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

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

A.General information about Agroeco-region

District: Uttarkashi

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

Main Blocks in Region: **Region A-** Chinyalisaur, Dunda, Naugaon,
Region B- Chinyalisaur, Dunda, Naugaon, Purola, Mori, Bhatwari
Region C- Chinyalisaur, Dunda, Naugaon, Purola, Mori, Bhatwari
Region D- Dunda, Naugaon, Purola, Mori, Bhatwari

Main village cluster in blocks: Dichli Gamri patti, Barsali patti, Matli Patti, Bisht Patti, Ramaserai Patti, Dhanari Patti, Bhandarsun Patti, Upla-Taknor patti, Dashgi patti, Jogat patti, Kamal ghaati, Dhari- Kalogi patti, Netwad Patti, Badagaddi patti, Gajana patti

Irrigated Clusters: Dichli Gamri patti, Bisht Patti, Ramaserai Patti, Kamal ghaati, Dhanari Patti

Rainfed Clusters: Dichli Gamri patti, Barsali patti, Matli Patti, Bisht Patti, Ramaserai Patti, Dhanari Patti, Bhandarsun Patti, Upla-Taknor patti, Dashgi patti, Jogat patti, Kamal ghaati, Dhari-Kalogi patti, Netwad Patti, Badagaddi patti, Gajana patti

Existing rain water management facilities:

1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj), very less check dam/trenches are available
3. Hydrum as lift device
4. Roof water harvesting but limited

B. Productivity Enhancement

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

1. Construction of small sized rain water harvesting LDPE tanks
2. Making bunds
3. Trenches and check dams.

2. Existing practices for soil health improvement

1. Appropriate Soil testing labs are not available with suitable staff.
2. Meagre/ no use of biofertilizers
3. Imbalanced/ insufficient nutrient use
4. Use of raw/partially decomposed FYM
5. Meagre/ no compost making/recycling of crop residue
6. Mixed cropping of cereal and legume
7. Soil health card scheme launched in 2015

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

1. Establishment of soil testing labs at Block level.
2. Soil sampling, testing and soil health card distribution.
3. Availability of nutrients/ micro-nutrients through cooperative societies
4. Promotion for use of organic fertilizers/ Bio fertilizers

i) Cereals and oilseeds

1. Seed/ soil inoculation with Azotobacter and Phosphorus solubilising microbial culture (250-300g each/ acre for seed inoculation;/ and 1-1.5 kg each mixed in well decomposed 25 kg FYM/ acre

for soil inoculation)..

2. Soil test based balanced use of fertilizers in irrigated areas as per recommendation; INM shall be preferred
3. Scientific preparation of FYM/ recycling of crop residue, weeds etc. through composting and/or vermicomposting
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

(ii) Pulses and soybean

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

(iii) **Vegetables and spices**

1. Seed/ nursery soil inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture (each of 200 g/m^2 for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture at transplanting.
3. Soil test based balanced use of fertilizers; INM shall be preferred
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

(iv)Apple and other fruits

1. Application of *Azotobacter*, Phosphorus solubilising microbial inoculants with 50 kg well decomposed FYM/ compost/ Vermicompost @25 kg per tree.
2. Soil test based balanced fertilization as per recommendation along with micronutrients; INM shall be preferred
3. Foliar application of micronutrients as per the requirement
4. Establishment of soil testing labs at Block level.
5. Soil sampling, testing and soil health card distribution.
6. Availability of nutrients/ micro-nutrients through cooperative societies
7. Promotion for use of organic fertilizers/ Bio fertilizers /green manuring

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

1. Most of the time farmers could not do anything due to non availability of crop contingency plan under changing climate condition.
2. Regular Occurrence: Frost, Drought, Cold wave.
3. Almost 90% agriculture is rainfed, which requires robust strategies of rainwater conservation and harvesting.
4. Soil erosion due to steep slopes and rainfall is quite high.
5. Field crops such as rice, wheat, mandua, jhangora are major crops of the region.
6. Vegetables and horticultural crops are being grown over very small area, except Apple, which is being grown over relatively large area.

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

1. Change in cropping pattern (change in sowing time)
2. Introduction of biotic & abiotic stress resistance varieties
3. Inbreeding of local germplasm/ varieties
4. The climatic projection suggests increasing air temperature and erratic distribution of rainfall.
5. Therefore following strategy should be followed to increased income under changing climatic scenario:

a. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
b. The rain water should be properly stored (In polythene tank, and by making bunds) and harvested for Kharif season crops.

c. Soil erosion triggered by higher slope gradient is the major issue of Uttarkashi. Therefore water and soil conservation techniques like terrace farming, bunding etc should be encouraged.
d. The area of off season vegetable like vegetable pea, potato etc should be increased.
e. given to cultivate of Kiwifruits as climatic conditions of Uttarkashi districts The frost susceptible vegetable crops should be grown on southern aspect of topography so that availability of radiation increases and the effect of frost could be minimized.
f. Crop residues should be burnt in the previous night if there is forecast of frost.
g. Organic mulch should be used in a vegetable field for enhancing energy level in field so that crop should be protected from frost.
h. Special emphasis should be specially Naugaon, Purola, Chinyali Saur (high hills), Dunda (high hills), Mori, southern Bhatwari are suitable for kiwifruit cultivation.
i. The climatic conditions, slope gradients and soils are suitable for sub tropical (in Valley region Citrus fuits, Mango) and Temperate fruits (Apple, pear, peach, Apricot, Walnut).
j. Due to increasing temperature the new orchards should be developed at higher altitudes to meet out the chilling requirement.

6 A. Name of Field Crop: Wheat

i. Existing varieties being used: Local variety

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

Region B: VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 and UP 2572

Region C: VL *Gehun* 829, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 (from 1500 to 1700m amsl), VL Gehun 832 and HPW 155, HS 365 and UP 2572(from 1700 to 2400m amsl

iii. Existing package of practices being used:

1. Traditional practices
2. Preparation of land- 1 or 2 ploughing with local plough no definite depth
3. Seed rate and seed sowing -150-175 kg/ha.
4. Broad casting
5. Manure and fertilizer- Use of undecomposed FYM (rainfed)
   Undecomposed FYM with small doses of chemical fertiliser by some progressive farmers (in irrigated conditions)as per availability
6. Irrigation usually maximum area is rain fed and in valley condition 1 or 2 irrigation

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

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

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

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

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

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

vii. Major disease associated with crop: Yellow rust, Leaf blight, Karnal bunt

viii. IPM Module for management of disease:

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

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

Leaf blight of wheat: *Alternaria triticina*

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

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*, Bathua (*Chenopodium album*)

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:

1. Proper adoption of package of practices with suitable information bridging can intensify the wheat production in the district.
2. Organic cultivation,
3. Adoption of low-cost based cultivation practices,
4. Wheat-Horse gram/Soybean(rainfed),
5. Wheat-Rice(irrigated),
6. Timely Sowing, Seed treatment, Use of HYV
7. FIRB
8. Contour cultivation and care soil & water conservation measures
9. Maximum use of value added compost/FYM
10. INM and soluble fertiliser
11. Integrated weed management

xii. Production constraints in agro-ecological region:

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices

6B. Name of Field Crop: Rice

i. Existing varieties being used: Local variety

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

Region A: Jethi rice - Vivek Dhan 154 and VL Dhan 157; Irrigated Rice - VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85*, Pusa Basmati 1509 & PRH 10) Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355

Region B: Irrigated - VL Dhan 65, VL Dhan 86, VL Dhan 68, VL Dhan 85, Pusa Basmati 1509 & PRH 10; Rainfed- Chatki Dhan - VL Dhan 208, VL Dhan 209; Jethi dhan –Vivek Dhan 154, VL Dhan 157, VL Dhan 156 and VL Dhan 158) Pant Dhan-19, HKR-127, PA 6444, VNR 2355

iii. Existing package of practices being used: Traditional practices

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

1. Adoption of Package of practices developed by ICAR-VPKAS, Almora
2. Preperation of land- 1 or 2 ploughing with local plough , puddling
3. Seed rate and seed sowing –

a. direct seeding rice- 100-125kg/ha in
b. transplanting- 40-50 kg/ha,
c. basmati20kg/ha,hy 20kg/ha
d. 25-30days seeding used

4. Manure and fertilizer-

a. 15 tonne FYM ,
b. NPK 100-120:60:40,
c. rainfed 50-60:30:20with micronutrients(Zn, Fe)

5. Irrigation-usually maximum area is rain fed and in valley condition as avalability of irrigation roaster
6. Use of pre and post emergence tp herbicide, rainfed- pre emergence
7. Use of IPM practices

v. Major insect pests associated with crop: Rice Stem borer, Brown plant hopper

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	

Brown plant hopper: ***Nilaparvata lugens***

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

Bio- insecticides

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

vii. Major disease associated with crop: Rice blast

viii. IPM Module for management of disease:

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

Major weeds associated with crop: *Echinochloa* sp.*, Ageratum conyzoids, Chenopodium album,*

Phyllanthus urinaria, Saccharum spontaneum, L. laptocloa, Sedges

ix. 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	

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

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Chlorimuron Ethyl 25% WP (Transplanted rice)	24	60

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

1. Proper adoption of package of practices with suitable information bridging can intensify the Rice production in the district.
2. Organic cultivation,

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

xi. Production constraints in agro-ecological region:

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices
3. Less availability of agriculture inputs
4. Use of imbalance and un decomposed FYM
5. Climate changing
6. Wild animal damages
7. Migration
8. Poor Irrigation facilities

6C. Name of Field Crop: Finger millet

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

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

iii. Existing package of practices being used:

1. Traditional practices
2. Seed variety
3. undecomposed FYM 1.5-2.0qt./nali,
4. 1-2 weeding

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

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

v. Major insect pests associated with crop: Root aphid, Stem borer, white grub

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

vii. Major disease associated with crop: Blast and stem rot

viii. IPM Module for management of disease:

1. Adoption of IPM modules developed by ICAR-VPKAS, Almora
2. Grow resistant variety such as VL 149
3. Seed treatment with carbendazim @ 1g/kg seed followed by 2 sprays of carbendazim @ 0.1% (first when 50 per cent ear heads are formed and second 10 days later)

4. For organic farming seed treatment with Bioagents like *T. harzianum* @ 10g/kg seed followed by 2 sprays of same @ 10g/litre of water (first when 50 per cent ear heads are formed and second 10 days later).

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

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

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

1. Proper adoption of package of practices with suitable information bridging can intensify the Ragi production in the district.
2. Organic cultivation,
3. Adoption of low-cost based cultivation practices,
   Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
   Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Timely Sowing
5. Seed treatment
6. Use of HYV
7. Gapfilling/Transplating
8. Contour cultivation and care soil & water conservation measures
9. Maximum use of value added compost/FYM
10. INM and soluble fertiliser
11. Integrated weed management
12. IPM
13. Good storage condition
14. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Non-availability of good quality seeds on time.
2. Non adoption of package of practices
3. Less availability of agriculture inputs
4. Use of imbalance and un decomposed FYM
5. Climate changing
6. Wild animal damages
7. Migration
8. Poor Irrigation facilities

6D. Name of Field Crop: Barnyard millet

i. Existing varieties being used: Local

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

iii. Existing package of practices being used:

1. Traditional practices
2. Seed variety
3. undecomposed FYM 1.5-2.0qt./nali,
4. 1-2 weeding

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

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

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

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

vii. **Major disease associated with crop:** Blast and stem rot

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

Smut

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

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

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

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

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

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

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

6E. Name of Field Crop: Maize

i. **Existing varieties being used:** Lal makka

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Region A, B & C: CMVL Sweet Corn 1, CMVL Baby Corn 2 (upto 2000m amsl 50 kg seed of maize single cross hybrid DH 296 is available with Maize Breeder of the University. Maize hybrid DH 296 is a potential high yielding hybrid and is final stage of testing in SVT.

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

1. Traditional practices
2. Sown as mixed cropping
3. Traditional seed variety
4. Undecomposed FYM 1.5-2.0qt./nail
5. 1-2 inter culture

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

1. Adoption of Package of practices developed by ICAR-VPKAS, Almora
2. Preparation of land- 1 or 2 ploughing ,
3. Seed rate and seed sowing – composit-18-20 kg/ha, hy 20-25kg/ha, , Gapfilling,spacing 60*20cm
4. Manure and fertilizer- -10 tonne FYM , NPK 100:120:60 :40,
5. Irrigation-usually maximum area is rain fed
6. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence
7. Use of IPM practices

v. Major insect pests associated with crop: Aphid, stem borer, shoot fly

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

Adoption of IPM modules developed by ICAR-VPKAS, Almora

Maize stem borer: *Chilo partellus*

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

Shoot fly: *Atherigona soccata*

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

Aphid

Spray any of the following insecticides after diluting in 500 litre water/ha

Thiamethoxam 25 WDG	100g/ha
Imidacloprid 17.8SL	100-125ml/ha
Dimethoate 30 EC	660ml/ha
Oxydemeton methyl 25EC	500ml/ha
Quinalphos 25EC	1000ml/ha
Monocrotophos 36SL	1400ml/ha

vii. Major disease associated with crop: Leaf blight, leaf blast, stem rot, and common rust

viii. IPM Module for management of disease:

1. Use of disease free certified seeds
2. Deep ploughing during summer
3. Crop rotation
4. Application of bio-agents i.e. *Psedumonas fluorescens* as seed treatment (10g /kg seed) plus soil application (2.5 kg/ha) and spray @ 0.1% and seed treatment with *Trichoderma viride* (10g /kg seed) and their stimulation by the addition of amendments can be done.
5. Fertilizer application
6. A fertilizer dose of 80 Kg N, 60 Kg P2O5, 40 Kg K2O is generally required. Entire PK and 10% of N is applied as basal. Remaining nitrogen is applied in 4 splits i.e. 20% at 4 leaf stage, 30% at 8 leaf stage, 30% at flowering stage and 10% at grain filling stage.
7. Row spacing
8. Should be done at 60-75 cm & plant to plant spacing, 20-25 cm.
9. Cultural practices
10. Cultural practices which includes sufficient availability of plant nutrients, optimum soil pH

(6.2-7.0), adequate water in fields, weed control, optimum plant population and use of disease free and high quality seeds are very helpful in reducing the damage caused by various diseases by reducing the plant stress.

