Agro-Ecology Specific Interventions/Technologies Recommended for Doubling Agricultural Income in U.S. Nagar

Agro-Ecological Region: up to 1000 m

A.General information about Agroeco-region
District: Udham Singh Nagar
Agro-ecological region: Region A (up to 1000 m)
Main Blocks in Region: Jaspur, Kashipur, Bazpur, Gadarpur, Rudrapur, Sitarganj and Khatima
Main village cluster in blocks: Khanpur-1, Anandkhera-1(Block Gadarpur);
Audhli, Lambhakheda (Block Sitarganj);
Bannakherra, Dhaki(Block Bazpur);
Banskhedi (Block Kashipur)
Irrigated Clusters: All
Rainfed Clusters: -
Existing rain water management facilities:
1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj)

B. Productivity Enhancement
1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region
1. Low cost lining material to check seepage
2. Efficient water application systems (sprinkler and drip)
3. Rejuvenation and popularisation of traditional water harvesting systems
4. Renovation of existing ponds and roof water harvesting must be promoted
5. Cost effective lifting devices
6. Roof top water harvesting system

2. Existing practices for soil health improvement
1. FYM 10 to 15 ton per hactare once in a two year
2. Meagre use of biofertilizers
3. Imbalanced fertilizer use
4. Meagre green manuring
5. Use of raw/partially decomposed FYM
6. Meagre compost making/ recycling of crop residue

3. Specific Action / Interventions recommended to improve soil health in specific agro-ecological region
1. Area expansion for pulse crops
2. Raising of groundnut for recommended area
3. Balanced fertilization and deep tillage
4. Green manuring (Sasbenia/sanhemp)
5. FYM
6. Inroduction of verimicomost pits
7. Promoted use of bio fertilizers

(a) Cereals and oilseeds
1. Seed/ soil inoculation with Azotobacter and Phosphorus solubilising microbial culture (250-300g each/ acre for seed inoculation;/ and 1-1.5 kg each mixed in well decomposed 25 kg FYM/ acre for soil inoculation).
2. Soil test based balanced use of fertilizers in irrigated areas as per recommendation; INM shall be preferred
3. Green manuring with Sesbania in low land paddy

4. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
5. Use of FYM @5-10t/ha OR application of vermicompost @2.5-3.0t/ha.

(b) Pulses and soybean

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

(c) Vegetables and spices

1. Seed/ nursery soil inoculation with Azotobacter/ Azospirillum inoculant and Phosphorus solubilising microbial culture (each of 200 g/m2 for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with Azotobacter/ Azospirillum inoculant and Phosphorus solubilising microbial culture at transplanting.
3. Soil test based balanced use of fertilizers; INM shall be preferred.
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

(d) Sugarcane

1. Set inoculation with Acetobacter/ Azospirillum inoculant and Phosphorus solubilising microbial culture.
2. Recycling of sugarcane trash through windrow composting
3. Soil test based use of balanced fertilizers; INM shall be preferred.
4. Use of FYM @10-12t/ha or application of vermicompost @ 3-4 t/ha.

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

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

1. Growing of vegetables and horticultural crops in very small area
2.Growing of Paddy, wheat, pulses in etc. with 100% irrigation facilities

Rice – vegetable pea – summer rice

Rice – vegetable pea – sugarcane- ratoon – wheat

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

1. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
2. In event of erratic rainfall distribution in rainy season (June-September), the rain water should be properly stored in farm pond / ponds and harvested for Kharif season crops.
3. The wheat sowing should be advanced by approximately one week in tarai region for nullifying the adverse effect of increasing temperature and terminal rains.
4. Micro irrigation technique should be maintained in plantation crops.
5. In order to minimize the impact of hail storms in mango and litchi the canopy geometry should be managed in a way that upper portion of tree should bear least fruit and bottom and middle portion should bear maximum fruits.
6. Decrease water table is a major issue in US Nagar therefore water savings techniques for example drip and sprinkler irrigation, and adaptation of low water requirement crops in cropping sequence such as replacement of Summer rice with short duration legumes crops (i.e 60 days Cow Pea, moong, urd).
7. For rice (kharif) crop SRI cultivation should be adopted for enhancing water use efficiency and crop productivity.
8. Imbalance use of fertilizer is in practise in US Nagar therefore Site Specific Nutrient management (Precision farming) should be adopted for enhancing Nutrient use efficiency, water use efficiency and crop productivity.Paired row sowing of sugarcane in September-October and

February-March.

9. Intercropping must be followed.

6A. Name of Field Crop: Wheat

i Existing varieties being used: HD2894, HD2967,UP2554,DBW17, PBW343, PBW502, PBW154,UP262, PBW373,UP2338, PBW226, WH711, DPW621-50

ii High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: VL Gehun 953, DBW-16, DBW-17, PBW-373, PBW-502, PBW-527, PBW-550, HD-2687, HD-2967, UP-2526, UP-2554, UP-2565, UP-2784, UP-2785, WH-542, UP-2684, UP 2628, UP 2748, UP 2584, RAJ-3765, RAJ-3077.

iii Existing package of practices being used:

1. Sowing time of crop varying from mid October to First week of January
2. Use of lower doses of P and K at basal
3. Indiscriminate use of plant protection chemicals

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

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

v.Major insect pests associated with crop : Wheat aphid and Termites

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

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

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

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

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

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

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

viii. IPM Module for management of disease:

Earcockle disease = Gall nematode : *Anguina tritici*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Carbofuran 3 %CG	3000	100000

Karnal bunt: *Tilletia indica = Neovossia indica*

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

Carboxin 75% WP (Seed Treatment/Kg)	2-2.5	
Thiram 75% WS (Seed Treatment/Kg)	2.5-3.0	7-10
Propiconazole 25% EC	500	30
Bitertanol 25% WP	2240	
Triadimefon 25% WP	500	25

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

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

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Carbendazim 50% WP (Seed Treatment/Kg)	1.0	2.0
Carboxin 75% WP (Seed Treatment/Kg)	1.5-1.9	2-2.5
Tebuconazole 2% DAS	0.02	1.00
Difenoconazole 3% WS	0.06	2.0

Biofungicides

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

Brown rust = Leaf rust: *Puccinia triticinia*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Mancozeb 75% WP	1500-2000	
Propiconazole 25% EC	500	30

Black rust=Stem rust: *Puccinia graminis tritici*

Name of the Fungicides	**(gm/ml) /ha**	**Waiting period (days)**
Mancozeb 75% WP	1500-2000	
Propiconazole 25% EC	500	30

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

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

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

ix.Major weeds associated with crop: *Phalaris minor,* Jangli chaulai, *Chenopodium album, Chenopodium murale, Melilotus alba*, Grassy and broad leaf weeds etc.

x.IPM Module for management of weeds:

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

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

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

Jangli Chaulai: Green Amaranth: *Amaranthus viridis, A.spinosus* (annual, dicot, broad leaves, leafy)

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

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

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

Grassy and broad leaf weeds annual, dicot, narrow leaves, leafy

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Paraquat dichloride 24% SL (Before sowing)	4250	120-150

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

1. Sowing through seed drill must be promoted
2. Need of agriculture diversification with horticultural crops along with live stocks management.
3. Adoption of proper cropping pattern.
4. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop, Cluster based farming, Inter cropping.

xii.Production constraints in agro-ecological region:

1. Wild animals.
2. Deteriorating soil heath, resistance in most of the insect pest for pesticides doses, farmers don't follow proper package of practices, Proper market linkage to sell the produce, improper use of ground water for irrigation facilities

6B. Name of Field Crop: Rice, Summer rice

i.Existing varieties being used: Pant Dhan11, HKR47, Pusa Sugandha4, HKR127, Pusa Basmati1

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

Pant Sankar Dhan-3, Pant Dhan-12, Pant Dhan-23, Pant Dhan-26, Narendra Sankar Dhan -2, Pusa Sankar Dhan -10, Pant Sugandh Dhan-25, Pant Sugandh Dhan-26, Pant Sugandh Dhan-27, Pusa Sugandh -5, VL Dhan – 85, VL Dhan-65, PR-113, Pant Basmati-1, Pant Basmati-2, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355 plus

iii.Existing package of practices being used:

1. Transplanting starts early ie last week of may
2. Transplanting over aged seedling
3. No use of P and K in basal
4. Majority of the farmers using practices of rice cultivation without proper consideration of rainfall and soil moisture conditions.
5. Use low yielding and old varieties of rice which are susceptible against various pests and diseases, farmers also not using proper compost before rice cultivation, they use imbalanced chemical fertilizers.
6. Due to lack of proper knowledge, majority of the farmers do not adopt proper plant protection measures which adversely affect the productivity.

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

1. Timely transplanting with appropriate aged nursery.
2. Balanced fertilization
3. Proper application of compost and farm yard manure and Green manuring must be followed before two months of planting.
4. Moong can be grown during summer season to improve the soil health.
5. Line planting must be done to maintain proper plant-plant and row-row distance, to minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. SRI technique should be followed. Efficient water application tolls should be used for irrigation and saving of water. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.
7. Quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.

v.Major insect pests associated with crop: Stem borer, Leaf folder, Case worm, Thrips, Brown

Plant Hopper, Rice hispa

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

Stem borer:

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

50 Days within transplating (2 inch water in field)

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

50 Days after tranplanting

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

Bio-insecticides

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

Leaf folder:

Following insecticides may be used to control leaf folders of rice

50 Days within transplating (2 inch water in field)

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

50 Days after transplating

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC	150	47
Indoxacarb 15.8 %EC	200	14
Cartap hydrochloride 50 %SP	1000	21
Cartap hydrochloride 75% SG	425-500	35-89
Flubendamide 39.35% SC	50	40
Flubendamide 20 %WG	125	30
Chromafenozide 80% WP	94-125	32

Fipronil 80%WG	50-62.5	30
Acephate 75 %SP	666-1000	15
Acephate 95 %SG	592	30
Monocrotophos 36 %SL	1400	
Dichlorovos 76% EC	627	
Chlorpyriphos 20 %EC	2500	30
Quinalphos 25% EC	2000	40
Quinalphos 25 %EC	1000	40
Flubendamide 4%+ Buprofezin 20 %SC	175+700	30
Flubendamide 3.5%+ Hexaconazole 5 %WG	1000	20

Bioinsecticides

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

Brown plant hopper: *Nilaparvata lugens*

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

Bioinsecticides

Name of the bioinsecticides	**(gm/ml) /ha**	**Waiting period (days)**
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5

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

Rice hispa: *Dicladispa armigera*

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

Rice bug: *Leptocorysa acuta*

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

Thrips

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

Bioinsecticides

Name of the Bioinsecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.15% EC (Neem seed kernel based)	2500-5000	5

Case worm

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

vii.Major disease associated with crop: Khaira disease, Rice blast, bacterial leaf blight, brown spot, sheath blight, False smut

viii.IPM Module for management of disease:

During Nursery Sowing

Deep summer ploughing or soil solarisation

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

Fertilizers

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

Khaira disease: Due to Zinc deficiency)

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

Sheath blight: *Rhizoctonia solani*

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

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

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

Biofungicides:

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

Rice blast: *Magnaporthe grisea*

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

Bacterial leaf blight: *Xanthomonas oryzae*

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

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

Biofungicides

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

Brown leaf spot: *Cochiobolus miyabianus*

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

Biofungicides

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

False smut: *Ustilaginoidea virens*

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

ix.Major weeds associated with crop: *Echinochloa* sp.*, Ageratum conyzoids, Chenopodium album, Phyllanthus urinaria, Saccharum spontaneum, L. laptocloa, Sedges.*

x.IPM Module for management of weeds:

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

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Anilofos 18% EC (Transplanted rice)	1660-2500	
Anilofos 2% G (Transplanted rice)	20000-25000	30
Bispyribac Sodium 10% SC (Nursary)	200	
Butachlor 50% EC (Transplanted rice)	2500-4000	90&120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90&120
Chlorimuron ethyl 25% WP (Transplanted rice)	24	60

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

Goat weed : *Ageratum conyzoides* (annual, dicot, broad leaves,leafy)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Paraquat dichloride 24% SL (Before sowing)	300-800	125-350

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

Rice flat sedge: *Cyperus iria* (annual, perennial, monocot, narrow leaves, sedge)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Azimsulfuron 50% DF (Transplanted & Direct sown)	70	59
Bensulfuron methyl 60%DF (Preemergence)	100	88
Bensulfuron methyl 60%DF (Postemergence)	100	71
Bispyribac Sodium 10 % SC (Transplanted rice)	200	78
Butachlor 50% EW (Transplanted rice)	2500-4000	90-120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5 %G	25000-40000	90-120
Cinmethylin 10% EC (Transplanted rice)	750-1000	60
Clomazone 50% EC (Transplanted rice)	8000-10000	90

2,4-D Ethyl Ester 4.5% GR (Transplanted rice)	25000	
Ethoxysulfuron 15% WDG (Transplanted rice)	83.3100	110
Flufenacet 60% DF (Transplanted rice)	200	90-110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 6% EC (Transplanted rice) Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Oxyflourfen 0.35.5% GR (Transplanted & Direct sown)	30000-40000	
Oxyflourfen 23.5 EC (Transplanted & Direct sown)	650-1000	
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
Paraquat dichloride 24% SL (Before sowing)	1250-3500	
Pyrazosulfuron ethyl 10% WP (Transplanted rice)	100-150	95
Bensulfuron methyl 0.6% + Pretilachlor 6 G	10000	88 (Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Metsulfuron methyl 10%+ chlorimuron ethyl 10 WP	20	90 (Transplanted rice)

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

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Anilofos 30% EC (Transplanted rice)	1000-1500	30
Azimsulfuron 50% DF (Transplanted & Direct sown)	70	59
Bensulfuron methyl 60%DF (Preemergence)	100	88
Bensulfuron methyl 60%DF (Postemergence)	100	71
Bispyribac Sodium 10% SC (Transplanted rice)	200	78
Butachlor 50% EC (Transplanted rice)	2500-4000	90-120
Butachlor 50% EW (Transplanted rice)	2500-3000	
Butachlor 5% G	25000-40000	90-120
Clomazone 50% EC (Transplanted rice)	8000-10000	90
Ethoxysulfuron 15 %WDG (Transplanted rice)	83.3-100	110
Orthosulfamuron 50% WG (Transplanted rice)	150	65 Pre
Oxadiargyl 80% WP (Transplanted rice)	125	97
Oxadiazon 25% EC (Transplanted rice)	2000	
Pendimethalin 30% EC (Transplanted & Direct sown)	3300-5000	
Pendimethalin 5% G (Transplanted & Direct sown)	20000-30000	
Pretilachlor 37% EW (Transplanted rice)	1500-1875	90
Pretilachlor 30.7% EC (Wet Direct Seeding)	1500-2000	110
Pretilachlor 50% EC (Transplanted rice)	1000-1500	75&90
Bensulfuron methyl 0.6% + Pretilachlor 6% G	10000	88 (Transplanted rice)
Clomazone 20%+ 2,4- D ethyl ester 30% EC	1250	110 (Transplanted rice)
Metsulfuron methyl 10%+ Chlorimuron ethyl 10% WP	20	90(Transplanted rice)

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

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

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

1. Adopting of proper cropping pattern under.
2. Need of agriculture diversification with other commercial crops along with live stocks management.
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop, Cluster based farming, Inter cropping.
4. Use of modern agricultural machinery for timely completion of field operation.

xii.Production constraints in agro-ecological region:

1. Wild animals
2. Reduced organic matter
3. Decreased water table
4. Farmers don't follow proper package of practices, Proper market linkage is not available.
5. Improper use of irrigation facilities, lack of quality input.

6C. Name of Field Crop: Sugarcane

i.**Existing varieties being used:** COS 767, CO-038, CO-0239,CoS88230

ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: COP99214, CO-0238 COP 5224, COP3220 and CO5011 COLK97184

Early Varieties : Co Pant 84211, Co Pant 94211, Co Pant 03220, CoS 88230, CoJ 85, CoS 96268, Co 238

Mid-late varieties : Co Pant 84212, Co Pant 90223, Co Pant 96219, Co Pant 97222, Co Pant 99214, Co Pant 05224

iii.Existing package of practices being used:

1. Most of the area is sown in spring with a spacing of 60 to 75 cm
2. Conventional method of planting

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

1. 2250 q/ha sugarcane yield with green manuring and space planting at 150 cm row spacing CO-038, CO-0239,CoS8823
2. Paired row planting of sugarcane in september october and ferbuary march
3. Intercropping must be follow for better remuneration.

v. Major insect pests associated with crop: Termites, White grub, Early Shoot borer, Stalk borer , Leaf hopper, Top borer and Root borer

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

Termite: *Odentotermes obesus* Ramb.

1. Avoid using FYM, if it is not very well decomposed.
2. Location and destruction of termite colonies in those species that build conspicuous mounds by breaking open the nest and removing the queen termite. Although secondary reproductive's often replace the destroyed queen, the time delay ensures reduction in overall colony build-up.
3. Ploughing or disturbing high field bunds would expose and destroy colonies of subterranean

termites.

4. Clearing and burning of crop residues and other debris in the crop ecosystem deprive the subterranean termites of food and reduce the activity of foraging workers.
5. Spray following insecticides if case of severe infestation:

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Imidacloprid 70% WS (per 100 Kg)	100-150	Seed treatment
Imidacloprid 17.8% SL	350	45
Bifenthrin 10% EC	1000	300
Chlorantraniliprole 18.5% SC -	500-625	208
Clothianidin 50% WDG (Drenching)	250	310

White grub: *Holotrichia* spp.

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

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

Top Borer: *Scirpophaga excerptalis* wlk.

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

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

Early shoot borer: *Chilo infuscatellus*

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

Fipronil 0.3% GR	25000-33300	270
Fipronil 5 %SC	1500-2000	270
Monocrotophos 36% SL	1500-2250	
Chlorpyriphos 20% EC	1250-1500	

Gurdaspur Borer: *Acigona steniellus* Hmpsn.

1. At the time of initial infestation when the top leaves become yellowish, a survey of the field must be done and if the attack of the pest is there cut of the wilted and yellow whorls and destroys them. As the early stage larvae are inside the top inter node, they are also destroyed.
2. Collection of egg masses and destroying them is important.
3. Affected canes with five to six top internodes harbouring borer larvae in the gregarious phase should be cut and removed regularly.
4. Stubbles harbouring hibernating larvae, easily identified by the presence of round tunnel holes at the cut ends, should be uprooted and burnt to kill the larvae.
5. After the crop is harvested, stubbles must be removed and destroyed.
6. Ratooning of heavily infested crop should be avoided.
7. Spraying of monocrotophos 36 SL at the rate of 2.0 liters per hectare is effective in controlling this pest.
8. Sugarcane leaf hopper or Pyrilla: Pyrilla perpusilla wlk.
9. Collection of egg clusters and destroying them is very useful. Alternatively, the egg masses may be kept in old cloth bags and suspended at different places in the field to facilitate selective emergence of adult egg parasitoids while trapping neonate nymphs.
10. In the areas where the infestation of Pyrilla is higher do not take the ratoon.
11. Give the Nitrogen in proper dose. More nitrogen enhances the attack of the pest.
12. Pyrilla eggs are parasitized by egg parasitoid Tetrastichus pyrillae Crowford. If more than 30 percent eggs are parasitized do not use any insecticide.
13. Nymph and adult parasite Epiricania melanoleuca Fletcher parasitizes both nymphs and adults. If 20 to 30 percent nymphs or 40 to 60 percent adults are found parasitized with intermittent rains, use of insecticides must be avoided.
14. Release of 15000 cocoons/ha or 8-10 lakhs eggs per hectare of Epiricania melanoleuca controls the pest. Leaf bits containing egg masses or cocoons are stapled on the under surface of the leaves in the centre of infested field (100 m^2) if the parasitoid inoculum is small.
15. Detrashing of leaves from August onwards reduces pyrilla populations, besides maintaining hygiene and enabling plant protection operations.
16. Selective use of pesticides restricted to border rows coupled with redistribution and colonization of Epiricania during pre-monsoon to post-monsoon period should be adopted.

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days**
Monocrotophos 36% SL	200	500
Dichlorvos 76% SC	300	376
Chlorpyriphos 20% EC	300	1500

Sugarcane stalk borer: Chilo auricilius

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

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

Sugarcane root borer: *Emmalocera depressella*

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

vii.Major disease associated with crop: Red rot of sugarcane, smut, wilt, leaf scaled, Pokkahboeng, grassy shoot (GSD) ratoon stunting (RSD), mosaic & yellow leaf disease (YLD)

viii.IPM Module for management of disease:

1. As most of the important sugarcane diseases such as red rot, smut, wilt, leaf scaled, Pokkahboeng, grassy shoot (GSD) ratoon stunting (RSD), mosaic & yellow leaf disease (YLD) are sett transmissible therefore, to overcome the problem follow the following practices.
2. Use only recommended resistant varieties of the zone.
3. Select only healthy cane seed/sett from the disease free field/nursery.
4. Treat/dip setts by carbendazim 50 WP 0.1% solution at least 30 minutes before planting.
5. If possible moist hot air treatment (MHAT) 54^0C for 4 hrs.
6. Ratooning of infected fields should be strictly avoided.
7. Follow proper selection of field and crop rotation.
8. Vectors and weeds should also be control to check the spread of viral/pytoplasmal diseases.

Whip smut: *Ustilago scitaminea*

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Methoxy-ethyl mercury chloride 6% FS	0.415/Kg	Seed treatment

ix.Major weeds associated with crop : Green amaranth, *Chenopodium album, Celosia argentina,* Umbrella plant, Jungle rice, *Ipomoea* sp.*,* Carrot grass

x. IPM Module for management of weeds:

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

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D sodium salt Technical (80WP)	2500 -3250	300
Diuron 80% WP	2000-4000	
Metsulfuron methyl 20% WP	30	346
Hexazinone 13.2%+ Diuron 46.8% WP	2000	282-306

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

Name of the Herbicide	(gm/ml) /ha	Waiting period (days)
2,4 D sodium salt Technical (80WP)	2500-3250	300

***Celosia argentina* (annual, dicot, broad leaves, leafy)**

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
2,4 D sodium salt Technical (80WP)	2500&3250	300

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

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Hexazinone 13.2%+ Diuron 46.8% WP	2000	282-306

***Ipomoea* sp. (annual, dicot, broad leaves, leafy)**

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Hexazinone 13.2%+ Diuron 46.8% WP	2000	282-306

Carrot grass: *Parthenium hysterophorus* (annual-biannual, dicot, broad leaves, leafy)

Name of the Herbicides	(gm/ml) /ha	Waiting period (days)
Metsulfuron methyl 20% WP	30	346
Hexazinone 13.2%+ Diuron 46.8% WP	2000	282-306

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

1. Deep tillage before sowing

2. Avoid puddle rice as preceding crop
3. Avoid summer sowing
4. Balanced fertilization.
5. Proper depth of planting and covering.

xii. Production constraints in agro-ecological region:

1. Quality seed

6D. Name of Field Crop: Maize

i. Existing varieties being used: Kanchan, Navin, Shweta, PEHM-1

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PEEHM- 5, QPM-9, Bio-605, S6217, BIsco-97 Gold

iii. Existing package of practices being used:

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

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

1. Green manuring must be followed before two months of sowing.
2. Moong can be grown during summer season to improve the soil health.
3. Line planting be done to minimize weed infestation, incidence of pests and diseases and for ideal vegetative growth of the plants.
4. Sowing should be done in mid of June to first week of July. Proper irrigation facility with drainage management as the crop is susceptible for drought and water logging.
5. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.
6. Quality seed of high yielding varieties should be preferred after that seed must be treated with carbendazim 2 g per kg of seed before sowing.
7. In order to avoid lodging problem in, hybrids such as 9164 having dwarf in nature and provide yield up to 25 Q per acre should be preferred for commercial cultivation.

v. Major insect pests associated with crop: Stem borer, Shoot fly, Maize thrips.

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

Maize stem borer: *Chilo partellus*

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

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

Maize thrips: *Frankliniella williamsi*

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Carbofuran 3 %CG	1000	33000

vii. Major disease associated with crop: Bacterial leaf blight and stalk rot, Bacterial stalk and top rot, Corticium ear rot, Root rot, Ergot

viii. IPM Module for management of disease:

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

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

Root rot (*Fusarium oxysporum*)

Name of the Biofungicides	**g/Kg seed**	**Treatment**
Trichoderma harzianum 2% WP	20 g/Kg seed	**Seed Treatment:** Make a thin paste of required quantity of *Trichoderma harzianum* 2.0% WP with minimum volume of water and coat the seed uniformly, shade dry the seeds just before sowing.

ix. Major weeds associated with crop: *Echinochloa,* Green amaranth, *Chenopodium album,* Rice flat sedge *Setaria glauca, Makoi laptocloa*

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

Jungle rice: *Echinochloa* sp. (annual, monocot, narrow leaves, grass)

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Alachlor 50% EC	5000	90
Alachlor 10 %GR	15000-25000	
Atrazin 50 %WP	1000-2000	
Diuron 80 %WP	1000	
Paraquat dichloride 24% SL (Before sowing)	800-2000	90-120

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

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Atrazin 50 %WP	1000-2000	
2,4 D Dimethyl amine salt 58% SL	860	50-60
2,4 D ethyl ester 38% EC	2650	50-60
Diuron 80 %WP	1000	
Paraquat dichloride 24% SL (Before sowing)	800-2000	90-120

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

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Alachlor 10 %GR	1500-2500	15000-25000
Diuron 80 %WP	800	1000

Rice flat sedge: *Cyperus* sp.) annual-perennial, monocot, narrow leaves, sedge

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
2,4 D Dimethyl amine salt 58% SL	860	50-60
2,4 D ethyl ester 38% EC	2650	50-60
Paraquat dichloride 24% SL (Before sowing)	800-2000	90-120

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

1. Sowing of compatiable cropping pattern under. Need of agriculture diversification with other valuable commercial crops.
2. Adoption of proper cropping pattern, Utilization of fallow land left after harvesting of main crop

by growing short duration vegetables, oilseeds and pulse crop, Cluster based farming, Inter cropping.

xii.Production constraints in agro-ecological region:

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

6E. Name of the field crop: Barley

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

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

iii. Existing package of practices being used:

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

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

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

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

vi.IPM Module for management of insect pests: -

Barley aphid: *Macrosiphum* sp.)

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

White grub:

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

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

viii.IPM Module for management of disease: -

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

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

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

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

ix.Major weeds associated with crop: *Phalaris minor,* Green Amaranth**,** *Chenopodium album*, Wild oat, Grassy and broad leaf weeds

x. IPM Module for management of weeds: Dwarf canary grass:

***Phalaris minor* (annual, monocot, narrow leaves, grass)**

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

Green Amaranth: ***Amaranthus viridis, A.spinosus*** **(annual, dicot, broad leaves, leafy)**

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

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

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

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

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

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

Grassy and broad leaf weeds

Name of the Herbicides	**(gm/ml) /ha**	**Waiting period (days)**
Paraquat dichloride 24% SL (Before sowing)	4250	120-150

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

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

xii.Production constraints in agro-ecological region:

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

7A. Name of the Pulse crop: Chick pea

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

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Pant Kabli Chana-1, GNG-1969, Aman, GNG-1958, Aadhar, Pusa-547, Pusa-256, Pusa-1053, JGK-1

iii. Existing package of practices being used:

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

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

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

7. Arrangement of irrigation facilities in case of drought should be available.
8. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

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

vi.IPM Module for management of insect pests:

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

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

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

Bio-insecticides

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

vii.Major disease associated with crop: Yellow Mosaic, Blast, seed or seedling rot, root rot, Stem and petiole blight

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

Blast disease:

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

Yellow mosaic disease

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

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

x.IPM Module for management of weeds: For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

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

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

xii.Production constraints in agro-ecological region:

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

7B. Name of the Pulse crop: Urd

i. Existing varieties being used: Pant Urd 31, Pant Urd 35 Pant Urd 19

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PU-31, PU-35, PU-40, Shekhar-2

iii. Existing package of practices being used:

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

1. They also do not follow balance use of chemical fertilizers,
2. It is also observed that due to lack of knowledge,
3. Most of the farmers adopt improper plant protection measures.

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

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

v.Major insect pests associated with crop: Fruit borer, Bihar Hairy Caterpillar (*Spilarctia obliqua*), Whitefly (*Bemisia tabaci*), , Stem flies (*Melanagromyza sozae*), Leafhopper (*Empoasca* sp.),Thrips (*Caliothrips indicus)*, Pod sucking bugs *(Riptortus* sp. and *Nezara viridula)*

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

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 theInsecticides	(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 theInsecticides	**(gm/ml) /ha**	**Waiting period (days)**
Quinalphos 25% EC	1500	

White fly

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

Stem fly

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

vii.Major disease associated with crop : Root rot , Yellow mosaic , Web blight & Anthracnose

IPM viii. IPM Module for management of disease :

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

Root rot (*Macrophomina phaseolina*)

Name of the Fungicides	**g/Kg seed**	**Treatment**
Trichoderma viride 1% WP (TNAU Strain Accession no. ITCC 6914)	4 g/Kg seed	**Seed Treatment:** Mix required quantity of the seeds with the required quantity of *Trichoderma viride* 1% WP and ensure uniform coating, shade dry and sow.
Trichoderma viride 1% WP	4g/Kg seed	

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

x.IPM Module for management of weeds:

1. Pendimethaline @ 1kg ai/ha
2. For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

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

1.Seed treatment with *Rhizobium* culture

2.Sowing of crop in suitable cropping pattern under irrigated condition with proper management of weed, insect pest and diseases.

xii.Production constraints in agro-ecological region:

1.Farmers don't follow proper package of practices,

2.Proper market linkage is not available,

3.Improper use of irrigation facilities,

4.Lack of quality input,

5.Wild animals

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 5, Shweta

iii. Existing package of practices being used:

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

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

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

Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

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

vi. IPM Module for management of insect pests :

Fruit Borer

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

White fly

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

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

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

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

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

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

x. IPM Module for management of weeds:

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

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

1. Sowing of crop in after harvesting of wheat to utilize fallow land left for cultivation of paddy.
2. Need to grow crop in kharif season as main crop.
3. Cluster based farming, Inter cropping.
4. Proper Plant protection measures.

xii. Production constraints in agro-ecological region:

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

7D. Name of Pulse Crop: Pigeon pea

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

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

increasing yield in specific agro-ecological region: Pant Arhar-3, Pant Arhar-291, UPAS-120, Pusa-992, Bahar, Amar, Narendra Arhar-1

iii. Existing package of practices being used:

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

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

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

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

vi.IPM Module for management of insect pests :

Pod borer: *Helicoverpa armigera*)

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

Redgram thrips: *Scirtothrips dorsalis*

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

vii.Major disease associated with crop: Yellow Mosaic, Blast, Wilt of pigeon pea, Seed rot, root rot, stem rot

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

Blast disease

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

Yellow mosaic disease:

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

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

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

Seed rot, root rot, 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 Bio-insecticides	g/Kg seed	Treatment
Trichoderma viride 1% WP (TNAU Strain Accession no. ITCC 6914)	4 g/Kg seed	**Seed Treatment:** Mix required 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: Broad leaf and narrow leaf weeds

x. IPM Module for management of weeds:

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

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

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

xii.Production constraints in agro-ecological region:

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

7E. Name of Pulse Crop: Lentil

i. Existing varieties being used: PM-4, PM-5, PL-406

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: PL-4, PL-7, PL-8, DPL-15, DPL-62

iii. Existing package of practices being used:

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

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

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

v. Major insect pests associated with crop: Pod borer, white fly, thrips

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

vii. Major disease associated with crop: Major diseases- Wilt and Rust

viii.IPM Module for management of disease:

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

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

x.IPM Module for management of weeds: For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

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

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

xii.Production constraints in agro-ecological region:

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

7F. Name of Oilseed crop: Toria/mustard

i. Existing varieties being used:-

ii. High yielding varieties: PT-30, PT-303, 507, Uttara, PPS-1, Pant Sweta, Type-9, Bhawani, VL Toria-3, Urvashi, Rohini, Vardan, Vasanti, PR-20

iii. Existing package of practices being used: -Traditional methods

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

1. Deep ploughing during summer months
2. **Land preparation:** One ploughing followed by 2-3 harrowings and planking; Using Zero till ferti- seed drill will increase farmers' income reducing the costs of planting and improving productivity.
3. **Sowing time to improve productivity and income:**
   Toria: Last week of September.
   Yellow *sarson* & *rai* (Mustard): First fortnight of October.
4. **Seed treatment**
   Seed treatment: Apron 35 SD @ 5g/kg. Only certified seeds should be used.
5. **Seed rate and spacing:**
   ***Toria*:** 4kg/ha about 3-4 cm deep in 30 cm apart rows
   Yellow *sarson* & *rai* (Mustard): 5 kg/ha with a row spacing of 30-45 cm.
6. **Thinning:** About 20-25 days after sowing maintaining a plant to plant space of 10 cm. The

thinned out plants could be used as **green forage**.

7. **Nutrient management:**
   Vermicompost: 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.
   Excess use of nitrogenous fertilizers should be avoided.
   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.
8. **Water management:** Rosette (25-30 days) and pre-flowering stages are the most sensitive to water deficit. Hence, irrigations shall be made at these stages wherever possible.
9. **Harvesting and threshing:**The crop should be harvested when about 75 % of the siliquae turn yellowish brown. After threshing, seeds should be stored with less than 8% moisture.

v. **Major insect pests associated with crop:** Mustard aphid, saw fly, Painted Bug, Mustard leaf miner

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

Mustard aphid: *Lipaphis erysimi*

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

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

Mustard saw fly : *Athalia lugens proxima*

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Imidacloprid 70% WS (Seed treatment/Kg)	4.9	7.0
Dimethoate 30% EC	200	660
Quinalphos 25% EC	300	1200

Painted Bug : *Bagrada cruciferarum*

Name of the Insecticides	**(gm/ml)/ha**	**Waiting period (days)**
Imidacloprid 70% WS (Seed treatment/Kg)	4.9	7.0
Dichlorvos 76% EC	500	627

Mustard leaf miner

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

vii. Major diseases associated with crop: Alternaria blight, White Rust and Downy Mildew

viii. IPM Module for management of disease:

Disease management:

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
4. Seed treatment with Apron 35 SD @ 6g/kg followed by 2-3 sprays with Mancozeb or Ridomil

MZ @ 0.2 per cent 1st at 50, 2nd at 60 and 3rd at 75 days after sowing for the management of *Alternaria* blight, White Rust and Downy Mildew diseases depending upon severity of the disease.

5. Foliar sprays (2-3) of Tebuconazole (0.05%) 1st at 50 and 2nd at 65 and 3rd at 75 DAS for management of *Alternaria* blight disease depending upon severity of the disease.
6. For management of *Sclerotinia* rot wider spacing (45x15cm) should be maintained; apply colonized *Trichoderma* decomposed cow dung/ FYM in the soil, seed treatment with garlic bulb extract (2%) followed by 2-3 foliar sprays of Propiconazole (0.05%) or Carbendazim (0.1%) during flowering *i.e.* 1st at 55 and 2nd at 65 and 3rd at 75 days after sowing depending upon disease severity.

Alternaria blight or Leaf spot: *Alternaria brassicae*

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

White rust : *Albugo candida*

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

ix. Major weeds associated with crop: *Chenopodium album, Ciprus* sp.

x. IPM Module for management of weeds:

1. Pre–emergence application of Pendimethalin @ 1kg *ai*/ha within two days of sowing.
2. About 20-25 days after sowing a hand weeding be done along with the thinning operation to take out the emerged weeds.

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

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

White sweet clover: *Melilotus alba* (annual-biannual, dicot, broad leaves, leafy)

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

Yellow sweetclover: *Melilotus indica* (annual-biannual, dicot, broad leaves, leafy)

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

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

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management.

xii. Production constraints in agro-ecological region: Wild animals

8.A Name of Fruit Crop: Litchi

i. Existing varieties being used: Rose scented, Lent bedana, Gola

ii. High yielding varieties:(Rose scented, calcuttia, gandaki Sampada, Gandaki lalima, Gandaki yogita (suitable for high density plantation)

iii. Existing package of practices being used: -

1.Proper layout of orchard, pit digging in the month of May-June with proper dimension.
2.Proper supply of nutrient (FYM, fertilizer and micronutrient) insecticide etc.
3.Plantation with gooti, in all spacing (Normal / High Density).

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

1. Soil analysis is needed prior establishment of new orchard.
2. High density plantation with canopy management.
3. Installation of Drip Irrigation system during plantation with plastic mulching to promote the moisture content.
4. Installation of rain gun in fruiting orchard to avoid the fruit cracking.
5. Rejuvenation of senile orchard,
6. Adoption of inter cropping of filter fruit crops and cultivation of vegetables especially leguminous group to enhance the soil fertility.
7. Intervention of safer insecticides promotes the pollination .
8. Bee-keeping to enhance the production through pollination support.

v. Major insect pests associated with crop: Fruit borer, mites, leaf roller

vi. IPM Module for management of insect pests :

Litchi mite:

1. Pruning of all the affected twigs / leaves during June just after harvest & destruction.
2. Application of Dicofol @ 0.05% (3ml/liter of water) or dimethoate @ 2ml/l twice at flush emergence in Sept-Oct at 7days interval.

Litchi fruit borer:

1. Collection and destruction of fallen infested fruits.
2. Use *Trichogramma chilonis* and Bt formulations.
3. At early stage of fruiting which coincides with egg laying, spray carberyl 50WP or Monocrotophos (0.04%) or Phosalone (0.05%)? Repeat twice at 10-12 days interval.
4. Application of Flubendiamide 39.35 SC (0.008%)@ 1.5ml/5l, Spinosad 45 SC (0.014%)@ 1.5ml/l or Novaluron 10 EC (0.015%)@1ml/l twice at colour brick stage at 7 days interval.

Litchi leaf roller:

1. Low infestation can be reduced by destruction of infested rolled leaves.
2. Application of Monocrotophos or Quinolphos @ 2ml/l of water at new flush

vii. Major disease associated with crop: Fruit Rot, Shoot Dying

viii. IPM Module for management of disease:

1. Spraying of Carbendazim @ 1gm/l water one week before fruit setting.
2. COC

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

x. IPM Module for management of weeds: Chemical, mechanical and biological control

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

1. Conservation of moisture under the orchard through drip irrigation as well as installation of rain gun during the ripening period of fruits to avoid the fruit cracking.
2. Cultivation of filler crop from the newly established and renovated orchard.
3. Post Harvest Management & marketing to be enhanced.

xii. Production constraints in agro-ecological region:

1. Urbanization affecting the area and production of litchi.
2. Old and Senile Orchard.
3. Application of chemical pesticides restricts the visit of pollinators / beekeeping.

8B. Name of Fruit Crop: Guava

i. Existing varieties being used:L -49, Pant Prabhat,Allahabad safeda, Lalit,sheweta

ii. High yielding varieties: L -49, Allahabad safeda, Lalit,sheweta

iii. Existing package of practices being used: -

1. Traditional farming of guava in hills.

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

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

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

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

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 fruit fly:

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: Wilting, fruit rotting

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, Cynodum dactylon, Parthenium, etc.*

x. IPM Module for management of weeds:

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

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

1. Enhancing the productivity by cultivating the filler and other vegetables and legumes crop as inter cropping.
2. HDD to be adopted by all

xii.Production constraints in agro-ecological region:

1. Lack of QPM.
2. Lack of irrigation facilities.
3. Fruit Fly is a major constraints during rainy season crops

8C. Name of Fruit Crop: Mango

i. Existing varieties being used: Dashehri , Langra, Chausa, & 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 Dushari, Langra, Chausa, Amrapali, Mallika, Bombay green, Pusa surya, Pusa Arunima, Arunika, Pusa shreshta, Pusa Lalima)

iii. Existing package of practices being used:

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

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

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

v. Major insect pests associated with crop: Shoot gall maker, fruit fly, hopper, mealy bug,

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 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 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 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 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:

Powdery mildew, anthracnose

viii. IPM Module for management of disease:

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

Powdery mildew: *Oidium mangiferae*

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

x. IPM Module for management of weeds:

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

Name of 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 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 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	1000-1250	100

DAS)		
Metribuzin 70% WP (Medium soil)	250	120
Metribuzin 70% WP (Heavy soil)	300	120
Metsulfuron methyl 20%WP	20	80
Metsulfuron methyl 20%WG	20	76
Triasulfuron 20 %WG	100	81
Pendimethalin 30% EC (Light soil)	3300	
Pendimethalin 30% EC (Heavy soil)	4200	
Sulfosulfuran 75% WG	33.3	110
Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP	400	100
Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC	1250	110
Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG	400	96
Sulfosulfuran 75%+Metsulfuron methyl 5%WG	40	110

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: In the beginning period of newly established orchard (10yrs), the filler crops like papaya, guava, low chill peaches in plains while cultivation of vegetable crops i.e. potato, peas, urd, moong and beans etc in hills.

xii. Production constraints in agro-ecological region:

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

8D. Name of Fruit Crop: Citrus

i. **Existing varieties being used:**Malta, Kinno, Hill lemon, Santra 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:**Grafted / budded planting material available in the State and outside State.

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

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

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

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

v. **Major insect pests associated with crop:**Lemon Butterfly, Citrus psylla, Leaf Minor, scale insects

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

Lemon butterfly:

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

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

Scale insects:

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

Name of Insecticides	(gm/ml)/ha
Quinalphos 25% EC	4200-5600

Citrus psylla: *Diaphorina citri*

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

Citrus leaf miner: *Phyllocnistis citrella*

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

vii. Major disease associated with crop: Canker , Dieback, Gummosis, Scab, Powdery mildew

viii. IPM Module for management of disease:

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

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

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

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

Scab : *Elsinoe fawcetii*

Name of Fungicides	(gm/ml)/ha	Waiting period (days)
Captan 75% WP	0.12%	1667

Powdery mildew

Name of Fungicides	(gm/ml)/ha	Waiting period (days)
Sulphur 80% WP	2500	3130

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

x. IPM Module for management of weeds:

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

Name of 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 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 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 Canopy Management (Training and Pruning)
2.Spraying schedule is required to avoid the diseases and pest in orchard.
3.INM modules to overcome the early senility of plants.
4.PHM & marketing to be enhanced.

xii. Production constraints in agro-ecological region:

1. In hilly terrain due to sloppy surface , nutrient loss is more as compared to plains.
2. In rainy season, water logging resulted the canker
3. Early degradation of plant (dieback& physiological disorder) health due to lack of proper nutrient management.

9A. Name of 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:T-621, Pragati, Indica,Varun, Pusa

Mukta , Sri Ganesh Gole Green star, Pride of India

iii. **Existing package of practices being used:** Use of high yielding cultivars with and suitable placement of pollinizer in high density planations with sufficent irrigation facility as drip for establishment of model and commercial orchards.

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

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

v. **Major insect pests associated with crop:** Diamond black moth, cabbage butterfly, Aphid and Painted bug

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

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

Before Planting

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

After Planting

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

Dimond back moth: *Plutella Xyllostella*

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

Painted bug

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

vii. Major disease associated with crop: *Sclerotenia* stem rot, *Xanthomonas* Black rot and Downy Mildew

viii. IPM Module for management of disease:

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

Downy Mildew:

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

Root rot/Collar rot (*Rhizoctonia solani*)

Name of Fungicides	(gm/ml)/ha
Mancozeb 75% WP (Drenching/ lit. water)	3

Biofungicides

Name of Biofungicides	(g/kg)/lit	Treatment
Trichoderma viride 1% WP	10 g/lit. water 2.5 Kg/ha	**Seedling Root dip Treatment:** Mix 10 g of *Trichoderma viride*1% WP in one litre of water and dip the cabbage seedling root for 30 minutes. **Soil Treatment:** Mix 2.5 Kg of *Trichoderma viride* 1% WP with 62.5 Kg FYM and broadcast uniformly over a hectare of land and irrigate the field immediately.

ix. Major weeds associated with crop :

Parthenium, Chenopodium album, Krishnil, Teepatiya

x. IPM Module for management of weeds:

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

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

Name of 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. Grow Rainy season crop at mid to higher altitudes (1600 – 1900 m amsl)
2. Advanced technical package and practises regarding crop.
3. