi-crop thresher.

Pea

1. Seedbed preparation by rotary plough,
2. Sowing by tractor drawn inclined plate planter,
3. Plant protection using ULV sprayer,
4. Chemical weed control,
5. Manual picking for vegetable pea,
6. Harvesting by self-propelled combine harvester for seed production.

Management of Orchards

1. Digging of holes by light weight power tiller operated post hole digger,
2. Watering by fertigation using drip method,
3. Pruning by power chain saw / mechanical pruners,
4. Fruit picking by mechanical hand held pickers,
5. Plant protection by aero blast sprayer,
6. Grading by mechanical graders.

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

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

Common property resource management, Pasture,
Chemical Fertilizers, Insecticides, Pesticides, Farm Yard Manure, Poultry Manure, Seed, Water and Tillage Machinery

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

1. Fertilizers, Seed, Irrigation, Tillage particularly Laser Land Levelling,
2. Fertilizer application should be based on soil test value at right time, right place and right method,
3. Basal application (50%N+100% P&K) at the time of sowing and 02 foliar application of N, secondary and micronutrients on standing crop,
4. Apply well decomposed organic manures and composts such as vermicompost, biofertilizer,

green manure and crop residue incorporation to supplement costly fertilizers to reduce cost up to 25-30%,
5. Inclusion of pulses in crop rotation,
6. Need based and recommended concentration of plant protection chemicals using correct method of application,
7. Enhanced use of bio-agents to control disease and pests instead of costly chemicals,
8. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons,
9. Use optimum and recommended seed rate at optimum spacing and depth,
10. Use good quality water and avoid excessive irrigation,
11. Use of delivery pipe for irrigation to check seepage losses,
12. Sprinkler and drip methods for irrigation should be encouraged to save water,
13. Promote reduced tillage and avoid use of heavy machines.
14. Incorporate crop residue or green manure 15 days prior to sowing along with slight dose of N,
15. No proper and timely supply of water in canal and govt. owned tube well systems under irrigated condition,
16. Faulty roistering system of water,
17. Unavailability of farm labourers in agricultural operations during sowing to harvesting of crops,
18. Non availability of farm machinery, tools and implements for small and marginal farmers,
19. Gentle to moderate slopes in farm,
20. Lands causing surface runoff of soil and nutrients,
21. Timely non availability of farm inputs viz., HYV seeds, N:P:K fertilizers, micronutrient containing fertilizers, low cost FYM, vermi compost, pesticides and effective insecticides,
22. Application of high rate of fertilizer without knowing the nutrient status of their soil,
23. Non/inadequate application of FYM/Vermi compost,
24. Negligence among farmers for testing of their soils for soil health and application as per crop needs,
25. Non availability of mobile soil testing labs van for spot testing of their soils,
26. No efficient irrigation and fertigation system in orchards,
27. No proper drainage system on farm lands of small and marginal farmers,
28. Lack of storage facilities (cold rooms and houses) and processing units for their produce,
29. Involvement of middle man in crop trading system,
30. Lack of interest among govt. machinery for dissemination of technologies, input and subsidies to small and marginal farmers,

H. off-farm income

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

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

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

of rural women, marketing potential and availability of locally available resources.

6. Loan procedure should be made more flexible with less interest rate.
7. As there were problems like non-cooperation among members, confusion regarding money matter, lack of confidence on office bearers with respect to group money etc., there is need of organizing training on good governance, democratic election and how to solve financial and administrative issues.
8. SHG's formed should be grouped into clusters, federations and registered cooperatives so as to converge with govt. schemes, facilitate collective purchase of input and marketing of products.
9. To encourage people to form and sustain SHG's so that new enterprise developed, intensive work needs to be done with them in sustainable manner.
10. Enterprises need to be identified depending upon local resources- human and material.
11. Market linkages need to be developed so that people can sell their produce gainfully.
12. To encourage SHG's better planning; training and sustained efforts on long term basis are required,
13. Target should not be only to form large number of SHGs but care should be taken that formed SHG may be in less number are functioning properly.

1.C Problems related with SHG:

1. Not interested in continuing the group
2. Non-cooperation among the members
3. Problem in getting loan
4. Lack of resources like money, space
5. Lack of knowledge regarding various income generating activities,
6. Lack of trainings
7. Lack of follow-up and monitoring from the forming agencies.
8. In hills farm holdings are very small and large part is rainfed depending upon rains with very low and uncertain productivity.
9. Young people do not stay in villages and move to other areas or take up other profession such as tourism, transport, hospitality etc.
10. People remaining in villages are not very enterprising.
11. It is seen in the survey that all individuals who took loan increase their livestock only that is their traditional work and did not start any other enterprises.

2.A Existing Micro-entrepreneur employment: Bee keeping

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

1. Mushroom, candle making and Bee Keeping,
2. Survey need to be conducted regarding locally available crops, fruits, vegetables and other things. On the basis of these enterprise can be generated. Aipan designing can be promoted in cloth, paper in the form of greeting cards, envelops, calendars etc. That has market value at national and international level,
3. Entrepreneurship with ornamental fishes,
4. Ornamental fish culture is still dormant in Uttarakhand state where as such culture practice has got tremendous scope, Through the developed technologies and extension services of ICAR-DCFR, ornamental farming in the state can be promoted thereby creating a scope of farmer's income,
5. Income-Rs. 100-125/- per square feet.

3.A Existing skill development facilities: Mushroom and vermi composting and bee keeping

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

All of Above on large scale, Training centre, processing and packaging units as per the locally available resources.

4.A Existing women skilling facilities: Candle making, Stitching

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

1. Candle making, Stitching on large scale,
2. Training centre, processing and packaging units as per the locally available resources

5.A Existing youth skilling facilities: Mushroom and Bee Keeping

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

Mushroom, Bee Keeping, Protected Cultivation

Training centre, processing and packaging units as per the locally available resources

Beekeeping

Packages of Practices for beekeeping with Italian honey bee, *Apis mellifera*

Beekeeping (or apiculture) is the maintenance of honey bee colonies, commonly in man-made hives, by humans. A beekeeper (or apiarist) keeps bees in order to collect their honey and other products that the hive produces (including beeswax, propolis, pollen, and royal jelly), to pollinate crops, or to produce bees for sale to other beekeepers. A location where bees are kept is called an apiary or "bee yard." Beekeeping provides excellent source of employment for the rural unemployed, enhances income of farmers, and the landless beekeepers. It enhances the productivity levels of agricultural, horticultural and fodder crops through pollination services. Beekeeping with *A. mellifera* L. is a common practice in hills as well as plains of Uttarakhand for honey production. For successful beekeeping, a person must require basic to advanced knowledge about all the aspects of honey bees with good management practices which involve following general points:

A good beekeeping management practices include:

1. Selection of good site for an apiary
2. Knowledge of bee flora
3. Seasonal bee management
4. Nutrition managements or artificial feeding during dearth period
5. Dividing and uniting colonies
6. Swarming : prevention and control
7. Disease and enemies management
8. Migration management
9. Other management practices for successful beekeeping

Selection of a good site for an Apiary

1. Selecting a good site for apiary can make a huge difference to honey bee health. There are following important things to consider when choosing a site:
2. It's important to know the bee foraging plants in a preferred area and their flowering periods.
3. Plants chosen should be producing high eminence nectar and pollen. Among the best beekeeping vegetation areas are forest woodlands, grasslands with dense covers of flowering herbs/shrubs, agricultural crops yielding nectar in abundance can be good beekeeping sites *e.g.* mustard, litchi, eucalyptus, barseem, maize, sunflower, legumes, cucurbits, apple, cherry, papaya, citrus, pear *etc*.
4. Apiary should be near to the running and fresh source of water.
5. Apiary location should be away from public places and roadsides (more than 300 meters).
6. Colonies should be sheltered from the extreme sun heat, frost, wind and floods.
7. An apiary should be sited far from fields which are sprayed with pesticides to avoid bee poisoning and honey contamination.
8. Avoid spraying when the plants are on flower or during peak foraging periods, if bees placed nearby the commercial farm fields.

Knowledge of bee flora

In order to survive, prosper and be productive, honey bee colonies must have a regular supply of both nectar and pollen in adequate quantities. Not all plant species are equally good for beekeeping. Some supply both nectar and pollen abundantly when in bloom and these are often called honey plants, because they are best suited for honey production. Plants producing nectar but little or no pollen are also considered to be honey plants. Other plants, however, may yield pollen but little or no nectar. These pollen plants are also important in beekeeping, especially at the time of colony build-up, when the bees need large amounts of the protein contained in pollen for their brood-rearing.

Seasonal bee management

Good management practices are the key to success as a beekeeper. Honey bee colonies should be opened, checked or monitored one to four times as per requirement of the season. Management practices are varying in different regions, availability of bee flora and climatic conditions.

a) Honey bee buildup season: This season comes before nectar flow season when colonies should be strong. Following practices should be taken by a beekeeper.

1. The strength of the colony should be improved for entering honey flow season.
2. Week colonies should be united.
3. If necessary, provide sugar syrup and make sufficient population.

b) Honey flow season: This season coincides with spring which has a plenty of bee flora, nectar and pollen from the various flowering plants. During this season, a beekeeper must follow these steps:

1. Provide more space for honey storage by giving comb foundation sheet or built combs.
2. Confine queen to brood chamber by using queen excluder.
3. Prevent swarming as explained in swarm management.
4. Prior to honey flow, provide sugar syrup and build sufficient population.
5. Divide strong colonies into 2-3 new colonies, if colony multiplication is needed.
6. Queen rearing technique may be followed to produce new queens for new colonies.

c) Dearth period Management: During the hot summers, chilled winters and heavy rainy days when there is no bee flora, bees cannot go outside and suffer with starvation. A beekeeper should consider following points:

1. Enough honey may be left in the hive to keep colony alive.
2. Protect from rain, wind and enemies
3. When the nectar is generally not available colonies should be given sugar syrup in the evening.
4. Remove empty combs and store in air tight container.
5. Use dummy division board to confine bees to small area.
6. Unite weak colonies, provide sugar syrup, pollen supplement and substitute

i. Summer management: Bees have to survive intense heat and dearth period by following means.

1. Provide sufficient shade, under trees or artificial structure.
2. Reduce heat by sprinkling water twice a day on gunny bag or rice straw put on the hives.
3. Increase ventilation by introducing a splinter between brood and super chamber.
4. Provide sugar syrup, pollen supplement, substitute and water.
5. Enough honey may be left in the hive to keep colony alive.
6. Unite weak colony with strong colony.

ii. Rainy season and monsoon management

1. Avoid dampness in apiary site and provide proper drainage.
2. In rains when bees are confined to the hive, provide sugar syrup feeding.
3. Remove empty combs and store in air tight container.
4. Use dummy division board to confine bees to small area.
5. Unite weak colonies and provide sugar syrup, pollen supplement and substitute.
6. Avoid bloodlessness in colonies, if pollen stores and fresh pollen is not available, feed the colonies either pollen substitute or pollen supplement.
7. If colonies are week and have poor food stores, provide candy or dry sugar instead of sugar

syrup

8. Keep in check the attack of enemies like wax moth, ants, mites and wasps.
9. The hive is kept on stands sloping towards entrance in order to drain out water.

iii. Winter management: It includes the following practices.

1. Maintain strong and disease free colonies and provide new queen to the hives.
2. Provide winter packing in cooler areas or hilly regions.
3. Remove empty combs and store in air tight container.
4. Use dummy division board to confine bees to small area.
5. Unite weak colonies and provide sugar syrup, pollen supplement and substitute.

iv. Nutrition management or artificial feeding during dearth period

Paying awareness to honey bee diet is just one of the more important aspects of successful beekeeping. Honey bee collects a number of substances to ensure its survival viz., nectar, pollen, water, propolis etc. However, during the scarcity of above essential diet components bees may not able to survive. Shifting the hives to alternate floral sources will help them stay healthy.

Sugar Supplement syrup foods for Honey Bees: About 8-11 lts of 2:1 sugar syrup (2 parts sugar to 1 part water) is the usual feeding per colony. In spring feeding, the syrup mix may be reduced 1:1 (1 part sugar to 1 part water). 3:1 bee syrup mix is for winter. At this concentration there is little water to evaporate. It is also less likely to freeze. Use boiling water in making the syrup. Allow to cool before serving.

Protein Supplement Foods for Honey Bees: The adult bees of a colony obtain their dietary protein from the pollen the workers collect and bring back to the hive or from nitrogenous food-stuffs provided by the beekeeper. There is a multitude of different artificial diet available as substitute or supplement for pollen but the following provides a general guide: Pollen: 5% ,Sugar: 20–50%, Yeast (torula): 20–50%, Flour (soya): 20–50% and Vitamin supplement: 1–3%. Increasing the amount of pollen and sugar will make the supplement more attractive to the bees which contain the quality and quantity of proteins and amino acids, lipids, vitamins, and minerals required for growth and development of individuals and reproduction of the colony. Pollen patties or protein cakes may well be an attractive proposition.

Supplying bees with water: A supply of water must be available to bees at all times. A lack of it adversely affects the nutrition, physiology, brood rearing, and normal behavior.

Swarming : Causes and management

Swarming is a natural phenomenon that ensures the survival of the species through a colony reproducing itself. Swarming normally occurs in spring, allowing the colony to establish itself over the following summer and autumn before winter brings a serious reduction in flowering species from which food can be obtained.

Cause of swarm:

1. Reproductive swarm
2. Overcrowding - too many bees, food stores and no cell space for the queen to lay eggs in.
3. March-April is swarming season and healthy colonies develop strong swarm desire.
4. Inclement weather - crowded bees confined by cold, wet weather will build queen cells and swarm out on the first sunny, warm day. All colonies in similar condition will swarm as soon as weather becomes favorable.
5. Large amount of drone brood in early spring is a precursor to strong swarm impulse.

Management:

1. Allowing this form of reproduction often results in the loss of the more vigorous division. The remaining colony may be so exhausted and set back due to the brood cycle disruption that it is unproductive for the season.
2. Beekeepers control swarming prior to the natural swarm time.
3. Place two or three drawn out combs in an empty super and place on top of the parent colony,

separated by a queen excluder.

4. Examine all the frames from the brood nest of the bottom colony for queen cells.
5. If the old (caged) queen is worth saving, a small nucleus consisting of two combs of brood and adhering bees can be made for her accommodation.
6. Capture any subsequent swarms with the help of swarming bag and return to the old hive by simply shaking the bees in front of the hive entrance.
7. In case parent colony, from where swarm has been issued is not known, the captured swarm should be placed in the new empty hives.
8. Only one young queen will survive and the bees will no longer attempt to swarm. If they do swarm again, repeat this step.
9. Provision of sufficient nectar storage space.
10. Colonies should receive maximum sunlight early in the season
11. Requeening a colony can help minimize swarming tendencies. Young queens produce more pheromones, thus inhibiting swarm preparation by the workers.
12. Clipping a queen's wing is a good way to minimize swarming tendencies in colonies
13. Removing queen cells from colonies before they swarm, a technique called "cutting queen cells," is useful as a swarm behavior repressor.

Disease and enemies management

Brood Diseases: They are generally easier to recognize as a group than adult diseases but are more difficult to control.

Disease	**Causal Organism**	**Symptoms**	**Management**
Bacterial Diseases			
American Foulbrood (AFB)	Spore forming bacterium, *Paenibacillus larvae* in temperate and sub-tropical regions.	1. The dead pre-pupae lie straight with head towards the opening of the cell (Sealed Cell) 2. Cell capping of infected brood becomes darker in colour, sunken and perforated. 3. A tooth pick inserted into the body of prepupa and drawn out shows ropiness. 4. The putrefying brood turns brown and has fish glue odor. 5. Dead broods dry up into scales, adhere to the cell bottom.	1. Sterilize the combs and other hive parts with Formalin @ 150 ml/ l or ethylene oxide @ 1 g/l water, for 48 h at 43^{o}C in fumigation chambers. 2. Terramycine capsule @ 250 mg per 3 liter sugar syrup or 500 mg per 5 liter sugar syrup should be given as half lt sol / box and should be given at weekly interval for 1 month . 3. Breeding disease resistant strains of bees is one of the best measures for the disease management. 4. Provide sufficient sugar syrup to the diseased bees. 5. Fumigate all the equipments with formalin in a closed place. 6. Streptomycin , 0.2 gm
European Foulbrood (EFB)	Non-spore-forming bacterium, *Melissococcus plutonius*	1. 3-5 days old are more susceptible to infection than older larvae 2. Bacteria, on swallowing with food, multiply in mid gut and are discharged with feces. 3. Diseased larvae become flaccid, turn brown and give foul-sour smell.	

			per half lt sugar syrup should be given twice a week to diseased bees.
Fungal Diseases			
Chalk Brood	Spore-forming fungus, *Ascosphaera apis*.	1. The infected larvae (3-4 days old) are quickly covered by the white cotton-like mycelium which eventually fills the entire cell. 2. The white/grey mass soon hardensThe larva in the cell will resemble a lump of chalk, hence, the name of the disease chalkbrood	3. Removal of mummies by bees results in natural control. 4. Collect and burn the mummified larvae. 5. Replace old, blackened brood combs as these may harbor chalk brood spores. 6. If a colony lacks sufficient food stores, supplement with good-quality feed. 7. Replace queens with stock bred for hygienic behavior and/or disease resistance. 8. Put bee boxes at proper ventilated and clean place, these should not be placed at places with higher humidity. 9. Thymol (0.7 % sol) can be used to prevent the disease. 10. 5 % sol of Formalin (40 %) can be used for disinfection of frames and equipments.
Stone Brood	*Aspergillus flavus*	1. It only infects larvae that are three to four days old. 2. The larval body becomes harden and mummify.	
Viral Disease			
Sac Brood Virus (SBV) and Thai Sac Brood Virus (TSBV)	Disease symptoms for diagnosis of both the diseases are similar. SBV is infective on *Apis cerana,* while TSBV infects *Apis mellifera.*	1. Brood death in prepupal but in unsealed stage. 2. Dead larvae straightening out and lying on their backs, with tip of the head capsule turned upwards. 3. Dead pre-pupae that turn into sac like structure. 4. Affected larvae becoming yellow or grayish, later darkening to blackish; the	1. For viral pathogens, there is no chemical control. 2. Affected colonies should be isolated beyond their flight range. 3. Check robbing, drifting and swarming. 4. Undertake selective breeding for natural resistance

		change in colour first starts from mouth-parts and head. 5. Dead larvae and pre pupae drying up in brood cells forming loose scales.	5. 250 mg terramycin / 5 lt of sugar syrup should be given to diseased honey bees at weekly interval.

Adult diseases:

Disease	Causal Organism	Symptoms	Management
Protozoan Disease			
Nosema Disease	*Nosema apis* Zander	1. Bees become dysenteric with distended abdomens. 2. Young infected bees take up nursing duties as usual but soon stop rearing brood because food glands are affected and they shift to foraging. 3. Affected bees have disjointed wings and are found crawling in front of the hive. 4. Large number of spores can be observed in the mid gut contents of infected bees under microscope. 5. The disease is particularly severe during spring and winter and there is depletion of strength	1. Provide upward ventilation to reduce humidity. 2. Feed bees with fumagillin @ 10 mg/ lt water in concentrated syrup. It inhibits DNA replication of the pathogen. And Gramicidin may also be used for its treatment. 3. Disinfect the empty hives with ethylene oxide or acetic acid fumigation @ 120 ml / hive. 4. Wash hands with soap before inspecting the box and disinfect all the beekeeping equipments with Formalin to prevent the infection. 5. This disease is mainly due to dirty water of rainy season. Provide clean water in a pot and put it over a stand. Make one hole in pot and fix cotton plug along with wooden stick in the hole so to distrupt the rapid flow of water and bees can easily take the water.
Amoeba Disease:	*Malpighamoeba mellifecae*		1. Scarp off the bottom board and disinfect it with 2% carbolic acid or acetic Acid. 2. Spores can be destroyed by temperature treatment at 49°C for 24hr. 3. Feed bees with Fumagillin @10 mg per liter of sugar syrup.
Mite diseases			
Varroasis	An Ectoparsitic mite,*Varroa destructor*	1. Parasitize immature drone and worker bees within their cells. 2. Colonies severely	1. Screened bottom board with sticky board. 2. Application of formic acid (as vapor or pads).

Brood mite	An ectoparasitic mite, *Tropilaelaps clareae*	infested appear restless and weakened. 3. Only a few bees remain along with the queen 4. Mites tear the integuments of the adult bees and suck the haemolymph. 5. Reduced adult bee population in the infested colonies queen supersedure, spotty broods are common. 6. Affected young larvae turn in to light brown colour 7. The brood fails to develop in to adults or malformed adults are formed.	3. Thymol powder @ 0.25g/ hive dusted in the passages of frames. 4. Thirty two grams of crystal oxalic acid (dehydrate) is thinned in one liter of sugar water (1:1). 5. Lactic acid (8 ml of 15 % acid per comb) is clearly better tolerated by bees and does not cause problems in warmer climatic zones.
Acarine diseases	Treacheal mite, *Acarapis woodi,* An endoparsitic mite	1. Mites pierce the wall of the tracheae and suck the haemolymph. 2. Infested bees have shorter longevity and reduced flight ability. 3. Irregular dark stains initially develop on the infested tracheae which ultimately blacken. 4. In severe cases, "K winged" shape can be is seen, where the two wings on one side of the thorax become unattached, such bees unable to fly.	1. Use of folbex strips (a mixture of potassium nitrate and chlorobenzilate) as a fumigant at the rate of 1-2 strips per colony. 2. Use of menthol crystals @ 50 g per hive or menthol strips. 3. Formic acid @ 5ml. per hive in glass vial.

Enemies of honey bees:

Enemy	Important Features	Management
Wax Moth		

Greater wax moth (*Galleria mellonella*)	Observed throughout the year but its occurrence is severe during July to Oct and Nov to Dec. Empty combs, rendered wax, comb foundation and bee collected pollen, if not properly stored and left unattended, almost always suffer considerable damage from wax-moth infestation	1. The entrance should be reduced to avoid the entry of adult moths. 2. A water soluble concentrate of spores of *Bacillus thuringiensis* Serotype 7 provides an excellent protection of stored combs without affecting the organoleptic properties of the honey. 3. Stack the empty combs in supers (up to 8-9 super) leaving some empty space in lower most super. Make it airtight by using mixture of mud and dung. 4. Avoid fumigation with naphthalene, ethylene die-bromide and PDB 5. Fumigate the empty combs with sulphur powder @ 230g/m3 and after that seal them properly.
Lesser wax moth (*Achroia grisella*)	The lesser wax moth is generally smaller than the greater wax moth, except when the latter is dwarfed owing to poor diet during its larval stage.	
Wasps &Hornets (*Vespa orientalis, V.cincta, V. magnifera* etc)	They appear after spring and continue during monsoon season and cause maximum damage to colonies during July-September in Uttarakhand.	1. Keep the colonies strong and ensure proper food in the colonies. 2. Reduce the hive entrance or use queen gate or protective screens. 3. Destroy the wasp combs and use wasp traps with honey/ sugar/ Gur.
Ants	Ants may destroy whole colony within few hrs by robbing honey, pollen, predating on eggs, brood & adults. Attack is usually observed in rainy season.	1. Keep apiary clean by removing old and rotton woods, stones, weeds etc. 2. Place the hive stand post on the water filled bowl or earthen pots. And clean the bowl regularly.

Other enemies :

1. Wax beetle, *Platybolium* sp. (Tenebrionid beetle) and small hive beelte, *Aethina tumida*.
2. Birds: King crow, *Dicrurus* sp; Bee eater, *Merops* sp.
3. Lizards, termites, toads and frogs.
4. Others like death's head hawk moth, *Acherontia styx;* robber flies; dragon flies, praying manids. Some mammals: bears, badgers and off course man

Migration management

Migration of bee colonies from one place to another where sufficient bee flora is available for the survival of bees and better honey production is an essential task in beekeeping. For example plains to forests, hills to farms and orchards in the adjacent plains in order to utilize the local bee flora and improve bee forage availability to bee colonies. Migratory beekeeping in the *Tarai* region of Uttarakhand could enhance honey production and colony multiplication. The suitable areas identified for migration in Tarai region are as follows:

Sl. No.	Location	Period	Honey crop
1.	Pantnagar	April, May and June	Papaya, Maize and Sunflower
2.	Haldi, N- block Pantnagar	December and January	Berseem and Mustard
3.	Pilibhit	November, December and January	Mustard

4.	Melaghat, Khatima	January – February	Eucalyptus
5.	Pattharchatta, Pantnagar and Ramnagar	March	Litchi
6.	Sitarganj	May- June	Jamun
7.	Moradabad	July	Maize
8.	Sambhal	August –October	Bajra

Preparing colonies for migration:

1. Provide proper ventilation by using entrance screens and even top screen in place of inner cover during hot weather
2. Nail all the movable parts of the hive properly or tie with migratory belts
3. Before packing the colony, remove frames of honey which are more than half sealed since honey combs cannot bear much jolts. However, the colonies should have sufficient food during the journey
4. Close the entrance in the evening when all bees have returned.
5. Colonies should be moved during night .For deciding migrating site, the beekeeper should have a detailed knowledge of honey flow sources and density of bee colonies in the surrounding area. Avoid areas which already have lot of bee colonies.
6. Migration can involve shifting of one truck load of bees up to 200 Km or even more. If journey cannot be undertaken in one night during hot periods then the truck should be parked in the shade during day, entrances opened and provision of water should be made. Journey can be started in the evening after closing hive entrance.
7. On arrival at the destination, colonies are unloaded and placed at the desired site. Then the entrance screens are removed

Other Management Practices for successful beekeeping

Practice judicious methods

1. Monitor colony strength and unite weak colonies.
2. Use logical services for ideal colony assessment.
3. Ensure frames of brood for planned strength to coincide with honey flow season.
4. Do not combine weak collapsing colonies with healthy colonies

Managing Stock:

1. Maintain genetic quality to meet out all objectives:
2. Maintain stocks that are prolific disease and pest resistant.
3. Encourage high drone densities to provide well-mated queens and genetically diverse colonies.
4. Discourage stocks that are excessively defensive.
5. Select stock by propagating colonies that flourish when other colonies exhibit symptoms of stress.

Hive Maintenance:

1. Keep your equipment in good condition.
2. Check apiary for hive condition.
3. Inspect for rotten, loose or broken boards and frames.
4. Reconstruct, tighten or replace frame parts.
5. Paint supers with light colors to beat summer heat.
6. Take advantage of the bee flora/honey season to do maintenance and prepare for the new season.

Hygiene:

1. Practice good hygiene with hands, gloves, and other equipment to reduce transmission of pathogens between colonies.
2. Replace comb with new foundation to minimize residual chemicals in old wax.
3. Develop a comb replacement schedule.

Hive Security: Hive security can minimize economic losses.

1. Be aware that the probability of theft has increased with the increased value of pollinating crops.
2. Secure a signed contract when entering into a honey flow season.
3. Practice discretion when showing where your hives are located.

Final steps

1. Inspection of surroundings to place the apiaries in appropriate areas.
2. Observation of quarantine measures for all new introductions that have to be made in the apiary.
3. Regular verification of the health status of the colonies during the year.
4. Frequent renewal of honeycombs (every 2 yrs) and regular replacement of queens (every 1-2 yrs).
5. Selection of queens who show resistance to diseases, hygienic behaviour, low tendency to swarm and high productivity.
6. Ensuring that hive capacity is sufficient to discourage swarming.
7. Preventing acts of looting (not having in apiary highly diseased, weakened colonies).
8. Feeding colonies having no food stocks or in case of unfavorable weather conditions.
9. Providing adequate water supplies particularly in hot periods.
10. Appropriate use of the bee smoker (respecting the bees welfare and avoiding using toxic material that can contaminate the honey).
11. Elimination of the use of toxic substances or paints for hives (e.g. disinfectants, chemical treatments for wood, etc.).
12. Exclusive application of drugs registered for use in bees respecting instructions, maintenance of beekeeping equipments in good order and cleaning and, when necessary, renewing the materials.

Mushroom cultivation

The shrinking land, demand for functional foods, priorities for recycling agricultural residues and changing trades in view of globalization are going to play an important role in the agricultural scenario, and secondary agriculture is likely to play a pivotal role. Our country can emerge as a major player in mushroom production in wake of availability of plenty of agricultural residues and labour. To remain competitive it will be important to harness science and modern technologies for solving the problems of production and bio-risk management. Mushroom being an indoor crop, utilizing vertical space offers solution to shrinking land and better water utility. Packages and practices of mushroom cultivation in Almora is as follow:

1. **White Button Mushroom (*Agaricus bisporus*)**

Button mushroom scientifically known as *Agaricus bisporus* and has he widest acceptability. Cultivation of this mushroom is a complex process and requires two different temperature i.e. 22-26^{0}C for spawn run and 14-24^{0}C for fruit body formation. Besides specific temperature, it require proper humidity (80-90%) and enough ventilation during fruit body formation.

Steps of cultivation process

Compost preparation: Compost is an artificially prepared growth medium from which mushroom is able to derive important nutrients required for growth and fructification. Cemented floors and shade over the floor are required for making good quality compost. There are two main methods for compost preparation:

Long method of composting: This is an outdoor process and takes around 28 days in its completion with a total of seven turnings. The following materials are required for long method of compost:

Wheat straw	1000 Kg	Urea	10 kg
Wheat bran	50 kg	Gypsum	100 kg
Ammonium sulphate or calcium ammonium nitrate	30 kg	Furadan	500 g
Super phosphate	10 kg	B.H.C.	500 g

Muriate of Potash	10 kg		

Before making compost, wheat straw is spread on cemented floor and is turned many times with water being sprayed at regular intervals.

Day 0: At the stage, there should be around 75% humidity content in the wheat straw, to which wheat bran, calcium ammonium nitrate, urea, murate of potash, and super phosphate are mixed thoroughly and evenly. The material is then piled 1.5m thick x1.25m high with the help of wooden rectangular block. The blocks are removed. Once the entire material has been stacked up or piled up. Water is sprayed twice or thrice to keep the substrate moist. Temperature should be in the range of 70-750C.

1st turning Day 6: On the sixth day first turning is given to the stack. The purpose of turning is that every portion of the pile should get equal amount of aeration and water. If the turnings are not given, then anaerobic condition may prevail which may lead to the formation of non-selective compost. In the stack, the central zone is fermenting at its peak and has maximum temperature rest of the portion is either not at all fermented or ferments improperly. The correct method of turning is as: Removing about 15cm of compost from the top and spread it on one side of the floor, the rest part of compost on the other side of the floor. Now turning is done by shaking the outer (top most) part and the inner part of the compost, first separately and then missing them altogether thoroughly with the help of wooden buckets.

2nd turning (Day 10): On the tenth day, again the top most part and the inner part of the compost is separated, water is sprayed on the top part. Again the two parts are piled up together in such a way that now the top part is inside and the inner part is on the top of the stack.

***3rd turning (day 13)*:** it is also done in the same way as described earlier and required quantity Gypsum mixed at this stage.

***4th turning (day 16)*:** The same process of turning is followed. The required quantity of furadan & lindane are added during this turning.

***5th turning (day 19)*:** The compost is turned in the same manner.

***6th turning (day 22)*:** The same process of turning is followed. The required quantity of furadan and lindane are added during this turning.

***7th turning (day 25)*:** The compost is turned in the same manner

8th *turning (day 28)*: if no ammonia persists in the compost, spawning is done.

Short method of composting : Compost prepared by short method of composting is superior in production quality and the chances of infection and disease is quite low. Composting by this method requires special infrastructures, equipments etc. that initial cost is to high, therefore, the farmers can purchase the readymade compost from the authentic composting units. The compost when ready for spawning should have the following characteristics:

Moisture	About 68%	**Ammonia**	Below 0.006%
pH	7.2-7.5	**Nitrogen**	Around 2.5%
Fire fangs (Actinomycetes)	Excellent growth		

Proper timing for cultivation: Oct.- Mar. (02 crops)

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

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

14 days of spawning white mycelial growth is seen running the entire length of the tray/bag. This is then covered with casing soil on the surface.

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

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

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

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

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

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

2. Oyster mushroom

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

Steps of cultivation process

Substrate and its preparation

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

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

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

Proper timing for cultivation Feb-April & Aug.-Oct. (02 crops)

Cultivated spices: *P. sajor-caju, P. florida, P. sapidus, P. eryngii, P. cornucopiae, P. flabellatus, P. djmore, P. eous, P. ostreatus*

Spawning and crop management : Oyster mushroom spawn should be about 15-20 days old when mycelium has formed complete coating around the grain. The normal rate of spawning in a pasteurized substrate is 2-3% of the wet substrate. The spawning is usually done by mixing the

spawn throughout substrate. Before filling the substrate in polythene bags, holes of about 1 cm diameter are made at 10-15 cm distance all over the surface for free diffusion of gases and heat generated inside. The optimum temperature for growth of mycelium is 23 ±2°C. Relative humidity in growing room should be range between 85-90% during spawn-run. Spawn run usually takes about 15-20 days. After complete spawn run, polythene removed completely with help of sharp knife carefully. Usually 3-4 days after opening the bags, mushroom primordial (pin heads) begin to form. After opening the bags water should be sprayed 2-3 time per day regularly.

Harvesting and yield: Mature mushrooms become ready for harvesting in another 2-3 days. An average biological efficiency (fresh weight of mushrooms harvested divided by dry substrate weight x 100) can range between 70-80% and sometimes even more. To harvest the mushrooms, they are grasped by the stalk and gently twisted and pulled. A knife should not be used.

3. Milky Mushroom

Calocybe indica is commonly known as milky mushroom or dudhiya mushroom due to its milky white appearance of the fruit body. It can be easily cultivated at the temperature range between 25-35°C and relative humidity 70-90 per cent.

Substrate and its preparation

The tropical wastes like chopped paddy straw and wheat straw are used as substrate for cultivation. To avoid contaminations the straw should be treated by hot water and chemical as like oyster mushroom.

Proper timing for cultivation: April-Sept. (02 crops)

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

Spawning and crop management: About 18-20 days old spawn is used for spawning. Spawning should be done @ 4 per cent of ready substrate. The spawning is usually done by mixing the spawn throughout substrate. The spawned substrate should be filled in polythene bags 4-5kg per bag. The bags should be folded at the top and covered up. The optimum temperature for growth of mycelium, ranges between is 20-37°C. Relative humidity in growing room should be range between 80-85% during spawn-run. Spawn run usually takes about 15-20 days.

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

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

I. Enabling Policies

1.A Existing policies related with agriculture and animal husbandry: MANREGA

1.B Policies to be suggested for doubling income in the specific agro-ecological region:
Link MANREGA with Agriculture Production System

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: All District line Department and state and Central Agriculture Institute **3.A Existing Incentives:** No

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

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: Fish crop & fish pond insurance facility

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

1.A Existing marketing facilities: Local marketing & Mandi

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

1. Upgraded Mandi with assured procurement & Fish market,
2. Proper marketing facilities need to be developed in various region of the district do that farmers could get premium price of their produce. It has been seen that despite of high production, farmers do not get remunerative price of their produce in the markets due to poor marketing system.

2.A Existing grading facilities:

1. Grading is done by the farmers only in fruits and vegetable crops but proper grading is not done as they do manually,
2. At present ,there is one Mega Food park viz Patanjali Food Park, Haridwar which has one central processing unit & 6 primary processing centres(PPC) in Haridwar

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

For grains:

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

For horticultural crops:

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

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

For grains:

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

For horticultural crops:

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

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

For grains:

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

3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)
4. IRRI bags for particular commodity

For horticultural crops:

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

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

1. Problem of marketing is the biggest issue in the farmers.
2. In doubling income of farmers, role of proper marketing has immense importance.
3. Value addition is also important for which proper training, demonstrations, infrastructure need to be developed.

K. Online Management and Evaluation

1.A: Existing online management structure available: Farmers' help line (toll free).

1. **1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district:** Mobile app. For carp farming, Data base of individual farmer

2.A: Existing evaluation procedure: Manual

2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district: District level committees of State line departments with KVK experts may be formed for field and as well as online evaluation

3.A: Existing monitoring system: Physical

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

4.A: Existing feedback system: Manually

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

5.A: Existing reading system: Literature, Booklets, Hindi Extension Journals etc

5.B: Reading system required for online management and evaluation in specific agro-climatic region of district: Reading manuals may be developed/ published for easy operation of Mobile apps/ software developed for online management and evaluation for farmers as we well as concerned experts linked with it

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

Strategy 1 : Productivity Enhancement

1. Enhancement of productivity of sugarcane in Narson, Bahadarabad, Roorkee and Bhagwanpur block.
2. Promotion of Sugarcane: Sowing at recommend spacing, at right time, discouragement of summer sowing, promotion of inter cropping, management of white grub and top borer through recommended pesticides.
3. Promotion of improved varieties wheat (VL Gehun 953, HD 2967, UP 2382, UP 2425, WR 544, HD3086, UP 2628 UP 2554, UP 2526, UP 2565), Rice (PB 1509, PB-1, Pant Basmati 1, Pant Sankar Dhan-3, Pant Dhan-19, HKR-127) and sugarcane (Co Pant 99214, CO 0238, CoP 5224, CoP 3220) for the region.
4. Promotion of improved varieties of speciality corn (CMVL Sweet Corn 1 and CMVL Baby Corn

2).
5. Vegetable pea (VL Ageti Matar 7 and VL Matar 10)
6. Garlic (VL Lehsun 1).
7. Recommended package and practices will be followed for the above said crop varieties
8. Promotion of seed treatment.
9. Promotion of appropriate and timely irrigation.
10. Promotion of balanced use of fertilizer (inclusion of potash and micronutrients.)
11. Promotion of weed Management.
12. Rejuvenation of old Mango orchards in Bhagwanpur..
13. Production of high quality seedlings through tissue culture for Mango orchards.
14. Encouragement of proper pesticide application technology.
15. Promotion of use of stickers with pesticides spray
16. Promotion of sowing by trench method.
17. Promotion of onion/pulses (Marigold in spring and veg pea)/gram/Lentil.
18. Promotion of green manuring, bio-fertilizers and bio-pesticides in Roorkee and Bhagwanpur Block.
19. Increasing crop intensity, cultivation of catch crops viz. short duration moong/maize after harvesting of wheat and before sowing of paddy crops.
20. Promotion of high value vegetables and medicinal plants Roorkee Block.

Adoption of efficient irrigation techniques

1.Surface irrigation in laser levelled land

2. Micro- irrigation system in Sugarcane, Mango, Litchi, Guava and in Vegetables

3 Drip Irrigation in Green House Cultivation for Cut Flowers and Vegetables

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Domestication of high yielding breed such as Sahiwal, Tharparker (Cow), Murrah, Neeli, Bhadawari (Buffaloes), Jamuna Pari (Goat) in Narson, Bhagwanpur and Bahadarabad Block of the district.
2. Promotion of proper nutritional management of livestock-use of area specific mineral mixture, Urea, Molases, Mineral Block.
3. Development of grass land in different villages of all blocks.
4. Ensuring availability of good Veterinary surgeon at block level.
5. Training of dairy, poultry and fish farmers.
6. Rejuvenation of abandon pond for fisheries in all blocks .
7. Development of good nursery of fishes and availability of good species of fingerlings is required; fisheries should be promoted through favourable policies.

Strategy 3 : Integrating Farming system

1. Development of separate models for small and big land holdings.
2. Development of area specific and farmer specific model of IFS such as Crop + Dairy for big land holdings, Vegetable crop +Mushroom for small farmers of Bahadarabad Block;
3. Crop + Horticulture + Dairy + Mushroom + Bee Keeping

Cropping System

Crop	Area (mt. Sq.)
Sugarcane (spring)+ Onion-Ratoon	2000
Basmati Rice (PB 1509)-Mustard/Wheat	1500
Basmati Rice (PB 1509)-Potato-Urdbean	1500
Maize (cobs)-Arhar-Wheat	1100
Sorghum-Oat+Barseem+Mustard-Maize (fodder)	900

b. Horticulture/Agroforestry/Apiculture

High density Guava+Papya+Napier/Karonda at Boundaries	2000
Dairy 2 cows	600

Vermicompost	150
Apiculture (5 boxes)	-
Backyard poultry (20No)	100
Mushroom cultivation	150

Strategy 4 : Reducing post harvest losses and value addition

A. For Khanpur, Laksar and Bhagwanpur Block

1. Mechanization of harvesting of wheat and paddy.
2. Development of good network between farmers and mandi/buyers.
3. Establishment of Government Procurement Centres at maximum places for facilitating the farmers and preventing losses at the farmers place
4. Development of cold storage and processing facility for vegetable and fruits.

B. For Laksar and Bahadarabad Blocks

1. Development of modern sheller facilities for advanced or new varieties of aromatic rice.
2. Establishment of flour mills at local level.

C. For Bhagwanpur and Bahadarbad Industrial Units

Establishment of processing plant for the purchase and processing of local fruit, vegetable and other agricultural produce.

Strategy 5 : Waste land development and waste water

For Bahadarabad (low water table) & Khanpur (Water logged) Blocks

1. Reclamation of waste land.
2. Promotion of agro forestry plantation in wasteland for improvement of organic carbon.
3. Facilitation of seed suitable for wasteland to the farmers.
4. Establishments of treatment plants for waste water and polluted water and promotion of treated water for irrigation.
5. Channelization of river.
6. Construction of ponds for fish cultivation in the area with high water table and water logged area.
7. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Promotion of timely sowing, irrigation, mechanization of farm activities, balanced use of fertilization based on soil testing.
2. Promotion of use of recommended seed rate, weed management with latest weedicides, adoption of IPM and IDM.
3. Promotion of seed treatment, line sowing and mechanization in all the crops.
4. Facilitation of farmers with weather updates.
5. Implemented Chakbandi in district.

Strategy 7 : Off-farm income

1. Establishment of custom hiring centre for farm implements.
2. Promotion of sericulture in Roorkee and Bhagwanpur Block
3. Establishment of small scale processing units (for flour mill/oil expellers) by youth.
4. Development of online advisory centres by trained youths..

Strategy 8 : Enabling Policies

Narson and Roorkee Block

1. Khandsari industry should be revived.
2. Mandatory grassland for all villages.
3. Mandatory same year payment of sugarcane by the sugar mills.

For All Blocks of the district

1. MSP for all crops should be enhanced.
2. Purchase of local agricultural produce should be made mandatory for the processing industry of

the district.

3. Only wasteland should be used for establishment of industry and productive land should not be used.
4. Link MANREGA with Agriculture production system Promotion of FPO through policies support.

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

1. Promotion of FPO through policies support Organic Jaggery and Jaggery powder, Turmeric powder, Aromatic Rice. Organic Jaggery and Jaggery powder
2. Encouragement of Cooperative Societies as a tool of marketing channels.
3. Establishment of direct linkages with food processing industries may be established for better prices
4. Creation of improved transport facility from village to mandi.
5. Improvement of roads in the interior parts of the Laksar and Khanpur Block.

Strategy 10 : Online Management and Evaluation

1. Creation of independent effective and competent agencies for online management evaluation.
2. Development of Mobile apps/ software for online management and evaluation.