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

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

ix. Major weeds associated with crop: *Cyanodon dactylon* and *Chloris barbata*

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

1. Adoption of IPM modules developed by ICAR-VPKAS, Almora
2. Apply Atrazine 50%WP @ 1.0 kg a.i/ha or Alachlor 50%EC @ 2.5 kg a.i/ha or Diuron @ 0.8 kg a.i/ha within 3 days after sowing followed by one hand weeding at 25-30 days after sowing.
3. Apply 2,4-D Dimethyl Amine Salt 58%SL @ 0.5 kg a.i/ha or 2,4-D Ethyl Ester 38%EC @ 0.9 kg a.i/ha at 25 days after sowing to control broad leaf weeds.
4. Apply Tembotrine @ 120 g a.i/ha at 15-20 days after sowing to control grassy and non grassy weeds.
5. Minimum two hand weeding at 20& 35 DAS are required.

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

1. Proper adoption of package of practices with suitable information bridging can intensify the maize production in the district.
2. Timely Sowing
3. Sowing of Baby corn and Sweet corn Shot duration hybrid Varieties
4. Seed treatment
5. HYV
6. Inter cropping
7. Gap filling
8. Organic cultivation,
9. Adoption of low-cost based cultivation practices,
   Maize- Wheat/Lentil/Barley/oat (fodder) (rainfed),
   Maize+Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
10. Contour cultivation and care soil & water conservation measures
11. Maximum use of value added compost/FYM
12. INM and soluble fertiliser
13. Integrated weed management
14. IPM
15. Good storage condition
16. Sale of value added products

xii. Production constraints in agro-ecological region:

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices
3. Less availability of agriculture inputs
4. Use of imbalance and un decomposed FYM
5. Climate changing
6. Wild animal damages
7. Migration
8. Poor Irrigation facilities

7A. Name of the Pulse crop: Lentil

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

ii. High yielding varieties (the seed of which is available in the state) to be used for

increasing yield in specific agro-ecological region: Masoor 125, VL Masoor 126, VL Masoor 507, VL Masoor 514, PL 5 , PL 7, PL 8

iii. Existing package of practices being used:

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

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

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

v. Major insect pests associated with crop: Pod borer

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

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.
   Foliar spray of Propiconazole (0.1 %) at the appearance of disease and repeated 2-3 times at 15 days interval.

ix. Major weeds associated with crop: Local weeds

x. IPM Module for management of weeds: Manual weeding

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

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

xii. Production constraints in agro-ecological region:

Non adoption of package of practices

7B. Name of Pulse crop: Urd

i. Existing varieties being used: Local variety

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Urd 30, Pant Urd 31, Pant Urd 35

iii. Existing package of practices being used: Traditional methods

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

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

vi. IPM Module for management of insect pests :

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

Fruit Borer

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

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	
Phorate 10% CG	10000	

Stem fly

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

vii. Major disease associated with crop: Yellow Mosaic, Blast, Powdery mildew, Leaf blight

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

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

2. For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid

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

ix. Major weeds associated with crop: *Amaranthus viridis& Echinochloa*

x. IPM Module for management of weeds: Adoption of IPM modules

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

1. Proper adoption of package of practices with suitable information bridging can intensify the urd production in the district.
2. Preparation of land- 1 or 2 ploughing ,
3. Seed rate and seed sowing – 12-15kg/ha,spacing 30*45cm
4. Manure and fertilizer- -10 tonne FYM , NPK50:20 :20,
5. Irrigation-usually maximum area is rain fed
6. Use of pre and post emergence herbicide(Asper moisture availability), rainfed- pre emergence,Use of IPM practices

xii. Production constraints in agro-ecological region:

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices

7C. Name of Pulse Crop: Moong

i. **Existing varieties being used:** Pant moong 2

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 3, Pant Moong 4, Pant Moong 5, Pant Moong 6, Pant Moong 7, Pant Moong 8

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

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

v. **Major insect pests associated with crop:** White fly, fruit borer, hairy caterpillar, stem fly, leaf hopper, bugs, Blister beetle, white grub, thrips

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

Fruit Borer

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

White fly

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

vii. **Major disease associated with crop:** Yellow Mosaic, rust, powdery mildew and leaf blight

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

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

ix. **Major weeds associated with crop:** *Amaranthus viridis & Echinochloa*

x. **IPM Module for management of weeds:** Adoption of IPM modules

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Proper adoption of package of practices with suitable information bridging can intensify the moong production in the district.

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

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices

7D. Name of Pulse Crop: Pegion pea

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

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

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

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

v. **Major insect pests associated with crop:** Pod borer, pod fly, bug, thrips

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

1. Deep ploughing in summer
2. Intercrop with sorghum for reducing Helicoverpa armigera.
3. Early planting (mid- June) for avoiding peak infestation period of H. armigera on short duration crop
4. Planting of tall sorghum /maize varieties on borders for conserving natural enemies. These

plants also function as live perches for predatory bird.

5. First spray of Ha NPV@ 500 LE per ha or B.t. 1 kg/ha followed by second spray of NSKE5% followed by third spray of indoxacarb 15.8 EC, 400 -500 ml or spinosad 45 SC, 125 ml/ha at a interval of 12-15 days (when 2-3 egg or one larva)

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	

Bio-insecticides

Name of the Insecticides	**(gm/ml) /ha**
Bacillus thuringiensis serovar kurstaki (3a,3b,3c) 5% WP	1000-1250
Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750
NPV of Helicoverpa armigera 2.0% AS Strain No. GBS/HNPV -01	250-500
NPV of Helicoverpa armigera 2.0% AS Strain No. IBH-17268	250-500
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

Red gram podfly: *Melagromyza obtusa*

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

vii. Major disease associated with crop: Wilt, stem rot, and cankers

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

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

Stem rot: *Rhizoctonia bataticola Macrophomina phaseolina*)

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

Bio-insecticides

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Trichoderma viride 1% WP (TNAU	4 g/Kg seed	**Seed Treatment:** Mix required

Strain Accession no. ITCC 6914)		quantity of the seeds with the required quantity of *Trichoderma viride* 1% WP and ensure uniform coating, shade dry and sow.

ix. Major weeds associated with crop: Lantana, Crofton weed, Black Wattle

x. IPM Module for management of weeds: Adoption of IPM modules

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Proper adoption of package of practices with suitable information bridging can intensify the Pigeon pea production in the district.

xii. Production constraints in agro-ecological region:

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices

7E. Name of Pulse/oilseed Crop: Soyabean

i. Existing varieties being used: Kala bhatt(Oval), Pahari soybean

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

iii. Existing package of practices being used:

1. Traditional seed variety,
2. No use of plant protection measures, Only cultural practices

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

Adoption of Package of practices

v. Major insect pests associated with crop: Semi looper, Bihar hairy catter piller,White fly, Girdle beetle, Leaf miner, jassid, defoliators

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

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

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

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

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

Leaf miner	MACS 1370, Himso 1685, MACS 1370, MACS 1410
Pest complex	DS 2708, Dsb 23-2, Dsb 25, Himso 1685, JS 20-53, JS 20-79, JS 20-89, KDS 726, MACS 1370, MACS 1410, NRC 97, SL 983, PS 1543

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

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

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

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

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

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

Table 2: Major predators of insect pests of soybean

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

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

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

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

Table 4: List of insecticides recommended for soybean insect pests

Insect pest	Insecticide	Dosage
Sucking pests, stem fly	Thiamethoxam 30 FS (Seed treatment)	10ml/kg seed
Sucking pests	Acetamiprid 20 SP	100 ml/ha

Sucking pests	Spiromesifen 22.9 SC	600ml/ha
Sucking pests	Imidacloprid 17.8 SL	500 ml//ha
Sucking pests and girdle beetle	Triazophos 40 EC	800ml/ha
Defoliators	Dichlorovos 76EC	500 ml/ha
Defoliators and pod borer	Quinalphos 25 EC	1500 ml/ha
Sucking pests and defoliators	Monocrotophos 36 SL	800 ml/ha
Pod borer	Indoxacarb 15.8EC	333 ml/ha
Defoliators, stem fly and girdle beetle	Chlorantraniliprole 18.5 SC	150 ml/ha
Leaf miner	Carbaryl 50WP	2.0 kg/ha
Leaf miner and sucking pests	Oxydemeton methyl 25EC	350 ml/ha
Girdle beetle	Phorate 10 G	10 kg/ha
Stemfly and girdle beetle	Carbofuran 3 G	30 kg/ha

Bio-insecticides

Tobacco caterpillar (*Spodoptera litura*)

Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

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

Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

Semilooper (*Chrysodeixis acuta*)

Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

Soyabean leaf miner (*Odontota horni*)

Bacillus thuringiensis var. kurstaki Serotype H-3a,3b, Strain Z-52	750

vii. Major disease associated with crop: Wilt , brown stem rot, downy mildew and rust

viii. IPM Module for management of disease:

Rust: *Phakopsora pachyrhizi*

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

ix. Major weeds associated with crop : Local weeds

x. Production constraints in agro-ecological region:

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

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

1. Proper adoption of package of practices with suitable information bridging can intensify the

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

xii. Production constraints in agro-ecological region:

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices

7F. Name of oilseed crop: Toria/sarson

i. Existing varieties being used: Rara,Gharia

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

iii. Existing package of practices being used:

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

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

1. 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

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

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

Mustard saw fly : *Athalia lugens proxima*

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

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

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

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

Alternaria blight or Leaf spot: *Alternaria brassicae*

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

White rust : *Albugo candida*

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

Downy mildew: *Peronospora parasitica*

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

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

x. IPM Module for management of weeds:

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

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

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

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

xii. Production constraints in agro-ecological region:

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

8A. Name of oilseed 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: PT-303,507,Uttara, PPS-1

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: Lemon Butterfly, Citrus psylla, Leaf Miner

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

Citrus psylla

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

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.
6. Spraying with Malathion @ 1 ml/ l or quinalphos 25% EC @ 600-800 ml in 200-400 l of water/acre or 2.0 liters of carbaryl 5OWP in 1250 liters of water/ha during April (after fruit set) and October (after rainy season).

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

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

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

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

x. IPM Module for management of weeds:

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

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

***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: Local varity

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

iii. Existing package of practices being used:

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

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

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

v. Major insect pests associated with crop: Fruit fly, mealy bug, stone weevil, hopper, shoot gall, stem borer

vi. IPM Module for management of insect pests:

Mango Hopper:

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

months of July-August.

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

Mango mealy bug:

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

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

Mango shoot gall:

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

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

Mango fruit fly:

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

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

Mango stem borer:

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

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

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

viii. IPM Module for management of disease:

Die back : cutting of affected part of branches with 10-12 cm healthy parts . Use of 0.3% copper oxy chloride (4 g/ l) at cut surface

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

panicles.

Powdery mildew: *Oidium mangiferae*

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

Anthracnose: *Colletotrichum gloeosporioids*

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

ix. **Major weeds associated with crop:** *Cynodon dactylon*, *Cyperus rotundus* and *Bidens pilosa*

x. **IPM Module for management of weeds:** Through mechanical, 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:** Proper adoption of package of practices with suitable information bridging can intensify the Mango production in the district.

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

1.Non-availability of good quality plants on time.
2.Non adoption of package of practices

8C. Name of the Fruit crop: Guava

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

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

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

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

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

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

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

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

Guava fruit borer/ castor capsule borer:

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

Guava butterfly:

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

vii. **Major disease associated with crop:** Canker, wilt

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

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

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

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

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

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

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

8D. Name of the Fruit crop: Apple

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

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

iii. **Existing package of practices being used:** No package of practices are followed

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**
Adoption of Package of practices developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

v. **Major insect pests associated with crop:** San jose scale, Tent caterpillar, coddling moth, Red mite , stem borer, gypsy moth and maggot

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

San Jose Scale:

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

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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.

8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

vii. Major disease associated with crop: Powdery mildew, scab, canker and fire blight

viii. IPM Module for management of disease: Inter cropping, resistant/tolerant varieties and use bio control agent.

ix. Major weeds associated with crop: Lambs quarter, Sweet clover and Corn spurry

x. IPM Module for management of weeds: Through mechanical, chemical control. Adoption of IPM module developed by ICAR-CITH Mukteshwar, & SKUAS&T, J&K

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Proper adoption of package of practices with suitable information bridging can intensify the Apple production in the district.

xii. Production constraints in agro-ecological region:

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices

8E. Name of the Fruit crop: Peach

i. Existing varieties being used: Traditional plants are used

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Florda Sun, Saharanpuri No. 1 & No. 2, Florda Prince

iii. Existing package of practices being used: No package of practice are used

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Adoption of package of practices developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

v. Major insect pests associated with crop: Scale, tent caterpillar, codling moth, Aphid, fruit fly, tree borer, twig borer, Leaf miner, Hairy Caterpillar, shot borer, stem borer, chaffer beetles, mites, thrips

vi. IPM Module for management of insect pests:

San Jose Scale:

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

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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.

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

Peach Leaf Curl Aphid:

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

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

Peach Fruit Fly:

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

vii. Major disease associated with crop: Leaf curl, Blight, Shot hole

viii. IPM Module for management of disease: Adoption of IPM module developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

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

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

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

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

xii. Production constraints in agro-ecological region:

Proper adoption of package of practices with suitable information bridging can intensify the peach production in the district.

8F.Name of the Fruit crop: Pear

i. Existing varieties being used: Traditional plants are used

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

iii. Existing package of practices being used:

Use of old and traditional varieties

iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Adoption of package of practices developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

v. **Major insect pests associated with crop:** Scale, tent caterpillar, codling moth, Aphid, fruit fly , Leaf miner, Hairy Caterpillar, Totricid Moths, shot borer, stem borer, chaffer beetles, mites, thrips

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

San Jose Scale:

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

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

Codling Moth/ Fruit borer:

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

Peach Leaf Curl Aphid:

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

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

Peach Fruit Fly:

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

vii. **Major disease associated with crop:** Seedling Blight, Hairy root, Crown Gall, White root rot, collar rot, canker and die-back, scab, leaf sopt, powdery mildew

viii. **IPM Module for management of disease:** Adoption of IPM module developed by ICAR-

CITH Mukteshwar & SKUAS&T, J&K

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

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

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Proper adoption of package of practices with suitable information bridging can intensify the pear production in the district.

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

1. Non-availability of good quality plants on time.
2. Non adoption of package of practices

8G. Name of the Fruit crop: Plum

i. **Existing varieties being used:** Traditional varieties are used

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

iii. **Existing package of practices being used:**
Use of old and traditional varieties

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** High density plantation with drip irrigation system. Adoption of package of practices developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

v. **Major insect pests associated with crop:** Aphid, Fruit Fly, scale, tent caterpillar, codling moth

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

San Jose Scale:

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

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

Tent Caterpillar:

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

Codling Moth/ Fruit borer:

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.

9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

Peach Leaf Curl Aphid:

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

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

Peach Fruit Fly:

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

vii. Major disease associated with crop: Corynium Blight

viii. IPM Module for management of disease: Adoption of IPM modules developed by ICAR-CITH Mukteshwar & SKUAS&T, J&K

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

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

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Proper adoption of package of practices with suitable information bridging can intensify the plum production in the district.

xii. Production constraints in agro-ecological region:

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

9A. Name of the vegetable crop: Cabbage

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

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

i. Existing package of practices being used: No package of practices are followed

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

1. Soil Testing- Farmers should test their soils before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to go for deep ploughing before sowing the crop particularly during the hot season or before the snowfall
3. Seed- Farmers should adopt improved varieties/ hybrids
4. Soil solarisation practice should follow in nursery beds .
5. Seed Treatment- To combat the different seed borne diseases to treat the seed by Captan @

2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing

6. Seed Rate- It is recommended to use the seed quantity for different as follows-
   (Early)-600-700g/ ha open pollinated
   (Mid and Late)- 500-550g/ha open pollinated
   (Hybrid)-350-400g/ha
7. Optimum sowing time
   Region A- Mid Sept- Oct
   Region B Aug- Sept (Irrigated condition)
   Region C June, July (Rainfed)
8. Transplanting- Farmers should transplant seedlings properly as for early (40x45cm), medium (40x45cm),
9. Manures and fertilizers- Farmers should incorporate well rotten cow dung (20-25tonnes/ha) and NPK (120:60:60) in irrigated, half dose of NPK in unirrigated condition.
10. Irrigation- As per requirements. At critical stages such as head initiation and head development
11. Weed control- Farmers must know about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically.
12. Harvesting- The farmer must aware about the maturity stage of a particular crop variety so he can harvest the crop as per their object. In general the heads should be harvested when they attempt the size in between 500-750 gms.

iii. Major insect pests associated with crop: Diamond back moth, Leaf Webbers, Aphid

iv. IPM Module for management of insect pests :

1. Diamond black moth- plantation of mustard crop as trap crop at margins of cabbage field to attract the adults for egg laying,spray of *Bacillus thurengnsis* @ 1.0 kg /ha or
2. Cabbage butterfly - mechanically destroy the cluster of eggs,*Helicoverpa* - release of *Tricogramma* spp insect eggs @ 50000 / ha at the time of initation of flowering to 7- 10 days,

Before Planting

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

After Planting

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

Dimond back moth: *Plutella Xyllostella*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	50	3
Cyantraniliprole 10.26% OD	600	5
Indoxacarb 14.5% SC	200-266	7
Indoxacarb 15.8% EC	266	5
Spinosad 2.5% SC	600-700	3
Chhlorfenapyr 10% SC	750-1000	7
Emamectin benzoate 5% SG	150-200	3
Flubendamide 480% SC	45-60	7

Flubendamide 20% WG	90-120	7
Chlofluazuron 5.4% EC	1500	7
Diafenthiuron 50% WP	600	7
Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

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

Cabbage/cauliflower Aphid

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

Bioinsecticides

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

Painted bug

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

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

vi.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.

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

iii. IPM Module for management of weeds:

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

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

1. Use of hybrid varieties suitable for year round production system for mid or high hills.
2. Inter Cropping with coriander and rye in hills.

x.Production constraints in agro-ecological region:

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

9B. Name of the vegetable crop: Cauliflower

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

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

iii. Existing package of practices being used:

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

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

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

5. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma Viride 4g/kg before sowing.
6. Seed Rate- It is recommended to use the seed quantity for different as follows-
   Cauliflower (Early)-500-750g/ ha open pollinated.
   Cauliflower (Mid and Late)- 300-350g/ha open pollinated.
   Cauliflower (Hybrid)-250-300g/ha.
7. Varieties- Farmers should select proper variety for suitable sowing time as per maturity group.
8. For early crop- Early Kunwari, Pusa Kartiki, Pusa Early Synthetic; Mid- Pusa Synthetic, Pusa Shubhra, Pant Shubhra, Hisar No.1 and Late- Pusa Snowball-16, Pusa Snowball Kt-1, Pusa Hybrid-2.
9. Transplanting- Farmers should transplant seedlings properly as for early (30x30cm), medium (45x30cm), and late (60 x 45 cm).
10. Manures and fertilizers- Farmers should incorporate well rotten cow dung (15-20tonnes/ha) and NPK (150:80:60) in irrigated, half dose of NPK in un irrigated condition.
11. Irrigation- Farmers should apply water in the field at proper stage of the crop. As critical growing stage such as proper growing stage, curd formation and maturity stages.
12. Weed control- Farmers must know about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically.
13. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

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

vi. IPM Module for management of insect pests :

Before Planting

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

After Planting

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

Dimond back moth: *Plutella Xyllostella*

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

Lufenuron 5.4% EC	600	14
Novaluron 10% EC	750	5
Metaflumizone 22% SC	750-1000	3
Tolefenpyrad 15% EC	1000	5
Thiodicarb 75% WP	1000-1330	7
Fipronil 5% SC	800-1000	7
Cypermethrin 10% EC	650-760	7

Bioinsecticides

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

Cabbage/cauliflower Aphid

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

Bioinsecticides

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

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

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

***Xanthomonas* Black rot:**

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

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

x. IPM Module for management of weeds:

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

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

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

xii.Production constraints in agro-ecological region:

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

11. So far no minimum support price is fixed for the crop.

9C. Name of the vegetable crop: Radish

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

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

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

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

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

iii. **Existing package of practices being used:** No package of practices are adopted

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

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

v. **Major insect pests associated with crop:** Aphids, flea beetles and mustard saw fly

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

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

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

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

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

viii. **IPM Module for management of disease(except organic areas):** Adoption of IPM Modules developed by GBPUA&T, Pantnagar, ICAR-VPKAS, Almora & SKUAS&T, J&K

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

x. **IPM Module for management of weeds:** Weeding manually

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

in specific agro-ecological region:

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

xii. Production constraints in agro-ecological region:

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

9D. Name of the vegetable crop: Tomato

i. Existing varieties being used:

Region A: VL Tamatar 4
Region B: VL Tamatar 4, Manisha, Himsona, Navin 2000
Region C: VL Tamatar 4 upto 1800m amsl
Private company varieties like Himsona, Rakshhak etc.in all zones

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Pusa Ruby, VLT 4, Pusa 120, Arka Vikas, Arka Abha, Pant Bahar, Pant T 3 Available good yielding varieties like Naveen2000+, Himsona etc should be used from private sector and varieties like Pusa Sheetal, Pusa Gaurave, Pant T-3 should be used from Government sector for and B Zone

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

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

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

1. Adoption of package of practice developed by GBPUA&T, Pantnagar, ICAR-VPKAS, Almora & SKUAS&T, J&K
2. Use Inderminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition. Use Zn in deficient soil.
3. Use micronutrient including Ca, B and Mo
4. Crop rotation Tomato-cowpea-Early cauliflower

v. Major insect pests associated with crop: Fruit Borer, Serpentine Leaf Miner, Whiteflies, Tobacco Caterpillar, Red Spider Mites, Root-knot Nematodes

vi. IPM Module for management of insect pests:

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

1. Growing trap crop of African tall marigold as border row before 15 days of transplanting is

beneficial in reducing egg laying in main crop.

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

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

Bio-insecticides

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 1% EC Neem based	1000-1500	3
Azadirachtin 5% Neem Extract Concentrate Containing	200	5
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	1000-1500	
NPV of *Helicoverpa armigera* 0.43% AS	1500	
NPV of *Helicoverpa armigera* 2.0% AS Strain no. BIL/HV-9POB	250-500	
NPV of *Helicoverpa armigera* 0.43% AS Strain no. BIL/HV-9		

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

Bio-insecticides

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 5% Neem Extract Concentrate Containing	200	5

Leaf miner, *Liriomyza trifoli*

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

vii. Major disease associated with crop: Alternaria Blight, Late Blight, Powdery mildew, wilt

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

Late blight :

1. Burn the infected crop debris,
2. Avoid 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

Bacterial wilt:

1. Use crop rotation of maize,wheat and mustard,
2. Deep ploughing,
3. Keep proper drainage of water in field,
4. Drenching of 30 gm COC +1.0 gm Streptocyclin + 10 litre of water.

Wilt (*Fusarium oxysporum*)

Name of the Bio-insecticides	(gm/ml) /ha	Waiting period (days)
Pseudomonas fluorescens 0.5% WP (TNAU Strain Accession no. ITCCBE 0005	10 g/Kg seed 2.5 Kg/ha	**Seed Treatment:** Mix required quantity of the seeds with the required quantity of *Pseudomonas fluorescens* 0.5% WP and ensure uniform coating, shade dry and sow. **Soil Treatment:** 2.5 Kg of *Pseudomonas fluorescens* 0.5% WP. Spread uniformly over a hectare of land
Pseudomonas fluorescens 1% WP (IPL/PS-01 Accession no. MTCC5727	5g/Kg seed	**Seed Treatment:** Make a thin paste of required quantity of *Pseudomonas fluorescens* 1% WP with the minimum volume of water and coat the seed uniformly, shade dry the seed just before sowing.
Pseudomonas fluorescens 1% WP (Strain No. IIHR-PF-2 Accession no. ITCCB0034)	20 g/Kg 50 g/sqm 5 Kg/ha	**Seed Treatment:** Treat the seed with *Pseudomonas fluorescens* 1% WP **Nursery Treatment:** Treat the nursery beds with the *Pseudomonas fluorescens* 1% WP. **Soil Treatment:** Apply *Pseudomonas fluorescens* 1% WP with enriched FYM @ 5 tons/ha to the soil before sowing.
Trichoderma harzianum 1% WP (Strain No. IIHR-TH-2 Accession no. ITCC6888)	20 g/Kg 50 g/sqm	**Seed Treatment:** Treat the seed with *Trichoderma harzianum* 1% WP **Nursery Treatment:** Treat the nursery beds with the *Trichoderma harzianum* 1% WP.

	5 Kg/ha	**Soil Treatment:** Apply *Trichoderma harzianum* 1% WP with enriched FYM @ 5 tons/ha to the soil before sowing.
*Trichoderma viride*1.5% WP *(*Strain No. IIHR-TV -2 Accession no. ITCC6889)	20 g/Kg 50 g/sqm 5 Kg/ha	**Seed Treatment:** Treat the seed with *Trichoderma viride* 1.5% WP. **Nursery Treatment:** Treat the nursery beds with the *Trichoderma viride* 1.5% WP. **Soil Treatment:** Apply *Trichoderma viride*1.5% WP with enriched FYM @ 5tons/ha to the soil before sowing.

Powdery mildew:

Spray of wettable sulphur 3.0 gm/L or Karathen @ 0.5 ML/L of water

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

x. IPM Module for management of weeds:

1. Cultural practices.
2. Through recommended chemicals.

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

1. Proper adoption of package of practices with suitable information bridging can intensify the Tomato production in the district.
2. Reduce number of spray of pesticides.
3. Raise nursery on treated soil.
4. Treat seed with fungicide before sowing.
5. Manage fog during fruiting period.

xii. Production constraints in agro-ecological region:

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

9E. Name of the vegetable crop: Potato

i. Existing varieties being used:

Region A (up to 1000 m): K. Bahar, K Badshah, and Kufri Jyoti

Region B (1000-1500) : Tumari Local and Kufri Jyoti

Region C (1500-2400): Tumari Local and Kufri Jyoti

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

Region A (up to 1000 m): K. Khyati, K. Pukhraj K . Ashok, K. Sadabahar, K. Anand, etc

Region B (1000-1500): K Jyoti, K. Ashok , K. Himsona

Region C (1500-2400): K Girdhari, K Himalini and K Shailja

The seed of above listed varieties are not available or available in less quantity in different zones

iii. Existing package of practices being used:

1. No package of practices are adopted
2. Planting time:

Region A (up to 1000 m): October

Region B (1000-1500) : Feb-March
Region C (1500-2400): March-April

3. Spacing: 50-60 x 15-20 cm
4. Seed rate: 25-30 qtl/ha
5. Farmers are only using FYM along with urea at hills but the farmers in plains are using FYM + 160:100:120kg/ha NPK.

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

1. Region C: Late blight resistant variety such as K Girdhari, K.Himalini and K. Shailja should be selected for planting.
2. Fertilizer should be used on soil test basis.
3. Dehaulming practise should be adopted for long duration storage of tubers.
4. Suitable fungicides should be used for control of Late blight disease e.g. mancozeb, cardendazim alone and in combination.

v. Major insect pests associated with crop: Potato aphids, Hadda Beetle, Potato tuber moth, white grub

vi. IPM Module for management of insect pests:

Potato tuber moth: *Phthorimaea operculella*

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

Epilachna beetle: *Epilachna viginatioctopunctata*

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

Aphids: *Myzus persicae*

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

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

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

vii. Major disease associated with crop: Early blight, Late blight, leaf roll and mosaic

viii. IPM Module for management of disease:

Early blight of potato: *Alternaria solani*

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

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Chlorothaonil 75% WP (per lit. water)	0.875-1.250	14

Kitazin 48% EC	0.20%	48
Hexaconazole 2% SC	3000	21
Mancozeb 75% WP	1500-2000	
Propineb 70% WP	0.30%	15
Zineb 75% WP	1500-2000	
Captan 50% WP	2500	
Ziram 80% WP	1500-2000	3
Copperoxychloride 50% WP	1250	
Captan 70%+Hexaconazole 5% WP	500-1000	21

Late blight of potato: *Phytophthora infestans*

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

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

viii. Major weeds associated with crop: common weeds

ix. IPM Module for management of weeds:

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

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

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

x. Production constraints in agro-ecological region:

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

9F. Name of the vegetable crop: Brinjal

i. **Existing varieties being used:** Locally available varieties

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Pusa Purple Cluster, Pant Samarat, PH4, Pant Rituraj, BR 112, Rajni, Navkiran, Brinjal 704 (SunGro Seed), Navina, VNR212 (VNR Seed), Indame Supriya (Indo-American), Pant Rituraj, Pant Samrat (Pantnagar), Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used: No package of practices are adopted

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

1. Adoption of package of practice developed by GBPUA&T, Pantnagar & SKUAS&T, J&K
2. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
3. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
4. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
5. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed orCarbandazim @2g/kg of seed or*Trichoderma viride* 4g/kg before sowing
6. Seed Rate- The recommended seed rate of brinjal: Hybrid-250g/ha, Open pollinated-500-600g/ha
7. Planting
8. Transplanting- Farmers should transplant seedlings properly as for non spreading type varieties-

60cm x 60cm, spreading type varieties - 75cm x 60cm.

9. 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,
10. 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
11. 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.
12. Growth substances: Use 2,4-D @ 2ppm at flowering stage
13. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

v. Major insect pests associated with crop: Shoot and Fruit Borer, Epilachna Beetle, Aphids, Thrips, Leafhopper

vi. IPM Module for management of insect pests:

Brinjal fruit & shoot borer: *Leucinodes orbonalis*

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

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

Hadda beetle = Epilachna Beetle: *Epilachna vigintioctopunctata*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Cypermethrin 25% EC	150-200	1
Triazophos 35% + Deltamethrin 1% EC	1250	3

Aphid : *Aphis gossypii*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Triazophos 35% + Deltamethrin 1% EC	1250	3

Betacyfluthrin 8.49%+ Imidacloprid 19.81% OD	200	7
Fenvalerate 20% EC	375-500	5

Thrips

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

Major disease associated with crop: Phomopsis blight, Leaf Blight, Bacterial Wilt

vii. IPM Module for management of disease:

In Nursery

1. Soil Solarization of nursery bed by covering with polythene sheet (25 – 50 μ) for 45 to 60 days during April-June.
2. Use TH/PsF colonized compost
3. Seed biopriming with TH / PsF or TH + PsF (10 g/kg seed).
4. Use resistant cultivars like Pant Rituraj etc., if possible
5. Grow the nursery under tunnel of poly net of 50 mesh.

On Crop

1. Use TH/PsF colonized compost.
2. Use of healthy seedling.
3. Root dipping of seedlings in TH/PsF suspension (10 g/l water).
4. Roguing of virus infected plants followed by need based spraying of systemic insecticides for vector management
5. Need based spraying of mancozeb (2.5 kg/ha).
6. For the management of soil borne diseases follow crop rotation and rotate crop with maize, rice, wheat, okra or cowpea.

Blight

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

viii. Major weeds associated with crop: *Cyperus rotundus, Panicum repens, Cynodon dactylon, Amaranthus virdis, Parthenium hystroporus*

ix. IPM Module for management of weeds:

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

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

1. Proper adoption of package of practices with suitable information bridging can intensify the Brinjal production in the district.
2. Farmers should adopted intensification of the crop such as at least 3-4 crops in a year

a. Brinjal- Radish-Bottle gourd,
b. Brinjal- spinach-cowpea,
c. Brinjal- Turnip-Amaranthus,
d. Brinjal- Spinach-Bitter gourd etc.

xi. Production constraints in agro-ecological region:

1. Non-availability of good quality seeds on time.
2. Non adoption of package of practices

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

8G. Name of the vegetable crop: Chilli

i. **Existing varieties being used:** Local chilli, 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. No package of practices are adopted
2. Growing local varieties.
3. No line transplanting.
4. Generally they plant two over aged seedling at one place.
5. No or very less use of fertilizer.
6. Sowing of untreated seed.

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

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

v. **Major insect pests associated with crop:** Thrips, Yellow/White mite, Aphids

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

Management strategies sucking pests

A. Crop Hygiene

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

B. Other Cultural Control Practices

Use proper pre-planting practices.

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

Use proper post-planting practices.

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

Chilli thrips, *Scirtothrips dorsalis* Hood

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

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

Aphid

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

Yellow mite

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Hexythiazox 5.45% EC	300-500	3
Buprofezin 25% SC	300-600	5
Fenazaquin 10% EC	1250	7
Fenpyroximate 5% EC	300-600	7
Milbemectin 1% EC	325	7
Spiromesifen 240% SC	400	7

vii. Major disease associated with crop: Die-back, Anthracnose, leaf blight, leaf spot, root rot

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.

Leaf spot: *Cercospora capsici*

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

Early blight

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Captan 75% WP	1667	8

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

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

xii. Production constraints in agro-ecological region:

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

8H. Name of the vegetable crop: Cucumber

i. Existing varieties being used: Local Kheera, Kalyanpur Green, Japanese Long Green, Poona Khira, Pant Khira-1, Poinsette, Japanese Long Green, Straight Eight, Swarna Sheetal, Swarna Poorna, Swarna Ageti etc.

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

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

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

iii. Existing package of practices being used:

Use of traditional seeds,

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

1. Adoption of package of practice developed by ICAR-VPKAS, Almora, GBPUA&T, Pantnagar & SKUAS&T, J&K
2. Use of protected cultivation.
3. Adoption of crop/ soil health related crop rotations.
4. Recommended/suitable variety for Agroeco-region.
5. Use recommended spacing eg. 60-200 × 50-100 cm
6. Treating seed before sowing.
7. Balanced use of fertilizers (125: 155: 125 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).
8. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
9. Selection of optimum planting period.
   Region A: (Protected cultivation) : Sept
   Region B: (Protected cultivation): Feb to June
   Region C: (Protected cultivation): Feb- March
10. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
11. Adoption of micro irrigation technologies for efficient use of available water.
12. Adoption of fertigation system for efficient use of fertilizers

v. Major insect pests associated with crop:

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

vi. IPM Module for management of insect pests:

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

Red pumpkin beetle

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

vii. Major disease associated with crop: Anthracnose, Downey Mildew, Powdery Mildew, fruit rot, Gummy Stem Blight, leaf spot

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.

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

Leaf spot

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

Powdery mildew

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

Anthracnose

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Benomil 50% WP	100	200
Carbendazim 50% WP	150	300
Zineb 75% WP	1125-1500	1500-2000

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

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

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

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

xii. Production constraints in agro-ecological region:

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

8I. Name of the vegetable crop: Pumpkin

i. Existing varieties being used: Arka Chandan, Ambili, Pusa Biswas, CO-1, CO-2, Solan Badami, Farmer's own saved seed.

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

iii. Existing package of practices being used: No package of practices are used

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

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

v. Major insect pests associated with crop: Beetles , caterpillars, fruit fly

vi. IPM Module for management of insect pests:

Red pumpkin beetle

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

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

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.

Downy mildew

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

Powdery mildew

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

ix. Major weeds associated with crop: Common weeds

x. IPM Module for management of weeds:

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. Proper adoption of package of practices with suitable information bridging can intensify the pumpkin production in the district.
2. Use of well designed and recommended protected technology suited to area i. e poly houses, net house, insect proof net house, shed net house, poly tunnels with the use of mulches & micro irrigation structures.
3. To follow proper crop rotation.
4. Selection of varieties suited to Agroeco-region.

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

xii. Production constraints in agro-ecological region:

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

8J. Name of the vegetable crop: Pea

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

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Region A & B: Vivek Matar 10, Vivek Matar 12 & Vivek Matar 11
Region C: Arkel, Azad Pea 3, VL-7, Pusa Pragati, Punjab Agetha 6

iii. Existing package of practices being used: No Package of practices are followed

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

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

dose.

7. Water the crop as per need especially during flowering and pod setting.

v. Major insect pests associated with crop: Pod borer, Aphids, Leafhoppers

vi. IPM Module for management of insect pests:
Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

vii. Major disease associated with crop: Root and stem rot, collar rot, powdery mildew, leaf blight, rust, bacterial blight

viii. IPM Module for management of disease: Adoption of IPM Modules developed by ICAR-VPKAS, Almora, GBPUA&T, Pantnagar & SKUAS&T, J&K

Powdery mildew

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

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

x. IPM Module for management of weeds:
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:
Proper adoption of package of practices with suitable information bridging can intensify the pea production in the district.

xii. Production constraints in agro-ecological region:

1. Unavailability of good quality seeds on time.
2. Lack of scientific vigour amongst farmers.

8K.Name of the Vegetable crop: Leafy vegetables

i. Existing varieties being used: Local varieties are used
Locally available varieties of palak, methi and amaranthus

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:
Beet leaf- All Green, Pusa Bharti, Pusa Jyoti, Pusa Harit
Kasturi Methi- Kasuri Methi
Common Methi- Pusa Early Bunching
Coriander- Pant Haritima
Amaranthus- Pusa Choti Chaulai, Pusa Badi Chaulai
Palak- All Green, Pusa Harit
Methi- Pant Ragini, Pusa Early Bunching and Kasuri Selection

iii. Existing package of practices being used: No package of practices are used

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

1. Adoption of Package of practices developed by ICAR-VPKAS, Almora, GBPUA&T, Pantnagar & SKUAS&T, J&K
2. Seed- Farmers should use improved varieties/ hybrids of leafy vegetables
3. Seed Treatment- to protect crops from different diseases, farmers must treat the seed by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or T*richoderma viride* 4g/kg before sowing of seeds.
4. Seed sowing: Seed is sown by line sowing method
5. Seed Rate- It is recommended to use the seed quantity for different as follows-

a. Palak- winter crop-10-15 kg seeds/ha
Summer crop-25-30 kg/ha

b. Methi- direct sowing -20-30 kg/ha

c. Amaranthus
direct sowing-2kg/ha
Transplanting- 1kg/ha

6. Spacing: sowing of seed should be done at proper spacing

a. Palak: Row to Row- 20cm and plant to plant -5cm

b. Methi: Row to Row-20-30 cm and plant to plant 10-15cm

c. Amaranth: Row to Row-20-30 cm and plant to plant-10 cm

7. Manures and fertilizers- Farmers should incorporate well rotten cow dung (10-15 tonnes/ha) and NPK (50: 50:20). On the basis of soil testing. Top dressing of nitrogen after each cutting.
8. Application of Vermicompost @ 5qt/ha in the field is beneficial for leafy vegetables.
9. Cutting: cutting should be done at proper stage at 25-30 days after sowing.

v. Major insect pests associated with crop: Aphids, Painted bug, Laphygma

vi. IPM Module for management of insect pests: Adoption of IPM modules developed by ICAR-VPKAS, Almora, GBPUA&T, Pantnagar & SKUAS&T, J&K

vii. Major disease associated with crop:

viii. IPM Module for management of disease: Leaf spot, White rust, Downey Mildew

ix. Major weeds associated with crop: Broadleaf and grass weeds

x. IPM Module for management of weeds: Adoption of IPM modules developed by ICAR-VPKAS, Almora, GBPUA&T, Pantnagar & SKUAS&T, J&K

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

1. Green leafy vegetables are short duration crops with multi cut option which can be more remunerating to the farmers if market could be provided.
2. Follow deep summer / winter ploughing
3. Line sowing should be prefer
4. Follow proper crop rotation
5. Use of improve varieties of leafy vegetable
6. Timely weeding and hoeing should be done
7. Timely cuttings of leaves

x. Production constraints in agro-ecological region:

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

9A.Name of the fodder crop: Berseem

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

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

iii. Existing package of practices being used: No package of practices are followed

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

v. Major insect pests associated with crop: Aphid, leaf miner, dusky bug, thrip, whitefly, cricket, and cutworm

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

vii. Major disease associated with crop: IPM Module for management of disease: Root rot, Stem rot

viii. **IPM Module for management of insect pests:** Adoption of IPM
ix. **Major weeds associated with crop:** Chicory
x. **IPM Module for management of weeds:** Adoption of IPM
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

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

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

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

9B.Name of the fodder crop: Jai (oat)

i. **Existing varieties being used:** Local varieties
ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** JHO 11, Kent
iii. **Existing package of practices being used:** No package of practices are followed
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Adoption of Package of practices developed by ICAR-VPKAS, Almora & ICAR-IGFRI, Jhansi
v. **Major insect pests associated with crop:** lepidopteran caterpillars and moths
vi. **IPM Module for management of insect pests:** Adoption of Package of practices developed by ICAR-VPKAS, Almora & ICAR-IGFRI, Jhansi
vii. **Major disease associated with crop:** leaf rust and stem rust
viii. **IPM Module for management of disease:** Adoption of Package of practices developed by ICAR-VPKAS, Almora & ICAR-IGFRI, Jhansi
ix. **Major weeds associated with crop:** Seasonal weeds, ragweed, goose grass, wild mustard and buttonweed
x. **IPM Module for management of weeds:** Adoption of Package of practices developed by ICAR-VPKAS, Almora & ICAR-IGFRI, Jhansi
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

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

xii. **Production constraints in agro-ecological region:** Unavailability of seeds on time

10A. Name of the Medicinal crop: Niboo

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:** Kagzi lime
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:** Adoption of Package of practices developed by ICAR-CITH, Mukteshwar, J&K; GBPUA&T, Pantnagar
v. **Major insect pests associated with crop:** Leaf miner, Leaf caterpillar, White fly, Black fly, Aphids, Rust mite, Fruit sucking moth, Shoot borer, Stem borer, Mealy bugs
vi. **IPM Module for management of insect pests:** Adoption of Package of practices developed by ICAR-CITH, Mukteshwar, J&K; GBPUA&T, Pantnagar
vii. **Major disease associated with crop:** Twig blight, Scab, Canker, Tristeza virus
viii. **IPM Module for management of disease:** Adoption of Package of practices developed by ICAR-CITH, Mukteshwar, J&K; GBPUA&T, Pantnagar
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:** Niboo can be grown in the farmers' field as hill districts are highly affected by wild animals like monkey, pigs, etc. which most of the times destroy the crops. Lime can be one of the options to double the agricultural income of the farmers.
xii. **Production constraints in agro-ecological region:** Availability of the specific variety nearby is the main constraints.

11A. 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 in poly house with package of practice provided by private firm who supply plant material
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Plant density 6-9 plants per square meter area in polyhouse. Soil test based micronutrient application, soil sterilization with formaldehyde (2%), ensure regular de-suckering, drip system of irrigation
v. **Major insect pests associated with crop:** Aphid, leaf minor, white fly, thrips, stem borer, rat
vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.
vii. **Major disease associated with crop:** blight and corm rot, collar rot, leaf spot, Damping off
viii. **IPM Module for management of disease:** As per requirement through recommended pesticides
ix. **Major weeds associated with crop**: *Parthenium, Chenopodium album,* Krishnil, Teepatiya
x. **IPM Module for management of weeds:** weeding and hoeing
xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Clubbing of 4-5 different coloured varieties, drip irrigation, soil test based fertilizer application. Important colours are Red, yellow, Pink, Orange and white.
xii. **Production constraints in agro-ecological region:** High cost of plating material and high initial cost of poly house, heavy feeder and labour intensive crop, problem of thrips and powdery mildew bother the farmers

11B. 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:** Commercial varieties available with private company's varieties to meet the demand of market (may be procured from Sakata seeds)
iii. **Existing package of practices being used:** Raising crop in poly house with package of practice provided by private firm who supply plant material
iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Soil test based micronutrient application, soil sterilization with formaldehyde (2%), ensure regular de-suckering, drip system of irrigation
v. **Major insect pests associated with crop:** Thrips, leaf miner
vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides.
vii. **Major disease associated with crop:**
viii. **IPM Module for management of disease:** As per requirement through recommended

pesticides

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

x. **IPM Module for management of weeds:** weeding and hoeing

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

1. Adaptation of high cultivation practices
2. Marketing
3. High-tech packing and packaging material

x. **Production constraints in agro-ecological region:** High cost of plating material and high initial cost of poly house, heavy feeder and labour intensive crop, problem of thrips and powdery mildew bother the farmers

C1. Livestock: Buffalo

1.A Existing breeds available: Local, Graded Murra

1.B Specific breeds to be introduced: NA

2.A Existing feeds being used: Jungle rice

2.B Specific feeds to be introduced / advised:

1. Feed blocks
2. Nutritious grasses (Napier, Barseem, Oat, etc.)
3. Hay supplemented with grain, soy and other ingredients
4. To motivate farmer to grow fodder with technical assistance and timely supply of fodder seed

3.A Existing health services: Veterinary hospitals are available

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals.

4.A Existing management practices:

1. Traditional management practices with low height
2. Not good ventilation
3. Kachchha floor
4. No proper drainage
5. Poor hygiene

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

1. Vaccination of animals
2. De-worming
3. De-horning
4. Use of chaff cutter for fodder management
5. Growing of fodder crops
6. Disease management, etc.
7. Modern and scientific AH Practices should be adopted

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

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

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

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

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

C2. Livestock: Cattle

1.A Existing breeds available: CB jursey, CB HF, Graded Red Sindhi, Badri and local

1.B Specific breeds to be introduced: Sahiwal, Red Sindhi

2.A Existing feeds being used: Jungle grass

2.B Specific feeds to be introduced / advised:

1. Feed blocks
2. Nutritious grasses (Napier, Barseem, Oat, etc.)
3. Hay supplemented with grain, soy and other ingredients
4. To motivate farmer to grow fodder with technical assistance and timely supply of fodder seed

3.A Existing health services: Veterinary hospitals are available

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals.

4.A Existing management practices:

1. Traditional management practices with low height
2. Not good ventilation
3. Kachchha floor
4. No proper drainage
5. Poor hygiene

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

1. Vaccination of animals
2. De-worming
3. De-horning
4. Use of chaff cutter for fodder management
5. Growing of fodder crops
6. Disease management, etc.
7. Modern and scientific AH Practices should be adopted

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

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

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

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

C3. Livestock: Sheep

1.A Existing breeds available: Local, CB

1.B Specific breeds to be introduced: Good Breed Ram to improve existing germ plasm to produce fine long wool

2.A Existing feeds being used: Jungle grass

2.B Specific feeds to be introduced / advised:

1. To motivate farmer to grow fodder with technical assistance and timely supply of fodder seed
2. Feed blocks

3. Nutritious grasses (Napier, Barseem, Oat, etc.)
4. Hay supplemented with grain, soy and other ingredients
5. Development of Chara nursery and distribution among farmers

3.A Existing health services:

Veterinary hospitals are available

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

More awareness is needed for availing the health services of Veterinary hospitals.
More camps may be organized for vaccination and check up of animals.

4.A Existing management practices:

1. Traditional management practices with low height
2. Not good ventilation
3. Kachchha floor
4. No proper drainage
5. Poor hygiene

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

1. Vaccination of animals
2. De-worming
3. De-horning
4. Use of chaff cutter for fodder management
5. Growing of fodder crops
6. Disease management, etc.
7. Modern and scientific AH Practices should be adopted

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

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

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

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

C4. Livestock: Goat

1.A Existing breeds available: Local, Graded Gaddi

1.B Specific breeds to be introduced: Barbari

2.A Existing feeds being used: Jungle grass

2.B Specific feeds to be introduced / advised:

1. To motivate farmer to grow fodder with technical assistance and timely supply of fodder seed
2. Feed blocks
3. Nutritious grasses (Napier, Barseem, Oat, etc.)
4. Hay supplemented with grain, soy and other ingredients
5. Development of Chara nursery and distribution among farmers

3.A Existing health services:

Veterinary hospitals are available

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

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

2. More camps may be organized for vaccination and check up of animals.

4.A Existing management practices:

1. Traditional management practices with low height
2. Not good ventilation
3. Kachchha floor
4. No proper drainage
5. Poor hygiene

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

1. Vaccination of animals
2. De-worming
3. De-horning
4. Use of chaff cutter for fodder management
5. Growing of fodder crops
6. Disease management, etc.
7. Modern and scientific AH Practices should be adopted
8. Stall fed Goatary can be started in some area

5.A Problems of Livestock system- Goatary, Poultry, Fisheries: Non availability of proper breeds nearby. Non availability of feed material with low prices. Timely health check-ups of animals.

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

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

C5. Livestock: Pig

1.A Existing breeds available: Desi, CB

1.B Specific breeds to be introduced:

2.A Existing feeds being used: Waste food

2.B Specific feeds to be introduced / advised: Nutritious food

3.A Existing health services: Veterinary hospitals are available

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals

4.A Existing management practices:

1. Traditional management practices with low height
2. Not good ventilation
3. Kachchha floor
4. No proper drainage
5. Poor hygiene

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

1. Vaccination of animals
2. De-worming
3. De-horning
4. Use of chaff cutter for fodder management
5. Growing of fodder crops, disease management, etc.

6. Modern and scientific AH Practices should be adopted
7. Stall fed Goatary can be started in some area

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

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

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

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

C6. Livestock: Poultry

1.A Existing breeds available: Croiler

1.B Specific breeds to be introduced: Improved variety of Broilers, Layers, croilers

2.A Existing feeds being used: Waste food

2.B Specific feeds to be introduced / advised: Nutritious food

3.A Existing health services: Veterinary hospitals are available

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

1. More awareness is needed for availing the health services of Veterinary hospitals.
2. More camps may be organized for vaccination and check up of animals.
3. Regular monitoring/ Alertness for Bird flu

4.A Existing management practices:

1. Needs low input and provide high output in terms of good quality protein especially for growing and malnourished children.
2. Poultry sector, besides providing direct or indirect employment to rural women is also an important tool for subsidiary income generation for many landless and marginal farmers

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:

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

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

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

Vet. Health services

Resouces	Manpower							Infrastructure		
	No.	V. O.	LEO	Pharmacist	Lab. Tech.	Livestock Assistant	Para vets	Buildings	Equipments	Others

Vety. Hospitals	Existing	25	23	-	11	-	90	-	24	Basic necessary equipment available	-
	Proposed										
Mobile Vety. Unit	Existing	02	01	-	01	-	02	-	01	-	-
	Proposed										
Vety. Dispen.	Existing	43	-	54	-	-	-	-	-	Basic necessary equipment available	-
	Proposed										
AI centres	Existing	42	22	20	-	-	-	3	-	-	-
	Proposed										
Disease Diag. Labs	Existing	-	-	-	-	-	-	-	-	-	-
	Proposed										
Polyclinic	Existing	-	-	-	-	-	-	-	-	-	-
	Proposed										
Ambu. Clinics	Existing	-	-	-	-	-	-	-	-	-	-
	Proposed										

Availability of Medicines/ Vaccines

Superfluous/adequate/inadequate/grossly inadequate. If not adequate please provide suggestions

Specific health services to be required/ advised for doubling income in specific agro-ecological zone: Basic Pathological lab at hospital level

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

Mobile X-ray, Ultrasound facilities.

Problems of Animal Husbandry

Specific problems due to which income is not increasing	Poor accessibility	yes
	Water scarcity	Large area depends on rain for watering forage crops
	Natural disasters	Almost whole area is prone to Natural Disaster like flood, landslide, earthquake
	Wild life conflicts	
	Marketing of animals	No proper market is available
	Marketing of products	No proper market is available
	Budget	-
	Manpower shortage	Nil
	Capacity building	-
	Equipment & Implements (old/ shortage, etc.)	Shortage
	Mobility	-
	Risk cover (Insurance)	Very few animal are under risk cover
	Relook to policies	

D. Integrating Farming system

1.A Existing farming system: Crops + livestock

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

Crops + Livestock + Goat rearing + Backyard Poultry + Mushroom cultivation + Honey Bee + fodder production

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: No Grading facilities are available

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

A.For grains:

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

B.For horticultural crops:

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

2.A Existing processing facilities: No processing facilities are available

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

For grains:

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

For horticultural crops:

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

3.A Existing packing facilities: No packaging facilities are available

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: No storage facilities are available

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

For grain:

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

For Horticultural crop:

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

F. Waste land development and waste water

1.A Existing practices of soil water conservation: Very less 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:

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

gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.

15. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
16. Diversion of runoff through ditches from upper slopes to safer places.
17. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
18. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
19. Contour trenching (staggered/continuous).
20. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
21. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
22. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
23. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

2.A Existing plantation: Majority of the area is under forest cover in the district.

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: Plantation of suitable trees/brushes in waterlogged and eroded areas

3.A Existing fodder production:

1. Natural fodder is utilized.
2. Very less fodder production is done in the district.

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

Plantation of Hybrid Napier in bunds & waste lands

Adoption of practices developed by ICAR-IISWC, Dehradun and ICAR-IGFRI, Jhansi

Medium and high Hills;

Tall fescue (Festuca arundinacea

Rye grass (*Lolium perenne*)

Brome grass (*Bromus inermis*)

Cox Foot grass/Guchhi grass (*Dactylis gloemrata)*

Timothi grass (*Helum pratense*)

White clover (*Trifolium repens*)

Red clover (*Trifoliun pretense*)**)**

A.Tall fescue

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

B.Rye grass

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

6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

C.Timothi grass

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

D.White clover

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

E.Red clover

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

Waste 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: No treatment facility available

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

1. Sewage treatment plant may be established at cities and treated water can be utilized for agriculture purpose by channelizing through canals.
2. Domestic wastewater from kitchen and bathroom should be treated before being used for irrigation in vegetables and other crops.
3. Industrial wastewater should not be used for irrigation directly; and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.

G. Reduced cultivation cost

1.A Existing inputs being given:

A.Rice-wheat

1. Seeds, subsidized fertilizers, chemicals, implements, etc.

2. Annexure–II is enclosed for N,P and K.
3. In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg ZnSO4 (21% Zn) /ha or foliar spray of 0.5% ZnSO4 + 0.25% lime in standing crop.
4. In deficient soils, application of 10 kg Borax/ha, if B deficiency exist in field or two foliar spray of 0.2% Borax.
5. In Mn deficient soils, application of 30 kg MnSO4/ha, if Mn deficiency exist in field or two foliar spray of 0.5% MnSO4 + 0.25% lime before first irrigation and one month after .

B.Tomato/Capsicum

1. In deficient soils, application of 215 kg gypsum/ha, if S deficiency exist in field.
2. In Zn deficient soils, application of 10- 20 kg ZnSO4 (21% Zn) /ha or foliar spray of 0.5% ZnSO4 + 0.25% lime in standing crop.
3. Apple
4. In deficient soils, application of 10 kg Borax/ha or foliar spray of 0.2% Borax in standing crop.
5. In deficient soils, application of 215 kg gypsum/ha, if S deficiency exist in field.
6. In deficient soils, application of 300-450 g lime/tree every third year
7. Two foliar spray of 0.2% Borax at fortnightly interval after fruit formation.
8. Two foliar spray of 0.2% ZnSO4 + 0.2% MnSO4 + 0.2% lime at fortnightly interval in May/ June

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

Specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc. may be provided. **2.A Existing mechanization:**

Very less mechanization is available.

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

1.Power tillers
2.Power weeders
3.Paddy threshers
4.Wheat threshers
5.Mandua/ Madira threshers
6.Maize Sheller
7.Wheel Hand hoe
8.Manual/ power operated Wheat/Paddy reapers

3.A Existing collective inputs: Very less collective inputs are available

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

1.Common property resource management, Pasture
2.Community nursery
3.Establishment of Custom Hiring centres
4.Encourage use of well decomposed organic manures and biofertilizers; avoid excessive use of chemical fertilizers.
5.Reduce the dose of chemical fertilizers and avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
6.Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
7.Need based application of insecticides and pesticides, preferably enhanced the use of bio-agents; avoid the use of costly chemicals.
8.Follow line sowing of seed instead of broadcasting.
9.Encourage water harvest technology for irrigation.
10. Sprinkler and drip method for irrigation should be encouraged to improve water use efficiency.
11. Use of mulches and available composts/organic manures

12. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
13. Promote reduced tillage operations.

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

Irrigated valleys and lower hills

1. Represents subtropical climate with moderating high temperature (18-300 C) medium rainfall, low humidity (40-50%) and experiences no snowfall.
2. This situation covers 12% area. 80% of total precipitation is received during June to September.
3. Sal in outer Himalayas and pine and oak in mid and inner Himalayas are the predominant vegetation.
4. Soils are alluvial sandy loam to loam

Rainfed lower hills

1. Represents about 8% of the area.
2. Soils are gravelly and chirty, deep, sandy loam to silty clay loam.
3. Soils are acidic in nature.

Mid hills south aspects

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

Mid hills north aspects

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

High hills

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

Very high hills

1. Occupies about 4% area and is confined to inner Himalayas.
2. Climate is humid temperate with low to very low annual mean temperature ranging from (5-110 C).
3. The rainfall is low and snowfall is high and land covered under heavy snow for more than six months.
4. The weather remains foggy with high humidity.
5. Kharsu oak and Himalayan fir are the dominant vegetation.
6. The soils are highly acidic (4.0-5.0 pH).

7. soils exist above timber line from 300 m

Alpine pasture

1. Occupies about 4% of area.
2. Shrubs of medicinal plants are found abundantly.
3. The situation represents alpine climate where temperature throughout the year is very low range from 2 to 160 C. the rainfall is negligible.
4. The area covered under a thick layer of snow.
5. Non availability of timely seeds, fertilizers, insecticides, pesticides etc. at near places.
6. Scattered land
7. More Rain fed condition
8. Lack of scientific Knowledge
9. Lack of mechanization
10. Non practice of own seed production by farmers
11. Broadcasting sowing method which require more seed rate
12. Non practice of IPM and INM by farmers

Factors responsible for increasing cost of cultivation

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

kill plants and reduce plant population up to 70-80 %. Due to non availability of suitable plant protection chemicals as well as high cost they are beyond the means of farmers. Besides, non availability of water for solution also pose problems.

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

H. off-farm income

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

Self-help Groups of between 10-25 women created by either NGOs or under the SGSY (Swarnjayanti Gram SwarozgarYojana) for the purposes of meeting local credit needs.
They are sometimes called Mahila Mandals in villages.

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

1. The encouragement to existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. may be provided for better performance.
2. New SHGs may also be created other villages of the district.
3. There is need to have regular monitoring and follow up of SHG's by the forming agencies and time to time evaluation of the group.
4. Regular monitoring by the concerned agency must be ensured like ensuring regular meeting of the SHG, checking their register, regular collection of the money, help during conflicts, solving problems occurring during banking etc. and submitting the monitoring report to their concerned officials so that steps can be taken by the high officials to ensure regular continuity of the SHG.
5. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
6. A large number of groups discontinued as they were not having knowledge regarding income generating activities that can be started (what activities can be taken up, how to operate it, where to market the produce etc.) So there is need of encouragement, motivation along with imparting knowledge, skills and linking them to market.
7. Trainings should be provided to the rural women on income generating activities as per the need of rural women, marketing potential and availability of locally available resources.
8. Loan procedure should be made more flexible with less interest rate.
9. As there were problems like non-cooperation among members, confusion regarding money matter, lack of confidence on office bearers with respect to group money etc., there is need of organizing training on good governance, democratic election and how to solve financial and administrative issues.
10. SHG's formed should be grouped into clusters, federations and registered cooperatives so as to

converge with govt. schemes, facilitate collective purchase of input and marketing of products.

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

1.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:

Very less micro-entrepreneur employment is available in the district.

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

1. Mushroom production
2. Honey Bee production
3. Sericulture
4. Processing of fruits, vegetables & spices
5. Vermin composting units
6. Woollen knitting & Handicraft
7. Bio fertilizer units
8. Agri-clinic

3.A Existing skill development facilities: Less infrastructure for skill development is available.

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

1. Mushroom production
2. Honey Bee production
3. Sericulture
4. Processing of fruits, vegetables & spices
5. Vermin composting units
6. Woollen knitting & Handicraft

4.A Existing women skilling facilities: Less infrastructure for women skill development is available.

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

1. Processing of fruits, vegetables & spices

2. Woollen knitting & Handicraft
3. Mushroom production
4. Honey Bee production
5. Sericulture
6. Vermin composting units

5.A Existing youth skilling facilities: Less infrastructure for youth skill development is available

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

1. Mushroom production
2. Honey Bee production
3. Sericulture
4. Processing of fruits, vegetables & spices
5. Vermin composting units
6. Woollen knitting & Handicraft
7. Bio fertilizer units
8. Agri-clinic

Beekeeping

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

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

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

Beekeeping in Uttarakhand: Beekeeping has been an integral part of human society since centuries in hill regions of Uttarakhand state. The state of Uttarakhand has a predominantly agrarian economy and large number of small and marginal farmers in the mountainous state call for augmenting agricultural production by organic means. The indigenous bee sub-species *Apis cerana indica* commonly is ideal pollinator for organically grown mountain crops, with the capacity to significantly enhance agricultural productivity with an indirect but vital role in combating soil degradation by pollinating wild plants thereby enabling improved regeneration of bio mass, to be returned to the soil. Beekeeping with *Apis cerana indica F*. is a common practice in hills of Garhwal and Kumoun Himalaya which is carried out mostly by using traditional methods since long past and is stationary in nature. In these regions, beekeeping is also carried out with *Apis*

mellifera, but in winter season, due to temperature lower than 20ºC, colonies are being migrated to plains. According to report given by KVK Jeolikot(2017), in Uttarakhand, there are about 4,790 beekeepers with 45,247 number of *A. cerana indica* colonies yielding 546.70 mt of honey production. Whereas, in Almora region of Uttarakhand, there are about 400 beekeepers with 1,165 number of *A. cerana indica* colonies yielding 16.4 mt of honey production. The Uttarakhand state has extremely rich bee forage plants. In most of the remote areas where *Apis cerana indica* beekeeping is common, the use of pesticides and chemicals is negligible, the level of dangerous chemicals in the atmosphere is insignificant and the environmental pollution is at minimal level. Honey produced from such areas is purely natural, free of any residues and can be sold as an organic product. There is vast potential for beekeeping in the country. However, due to lack of knowledge, scientific beekeeping is not being practiced by, most of the beekeepers. It is necessary for beekeepers to participate in the trainings / other capacity building programmes on the subject to gain scientific knowledge on the subject. Selection of good apiary site, good quality bees and proper management are the main keys for success of beekeeping. Following are the important points to start beekeeping and further management practices.

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

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

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

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

3. Management of apiary:

A. Placement of colonies in apiary

1. Hives should be as per specification of BIS/ISI and should be of locally available seasoned light weight wood. Unseasoned and heavy wood should be avoided
2. Avoid nailing the bottom board with the brood chamber
3. Restrict number of bee colonies in a apiary from 50-100
4. Keep row to row and box to box distance as10 and 3 feet, respectively

Hives used for traditional beekeeping in hilly areas are

Wall hives: Wall hives locally known as 'Khadra', 'Jaala' or 'Jalota' are rectangular structures made in the walls of houses and 'Chhaan' or 'Sunni' (cattle sheds) at the time of construction. Each hive has a small round or rectangular opening on the outer side as an entrance for bees. The size of 'Jalotas' varies in different locations; usually they are 45-60 cm in length, 25-30 cm in width and 20-30 cm in height . Generally one hive is made in each wall, but numbers may vary from 2-4. The

interiors of hives are smoothed with cow dung and clay. In winters due to lack of floral resources and extreme cold in the hills, the population of *Apis cerana* colonies decreases to a great extent. Thick wall hives provide considerable insulation in such conditions.

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

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

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

B. Inspection of colonies

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

C. Provision of fresh water in the apiary

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

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

D. Dearth period management

1. Provide 50% sugar syrup to the colonies during dearth periods when honey stores in the colonies is not adequate and nectar is not available in the area. The syrup should be prepared by boiling clean water in the vessel and sugar added with slow stirring for few minutes. Cover the vessel with lid and let it cool. Feed cooled syrup.
2. Sugar syrup should be kept in such a way that the bees should not drown in it. This should be

ensured by using shallow vessels with straw to facilitate easy feeding
3. Do not prepare the feed in open in the apiary and avoid dripping on the ground to prevent robbing by bees and ants
4. Feed the colonies in the evening preferably after sunset
5. Feeding should be given to all colonies in the apiary at one time
6. Pollen substitute comprising of fat free soyabean flour (3 parts) + Brewer's yeast (1 part) + skimmed milk powder (1 part) + sugar (22 parts) +honey (50 parts) made in the form of patties should be provided when pollen stores in the colonies is not adequate and pollen is not available in the area
7. Provide fresh water near the colony in shallow vessels
8. Extra frames should be stored in air tight chambers and fumigated with sulphur powder regularly
9. Old and dark combs should be discarded

E. Care during honey extraction

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

F. Care during migration

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

G. Seasonal management of apiary

a**) Summer Management**

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

b) Monsoon management

1. Clean and bury deep the debris lying on the bottom board
2. Keep the surroundings of the colony clean by cutting the unwanted vegetation which may hamper free circulation of the air
3. Provide artificial feeding (sugar syrup and/or pollen substitute) as per requirement of the colony
4. Check the robbing within the apiary
5. Unite weak/laying worker colonies
6. Control predatory wasps, ants, frogs, lizards in the apiary

c) Post monsoon season management

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

(d) Winter management

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

e) Spring management

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

H. Protecting colonies from pesticides

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

I.Methods of attracting and catching swarms

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

J. Management of Honey Bee Diseases and pest

Honey bees could be affected by diseases and the real cause of abnormality or any disease present

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

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

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

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

K. Honey Extraction

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

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

Mushroom cultivation

The shrinking land, demand for functional foods, priorities for recycling agricultural residues and changing trades in view of globalization are going to play an important role in the agricultural

scenario, and secondary agriculture is likely to play a pivotal role. Our country can emerge as a major player in mushroom production in wake of availability of plenty of agricultural residues and labour. To remain competitive it will be important to harness science and modern technologies for solving the problems of production and bio-risk management. Mushroom being an indoor crop, utilizing vertical space offers solution to shrinking land and better water utility. Packages and practices of mushroom cultivation in Almora is as follow:

1. **White Button Mushroom (*Agaricus bisporus*)**

Button mushroom scientifically known as *Agaricus bisporus* and has he widest acceptability. Cultivation of this mushroom is a complex process and requires two different temperature i.e. 22-26^{0}C for spawn run and 14-24^{0}C for fruit body formation. Besides specific temperature, it require proper humidity (80-90%) and enough ventilation during fruit body formation.

Steps of cultivation process

Compost preparation: Compost is an artificially prepared growth medium from which mushroom is able to derive important nutrients required for growth and fructification. Cemented floors and shade over the floor are required for making good quality compost. There are two main methods for compost preparation:

Long method of composting: This is an outdoor process and takes around 28 days in its completion with a total of seven turnings. The following materials are required for long method of compost:

Wheat straw	1000 Kg	Urea	10 kg
Wheat bran	50 kg	Gypsum	100 kg
Ammonium sulphate or calcium ammonium nitrate	30 kg	Furadan	500 g
Super phosphate	10 kg	B.H.C.	500 g
Muriate of Potash	10 kg		

Before making compost, wheat straw is spread on cemented floor and is turned many times with water being sprayed at regular intervals.

Day 0: At the stage, there should be around 75% humidity content in the wheat straw, to which wheat bran, calcium ammonium nitrate, urea, murate of potash, and super phosphate are mixed thoroughly and evenly. The material is then piled 1.5m thick x1.25m high with the help of wooden rectangular block. The blocks are removed. Once the entire material has been stacked up or piled up. Water is sprayed twice or thrice to keep the substrate moist. Temperature should be in the range of 70-750C.

1st turning Day 6: On the sixth day first turning is given to the stack. The purpose of turning is that every portion of the pile should get equal amount of aeration and water. If the turnings are not given, then anaerobic condition may prevail which may lead to the formation of non-selective compost. In the stack, the central zone is fermenting at its peak and has maximum temperature rest of the portion is either not at all fermented or ferments improperly. The correct method of turning is as: Removing about 15cm of compost from the top and spread it on one side of the floor, the rest part of compost on the other side of the floor. Now turning is done by shaking the outer (top most) part and the inner part of the compost, first separately and then missing them altogether thoroughly with the help of wooden buckets.

2nd turning (Day 10): On the tenth day, again the top most part and the inner part of the compost is separated, water is sprayed on the top part. Again the two parts are piled up together in such a way that now the top part is inside and the inner part is on the top of the stack.

***3rd turning (day 13)*:** it is also done in the same way as described earlier and required quantity Gypsum mixed at this stage.

***4th turning (day 16)*:** The same process of turning is followed. The required quantity of furadan & lindane are added during this turning.

***5th turning (day 19)*:** The compost is turned in the same manner.

***6th turning (day 22)*:** The same process of turning is followed. The required quantity of furadan and lindane are added during this turning.

***7th turning (day 25)*:** The compost is turned in the same manner

8th *turning (day 28)*: if no ammonia persists in the compost, spawning is done.

Short method of composting : Compost prepared by short method of composting is superior in production quality and the chances of infection and disease is quite low. Composting by this method requires special infrastructures, equipments etc. that initial cost is to high, therefore, the farmers can purchase the readymade compost from the authentic composting units. The compost when ready for spawning should have the following characteristics:

Moisture	About 68%	**Ammonia**	Below 0.006%
pH	7.2-7.5	**Nitrogen**	Around 2.5%
Fire fangs (Actinomycetes)	Excellent growth		

Proper timing for cultivation: Oct.- Mar. (02 crops)

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

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

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

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

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

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

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

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

2. Oyster mushroom

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

Steps of cultivation process

Substrate and its preparation

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

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

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

Proper timing for cultivation Feb-April & Aug.-Oct. (02 crops)

Cultivated spices: *P. sajor-caju, P. florida, P. sapidus, P. eryngii, P. cornucopiae, P. flabellatus, P. djmore, P. eous, P. ostreatus*

Spawning and crop management : Oyster mushroom spawn should be about 15-20 days old when mycelium has formed complete coating around the grain. The normal rate of spawning in a pasteurized substrate is 2-3% of the wet substrate. The spawning is usually done by mixing the spawn throughout substrate. Before filling the substrate in polythene bags, holes of about 1 cm diameter are made at 10-15 cm distance all over the surface for free diffusion of gases and heat generated inside. The optimum temperature for growth of mycelium is 23 ±2^{o}C. Relative humidity in growing room should be range between 85-90% during spawn-run. Spawn run usually takes about 15-20 days. After complete spawn run, polythene removed completely with help of sharp knife carefully. Usually 3-4 days after opening the bags, mushroom primordial (pin heads) begin to form. After opening the bags water should be sprayed 2-3 time per day regularly.

Harvesting and yield: Mature mushrooms become ready for harvesting in another 2-3 days. An average biological efficiency (fresh weight of mushrooms harvested divided by dry substrate weight x 100) can range between 70-80% and sometimes even more. To harvest the mushrooms, they are grasped by the stalk and gently twisted and pulled. A knife should not be used.

3. Milky Mushroom

Calocybe indica is commonly known as milky mushroom or dudhiya mushroom due to its milky white appearance of the fruit body. It can be easily cultivated at the temperature range between 25-35^{o}C and relative humidity 70-90 per cent.

Substrate and its preparation

The tropical wastes like chopped paddy straw and wheat straw are used as substrate for cultivation. To avoid contaminations the straw should be treated by hot water and chemical as like oyster mushroom.

Proper timing for cultivation: April-Sept. (02 crops)

Cultivated species: Calocybe indica and Macrocybe gigentium

Spawning and crop management: About 18-20 days old spawn is used for spawning. Spawning should be done @ 4 per cent of ready substrate. The spawning is usually done by mixing the spawn throughout substrate. The spawned substrate should be filled in polythene bags 4-5kg per bag. The bags should be folded at the top and covered up. The optimum temperature for growth of mycelium, ranges between is 20-37^{o}C. Relative humidity in growing room should be range between 80-85% during spawn-run. Spawn run usually takes about 15-20 days.

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

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

I. Enabling Policies

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

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

1. Expend application scientific methods and mechanized cultivation
2. Promotion of secondary agriculture
3. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
4. Checking migration by attracting rural youth in agriculture.
5. Promotion of eco-village tourism through rural youth
6. The Non-Resident-Uttarakhandies (NRUs) may play major role by adopting certain village/ clusters and initiate development process therein.

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

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

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

1. KCC must be required for farmers to get subsidy.
2. The crop insurance under PMFBY may be linked with KCC accounts for automatic crop insurance.
3. Subsidised seeds and fertilizers should be provided and the subsidy amount may be transferred in KCC account of farmers.
4. Provision of subsidised inputs (seed, chemical fertilizers, etc.) in agri-clinics at cluster level.

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: KCC must be required for farmers to get subsidy.

1. The crop insurance under PMFBY may be linked with KCC accounts for automatic crop insurance.
2. Subsidised seeds and fertilizers should be provided and the subsidy amount may be transferred in KCC account of farmers.
3. During failure of the main crop, provision and availability of improved seeds of short duration crops should be ensured.

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

1.A Existing marketing facilities: Very rare market linkages are available to the farmers.

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

1. Mini mandies to be established at Block level.
2. Cooperative societies may become a tool of marketing channels.

3. Better transportation facilities with cold chain van may be provided at Block level.
4. Direct linkages with food processing industries may be established for better prices.

2.A Existing grading facilities: No grading facilities are available.

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

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

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

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

1. Transportation problem during rainy season.
2. No Mandi is available in the district.
3. No value addition plants of crops are available
4. No government Cold Store is available where as Private cold store are available with higher storage charges.

K. Online Management and Evaluation

1.A: Existing online management structure available: Internet etc. is available at cities. Internet literacy at village level is also a challenge

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

2.A: Existing evaluation procedure: Manual

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

Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.

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.

District level committees of State line departments with KVK experts may be formed for field and as well as online monitoring.

4.A: Existing feedback system: Manually

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

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

5.A: Existing reading system: Literature, Booklets, Hindi Extension Journals etc

5.B: Reading system required for online management and evaluation in specific agro-climatic region of district: Reading manuals may be developed/ published for easy operation of Mobile apps/ software developed for online management and evaluation for farmers as we well as concerned experts linked with it.

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

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953 and UP 2572), paddy (VL *Dhan 65,* Vivek *Dhan 85 and* Vivek *Dhan154*, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355, Pusa Basmati 1509 & PRH 10,); Barely (VL Jau 118 and VL Jau 130); Amaranthus (VL *Chua* 44); Buckwheat (VL *Ugal* 7) in *Bisht and Barsali* cluster.
2. Promotion of high yielding variety of lentil (VL *Masoor* 126, VL *Masoor* 507*,* VL *Masoor* 129), horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19), soybean (VL Soya 47, VL Soya 63 and VL Bhat 65) and Pigeon pea (VL *Arhar* 1) in *Bisht, Dichali- cluster.*
3. Promotion of subtropical fruit crops Mango, Guava and Litchi in *Bisht, Dichali- Gamri* cluster.

4. Promotion of high density plantation of Mango (variety Amarpali) and Guava (Pant Prabhat) in *Kumrada, Mani, and Chinyalisaur* area.
5. Promotion of high yielding varieties of vegetable pea (Vivek Mattar 10& 11), French bean (VL Boni Bean 1 & VL Bean 2), tomato (VL Tamatar 4), Onion (VL Piyaz 3) and garlic (VL Garlic 1) in *Gamri, Bisht and Dichali cluster*.
6. Cultivation of hybrid napier (CO-1) in bunds in each cluster.
7. Promotion of efficient and timely use of IPM and IDM practices at village level of each cluster.

Management of wild animal problem

1. Promotion of protected cultivation of vegetables in *Gamri* cluster.
2. Promotion of live fencing of wild rose, Karonda plant in surrounding the field in *Bisht* cluster.
3. Promotion of ginger, garlic, turmeric and jackfruit in *Gamri* and *Barethi* area.
4. Promotion of plantation of wild fruits like Kafal, Wild apricot (Chullu), wild pear in Van Panchayat area for wild animal.
5. Strengthening of farmers through skill training
6. Organisation of regular trainings and feedback with experts regarding scientific methods of cultivation in each cluster.

Promotion of efficient water management

1. Efficient management of rain water harvesting with drip-fertigation system in *Gamri, Bisht* clusters.
2. Creation of rain water harvesting structure in private and government buildings in all the villages of the region.
3. Promotion of water conservation techniques like mulch, micro irrigation system in juvenile plants in *Kumrada, Baldogi and Barethi* area.

Adoption of farm mechanization

1. Promotion of Vivek Mandua/Madira Thresher and Vivek paddy thresher for drudgery reduction at each cluster.
2. Promotion of serrated sickle, maize sheller for drudgery reduction of farm women in all the clusters of region A.

Management of soil health

1. Popularization of soil testing in intensive mode and distribution of soil health cards to farmers for judicious use of fertilizers.
2. Promotion of cultivation of green manuring crops like Sesbania, Sunhemp, and lobia in *Dichali and Bisht* cluster.
3. Adoption of well decomposed FYM and other compost.

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion pure genetic breeds of cow (Jersy, Sindhi and Sahiwal) and buffalo (Murrah) in Bisht & *Dichli* Cluster.
2. Adoption of suitable mineral mixture, green fodder in all cluster.
3. Establishment of Fodder Bank in *Barethi and Dunda* to meet fodder requirement of area.
4. Organisation of timely de-worming, de-horning and vaccination programmes of livestock.
5. Establishment of milk collection centre & chilling plant at *Chinyalisaur & Srikot*.
6. Promotion of Urea, Molasses, Multi-nutrient Blocks at *Nyaypanchayt* level.
7. Introduction and promotion of cross Heiffer for increasing income of marginal farmer.
8. Strengthening of traditional water bodies/rivulets with carps at *Dharasu, Mani area*.

Strategy 3 : Integrating Farming system

Following IFS model may be develop in each cluster for one acre.

Cropping system (Area 4000 m2)

Rice-wheat
Maize- Wheat
Horsegram/Pigeon pea-Lentil

Tomato/capsicum-Vegetable pea
Okra-Potato

Horticulture

Mango/Guava/Lemon (100 plants)

Livestock

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

Others

One vermicompost of 20 m^2

One Polytunnel of 10 m^2 for nursery raising

Fodder production mainly hybrid napier in bunds.

Strategy 4 : Reducing post harvest losses and value addition

1. Installation of mini grading & processing centres for Fruit & vegetable should be installed at *Chinyalisaur and Dunda*.
2. Promotion of packing & storage facilities for Processed/raw fruits and vegetables should be installed at *Chinyalisaur and Dunda*.

Strategy 5 : Waste land development and waste water

Plantation of Mulberry plants, Wild fruit plants (wild apricot, golden raspberry, Wild pear), Fodder trees (Bheemal, Utees, Oak) may be promoted at village level in each cluster.

Construction of trenches, LDPE tanks and check dams/ trenches at each clusters of region A.

Strategy 6 : Reduced cultivation cost

1. Adoption of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers may provided through custom hiring centre at each *Nyay Panchayat*.
2. Adoption of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc. may be provided at cluster level.
3. Promotion of timely availability of seeds, fertilizers, insecticides, pesticides etc. at Nyaay Panchayat level.
4. Implementation of *Chakbandi* of scattered land.
5. Minimization of Rain fed condition.
6. Organisation of trainings to increase scientific Knowledge.
7. Promotion of practice of IPM and INM by farmers.

Strategy 7 : Off-farm income

1. Encouragement to existing SHGs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. may be provided for better performance at cluster level.
2. Promotion to micro entrepreneur employment through Mushroom production, Honey Bee production, Sericulture, Processing of fruits, vegetables & spices, Vermin composting units, Woollen knitting & Handicraft, Bio fertilizer units, Agri-clinic at each cluster.

Strategy 8 : Enabling Policies

Following activities may be performed in each cluster.

1. Expend application of scientific methods and mechanized cultivation.
2. Promotion of secondary agriculture.
3. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
4. Promotion for checking migration by attracting rural youth in agriculture.
5. Promotion of eco-village tourism through rural youth.
6. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
7. Implementation of Soil Health Card Scheme in intensive mode in each clusters.
8. Adoption of certain village/ clusters and initiate development process therein by Non-Resident-

Uttarakhandies (NRUs).

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

1. Installation of mini *mandies* at Chinyalisaur.
2. Strengthening of Cooperative societies may become a tool of marketing channels.
3. Promotion of better transportation facilities with cold chain van may be provided at Block level.
4. Creation of direct linkages with food processing industries may be established for better prices.
5. Installation of Fruit & vegetable processing units should be in clusters.
6. Incorporation of post harvest facilities including grading, packaging for Processed /raw fruits and vegetables in each clusters.

Strategy 10 : Online Management and Evaluation

1. Development of mobile apps/ software for online management and evaluation may be developed and farmers as well as concerned experts may be linked with it.
2. Formation of District level committees of State line departments with KVK experts for field and as well as online monitoring, evaluation and feedback.
3. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
4. Organization of monthly review meeting at district to solve the problems related with farmers.
5. Promotion of use of radio, TV talks and use of Whatsapp etc. for effective implementation of program.

Region: B (1000-1500 m)

Strategy 1 : Productivity Enhancement

Promotion of efficient water management

1. Promotion of rain water harvesting and drip-fertigation system in *Ramaserai, Dhanari and Barsali* clusters.
2. Construction of low cost LDPE tank for rain water harvesting in *Kamal ghatti, Naugaon, Matli clutsers*.
3. Promotion of water conservation techniques like mulch, micro irrigation system in juvenile plants in *Khaladi, Matli and Dhanari area.*

Introduction, adoption and popularization of high yielding varieties

1. Promotion of Pigeon pea (VL Arhar-1), lentil (VL M-129) and Field pea (VL 42) in clusters namely *Dhanari, and Barsali cluster.*
2. Adoption of high yielding varieties of wheat (VL *Gehun* 832, VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953 and UP 2572), paddy (VL *Dhan 65,* Vivek *Dhan 85 and* Vivek *Dhan154*, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355, Pusa Basmati 1509 & PRH 10,); Barely (VL Jau 118 and VL Jau 130); Amaranthus (VL *Chua* 44); Buckwheat (VL *Ugal* 7) in *Barsali, Matli, Ramaseri, Dhanari Kamal Ghati.*
3. Promotion of small millets mainly foxtail millet in *Dhanari and Badagaddi* cluster.
4. Promotion of subtropical fruit crops Lemon, Pomegranate (Kandhari, Ganesh), peach (Floradasun, FL16-33), nectarine in *Barsali, Kamal Ghati, Naugaon, Dhanari and Matli* cluster.
5. Promotion of high density plantation of Pomegranate (variety Kandhari) and Nectarine (Snow queen) in *Khaladi, Naugaon and Gangori* area.
6. Promotion of protective cultivation, use of polyhouses and polytunnel for off season vegetable cultivation in *Bhandarsyun, Naugaon, Kharadi, Badagaddi, Gajana and Taknaur cluster*.
7. Cultivation of hybrid napier in bunds in each cluster.

Management of wild animal problem

1. Promotion of ginger, garlic and turmeric in *Barsali, Dhanari* and *Matli* area.
2. Promotion of live fencing of wild rose, Karonda plant in surrounding the field in *Barsali, Badagaddi and Taknaur* cluster.
3. Promotion of lime and stone fruit in *Bhandarsyun, Naugaon, Matli, Kharadi, Badagaddi, Gajana and Taknaur cluster.*

4. Promotion of plantation of wild fruits like Kafal, Wild apricot (Chullu), wild pear in Van Panchayat area for wild animal.

Adoption of farm mechanization

1. Promotion of Power weeder, Vivek Mandua/Madira Thresher and Vivek paddy thresher for drudgery reduction in *Dhanari, Ramaserai and Barsali* Cluster.
2. Promotion of small hand tools like serrated sickle, hand wheel hoe and fork for drudgery reduction of farm women in all the clusters.

Management of soil health

1. Popularization of soil testing in intensive mode and distribution of soil health cards to farmers for judicious use of fertilizers.
2. Promotion of cultivation of legume crops like pea, soybean and green manuring in *Matli, Badagaddi and Naugaon* cluster.
3. Adoption of well decomposed FYM and other compost.
4. Strengthening of farmers through skill training
5. Organisation of regular trainings and feedback with experts regarding scientific methods of cultivation in each cluster.

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Adoption of pure genetic breeds of cow (Jersy and HF) and buffalo (Murrah) in *Matli, Barsali, Kamal Ghati and Naugaon* Cluster.
2. Selection of suitable mineral mixture, green fodder.
3. Establishment of Fodder Bank in *Naugaon & Matli* to meet fodder requirement of area.
4. Organisation of timely de-worming, de-horning and vaccination programmes of livestock.
5. Establishment of milk collection centre & chilling plant at *Naugaon and Gangori.*
6. Promotion of Urea, Molasses, Multinutrient Blocks at *Nyaypanchayt* level.
7. Introduction and promotion of cross Heiffer for increasing income of marginal farmer.

Strategy 3 : Integrating Farming system

Following IFS model may be develop in Region B for one acre.

Cropping system (Area 4000 m2)

Maize- Wheat
Paddy-Pea/wheat
Soybean/Pigeon pea-Lentil
Tomato-radish-Vegetable pea
Paddy-Wheat-frenchbean

Horticulture

Pomegranate/Stone fruit/Lemon (100 plants)

Livestock

Cow (1)+Goat/sheep (10)

Others

One vermicompost of 20 m2
One Polytunnel of 10 m2 for nursery raising
Fodder production mainly hybrid napier in bunds.

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of large capacity (1000 MT) cold houses in fruit/ vegetable producing blocks i.e. *Bhatwari, Naugao* and *Purola* blocks.
2. Installation of mini grading and processing centres for Fruit & vegetable at *Gangori, Badkot* and Brhamkhaal.
3. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all the blocks.
4. Installation of packing and storage facilities for Processed/raw fruits and vegetables at *Gangori, Badkot* and Brhamkhaal.

Strategy 5 : Waste land development and waste water

1. Plantation of Mulberry plants, Wild fruit plants, Fodder trees (Bheemal, Utees, Oak) may be promoted at each cluster.
2. Construction of trenches, LDPE tanks and check dams/ trenches at each cluster.

Strategy 6 : Reduced cultivation cost

1. Adoption of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers may provided through custom hiring centre at each *Nyay Panchayat*.
2. Adoption of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc. may be provided at cluster level.
3. Promotion of timely availability of seeds, fertilizers, insecticides, pesticides etc. at Nyay Panchayat level.

Strategy 7 : Off-farm income

1. Promotion of secondary agriculture viz., Mushroom cultivation, Honey Bee production, Sericulture, Vermin composting units
2. Promotion of woollen knitting & handicraft work.
3. Establishment of bio fertilizer units and agri-clinic at each cluster.
4. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making etc. may be provided for better performance at cluster level.

Strategy 8 : Enabling Policies

Following activities may be performed in each cluster.

1. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
2. Promotion of mechanization for low cost and drudgery reduction.
3. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
4. Promotion of secondary agriculture
5. Promotion of eco-village tourism through rural youth
6. Implementation of Soil Health Card Scheme in intensive mode in each clusters.
7. Adoption of certain village/ clusters and initiate development process therein by Non-Resident-Uttarakhandies (NRUs).

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

1. Installation of mini *mandies* at Naugaon, Uttarkashi.
2. Strengthening of cooperative societies may become a tool of marketing channels.
3. Promotion of better transportation facilities with cold chain van at Block level.
4. Creation of direct linkages with food processing industries for better prices.
5. Installation of Fruit & vegetable processing units in clusters.
6. Incorporation of Post harvest facilities including grading, packaging for Processed /raw fruits and vegetables in each clusters.

Strategy 10 :Online Management and Evaluation

1. Development of Mobile apps/ software for online management and evaluation may be developed and farmers as well as concerned experts may be linked with it.
2. Formation of District level committees of State line departments with KVK experts for field and as well as online monitoring, evaluation and feedback.
3. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
4. Organization of monthly review meeting at district to solve the problems related with farmers. Promotion of use of radio, TV talks and use of Whatsapp etc. for effective implementation of program.

Region: C (1500-2400 m)

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of Soybean (VLS 47, VL Soya 59, VL Soya 63, VL Soya 65, VL Soya 77,), lentil (VL Masoor 125, VL Masoor 507, VL Masoor 126, VL Masoor 129) and Field pea (VL 42) in clusters namely *Gajana, and Upla taknor, Mori, Sangamchatti cluster.*
2. Adoption of high yielding varieties of wheat (VL *Gehun* 832) and Amaranthus (VL Chua 44) in *Upla taknor, Dhari Kalogi, Gaajana, Syuri, Jakhol, and Jogat.*
3. Promotion of temperate fruit crops apple (Red spur, Royal spur, Organ spur), kiwi (Hayward/Allison/Monty+Tomari), peach (Flordasun, FL-16,33), walnut, nectarine (Snow queen) in *Upla-taknor, Dhari Kalogi, Gaajana, Syuri, Jakhol, Netwad, Jogat, Tikochi and Silkyara cluster.*
4. Promotion of high density plantation of Apple (variety spur) and Nectarine (Snow queen) in *Upla-tacknor, Dhari Kalogi* and Silkyara, Naitwar, and Tikochi cluster.
5. Promotion of protective cultivation, use of polyhouses and polytunnel for off season vegetable cultivation in *Upla taknor, Dhari Kalogi, Gaajana cluster.*
6. Cultivation of hybrid napier in bunds in each cluster.

Management of wild animal problem

1. Promotion of Chestnut and stone fruits in *Upla-taknor, Dhari Kalogi* and Silkyara, Naitwar *cluster.*
2. Promotion of plantation of wild fruits like Kafal, Wild apricot (Chullu), wild pear in Van Panchayat area for wild animal.
3. Promotion of efficient water management
4. Promotion of rain water harvesting and drip-fertigation system in *Dhari Kalogi, Upla-taknor, Gaajana, Jogat and Silkyara cluster.*
5. Construction of low cost LDPE tank for rain water harvesting in *Dhari Kalogi, Upla-taknor, Gaajana, Jakhol, Syuri, Jogat, and Silkyara cluster.*
6. Promotion of water conservation techniques like mulch, micro irrigation system in juvenile plants in Gajna, *Syuri, Jogat, and Silkyara.*

Adoption of farm mechanization

1. Promotion of Power weeder, Fruit harvester for drudgery reduction in *Dhari Kalogi, Upla-taknor, Gaajana, and Jakhol.*
2. Promotion of small hand tools like Secateurs, serrated sickle, hand wheel hoe and fork for drudgery reduction of farm women in all the clusters.

Management of soil health

1. Popularization of soil testing in intensive mode and distribution of soil health cards to farmers for judicious use of fertilizers.
2. Promotion of cultivation of legume crops like pea, soybean and green manuring in *Upla-taknor, Dhari Kalogi, Gaajana and Naitwar.*
3. Promotion of well decomposed FYM and other compost.
4. Strengthening of farmers through skill training
5. Organisation of regular trainings and feedback with experts regarding scientific methods of cultivation in each cluster.

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of pure genetic breeds of cow (HF, Jersy), sheep (Rambouillet, Marino) in *Dhari-kalogi, Upla-Taknaur and Netwad* Cluster.
2. Selection of suitable mineral mixture, green fodder.
3. Establishment of Fodder Bank in *Bhatwar, Mori & Purola* to meet fodder requirement of area.
4. Organisation of timely de-worming, de-horning and vaccination programmes of livestock.
5. Organisation of regular training programmes & awareness.

6. Establishment of milk collection centre & chilling plant at *Purola, Mori & Bhatwari.*
7. Promotion of Urea, Molasses, Multinutrient Blocks at *Nyaypanchayt* level.
8. Introduction and promotion of cross Heiffer, Jersey and Sindhi for increasing income of marginal farmer.
9. Strengthening of traditional water bodies/rivulets with carps at *Dharasu, Mani area*.

Strategy 3 : Integrating Farming system

Following IFS model may be develop in Region C for one acre.

Cropping system (Area 4000 m2)

Soybean-Lentil
Cole crops-vegetable pea
Maize-potato
Pea-wheat-Radish

Horticulture

Apple/ Kiwi/Pear (100 plants)

Livestock

Cow (1)+sheep (10)

Others

One vermicompost of 20 m2
One Polytunnel of 10 m2 for nursery raising
Bee keeping.

Strategy 4 : Reducing post harvest losses and value addition

1. Establishment of mini grading & processing centres for Fruit & vegetable at *Maneri, Silkyara, Netwad*, *Hudoli and Dhari cluster.*
2. Installation of packing & storage facilities for Processed/raw fruits and vegetables at *Maneri, Silkyara, Netwad*, *Hudoli and Dhari cluster.*

Strategy 5 : Waste land development and waste water

1. Plantation of Mulberry plants, Wild fruit plants, Fodder trees (Bheemal, Utees, Oak) may be promoted at each cluster.
2. Construction of trenches, LDPE tanks and check dams/ trenches at each cluster.

Strategy 6 : Reduced cultivation cost

1. Adoption of Power tillers, Power weeders, Wheel Hand hoe, horticultural kits, power tree sprayers may provided through custom hiring centre at each *Nyay Panchayat*.
2. Adoption of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc. may be provided at cluster level.
3. Promotion of timely availability of seeds, fertilizers, insecticides, pesticides etc. at Nyaay Panchayat level.
4. Implementation of *Chakbandi* of scattered land.
5. Minimization of Rain fed condition
6. Organisation of trainings to increase scientific Knowledge.
7. Promotion of practice of IPM and INM by farmers

Strategy 7 : Off-farm income

1. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. may be provided for better performance at cluster level.
2. Promotion to micro entrepreneur employment through Mushroom production, Honey Bee production, Processing of fruits, vegetables & spices, Vermin composting units, Woollen knitting & Handicraft, Agri-clinic at each cluster.

Strategy 8 : Enabling Policies

Following activities may be performed in each cluster.

1. Expend application of scientific methods and mechanized cultivation

2. Promotion of secondary agriculture
3. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
4. Promotion for checking migration by attracting rural youth in agriculture.
5. Promotion of eco-village tourism through rural youth.
6. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
7. Implementation of Soil Health Card Scheme in intensive mode in each clusters.
8. Adoption of certain village/ clusters and initiate development process therein by Non-Resident-Uttarakhandies (NRUs).

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

1. Installation of mini *mandies* at *Bhatwari, Purola, Mori*.
2. Strengthening of Cooperative societies may become a tool of marketing channels.
3. Promotion of better transportation facilities with cold chain van at Block level.
4. Creation of direct linkages with food processing industries for better prices.
5. Installation of Fruit & vegetable processing units in clusters.
6. Incorporation of Post harvest facilities including grading, packaging for Processed /raw fruits and vegetables in each clusters.

Strategy 10 :Online Management and Evaluation

1. Development of mobile apps/ software for online management and evaluation may be developed and farmers as well as concerned experts may be linked with it.
2. Formation of district level committees of State line departments with KVK experts for field and as well as online monitoring, evaluation and feedback.
3. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
4. Organization of monthly review meeting at district to solve the problems related with farmers.
5. Promotion of use of radio, TV talks and Whatsapp etc. for effective implementation of program.

Region: D (>2400 m)

Strategy 1 : Productivity Enhancement

Introduction, adoption and popularization of high yielding varieties

1. Promotion of high yielding varieties of crops mainly rajmash (Local improved harshil rajma), amaranths (VL Chua 44) in clusters namely *Upla-taknor, Netwad-Jakhol and Aarakot cluster.*
2. Promotion of temperate fruit crops high chilling apple (Delicious groups) and walnut, nectarine (Snow queen) in *Upla-taknor, Jakhol, Aarakot and Netwad cluster.*
3. Promotion of scientific cultivation of medicinal crops (kutki, atees, paashan bhed, kala jeera, etc.) in *Upla-taknor, Jakhol, Aarakot and Netwad cluster.*
4. Promotion of protective cultivation, use of polyhouses and polytunnel for off season vegetable cultivation in *Upla-taknor, Jakhol, Aarakot and Netwad cluster.*
5. Promotion of efficient and timely use of IPM and IDM practices at village level of each cluster.

Promotion of efficient water management

1. Promotion of efficient management of rain water harvesting with drip-fertigation system in *Upla Taknor and Aarakot* clusters.
2. Creation of rain water harvesting structure in private and government buildings in all the villages of the region.
3. Promotion of water conservation techniques like mulch, micro irrigation system in juvenile plants in Harshil, Dharali, and Arakot area.

Management of wild animal problem

1. Promotion of plantation of wild fruits like Wild pear (Mehal) in Van Panchayat area for wild animal.
2. Strengthening of farmers through skill training

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

Adoption of farm mechanization

1. Promotion of Power weeder, Fruit harvester for drudgery reduction in *Upla-taknor, Arakot and Jakhol cluster.*
2. Promotion of small hand tools like Secateurs, serrated sickle, hand wheel hoe and fork for drudgery reduction of farm women in all the clusters.

Management of soil health

1. Popularization of soil testing in intensive mode and distribution of soil health cards to farmers for judicious use of fertilizers.
2. Adoption of well decomposed FYM and other compost.

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Promotion of pure genetic breeds of sheep (Rambouillet, Marino) and Yak in *Upla-Taknaur and Netwad* Cluster.
2. Development of pasture (*Bugyal*) for grazing.
3. Establishment of Fodder Bank in *Harshil and Netwad* to meet fodder requirement of area.
4. Organisation of timely de-worming and vaccination programmes of livestock.

Strategy 3 : Integrating Farming system

Following IFS model may be develop in Region D for one acre.

Cropping system (Area 4000 m2)

Rajma/chua- fellow
Protective cultivation
Cole crops-fellow

Horticulture

Apple high chilling varieties(100 plants)

Livestock

Sheep (20)

Others

One Polytunnel of 10 m2 for nursery raising
Bee keeping.

Strategy 4 : Reducing post harvest losses and value addition

1. Installation of mini grading & processing centres for Fruit, vegetable and wool at *Harshil and Sankari cluster.*
2. Installation of packing & storage facilities for Processed/raw fruits and vegetables at *Harshil and Sankari cluster.*

Strategy 5 : Waste land development and waste water

1. Development of pasture (*Bugyal*) and Meadow for grazing.
2. Construction of trenches, LDPE tanks and check dams/ trenches at each cluster.

Strategy 6 : Reduced cultivation cost

1. Adoption of Power weeders, horticultural kits, power tree sprayers may provided through custom hiring centre at each *Nyay Panchayat*.
2. Promotion of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc. may be provided at cluster level.
3. Promotion of timely availability of seeds, fertilizers, insecticides, pesticides etc. at Nyay Panchayat level.
4. Organisation of trainings to increase scientific Knowledge.
5. Promotion of practice of IPM and INM by farmers

Strategy 7 : Off-farm income

1. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Pickle making, Jam & Jelly making, & packing, etc. may be provided for better performance at

cluster level.

2. Establishment of distillation unit for medicinal & aromatic plants at *Dharali and Sankari-Jakhol* cluster.
3. Promotion to micro entrepreneur employment through Bee keeping, Processing of fruits, vegetables, Woollen knitting & Handicraft, Agri-clinic at each cluster.

Strategy 8 : Enabling Policies

Following activities may be performed in each cluster.

1. Expend application of scientific methods and mechanized cultivation
2. Promotion of secondary agriculture
3. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
4. Promotion for checking migration by attracting rural youth in agriculture.
5. Promotion of eco-village tourism through rural youth
6. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
7. Implementation of Soil Health Card Scheme in intensive mode in each clusters.
8. Adoption of certain village/ clusters and initiate development process therein by Non-Resident-Uttarakhandies (NRUs).

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

1. Installation of mini *mandies* to be established at *Harshil & Sankari.*
2. Strengthening of Cooperative societies may become a tool of marketing channels.
3. Promotion of better transportation facilities with cold chain van may be provided at Block level.
4. Creation of direct linkages with food processing industries for better prices.
5. Installation of Fruit & vegetable processing units in clusters.
6. Incorporation of Post harvest facilities including grading, packaging for Processed /raw fruits and vegetables in each clusters.

Strategy 10 :Online Management and Evaluation

1. Development of mobile apps/ software for online management and evaluation may be developed and farmers as well as concerned experts may be linked with it.
2. Formation of district level committees of State line departments with KVK experts for field and as well as online monitoring, evaluation and feedback.
3. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
4. Organization of monthly review meeting at district to solve the problems related with farmers.
5. Promotion of use of radio, TV talks and use of Whatsapp etc. for effective implementation of program.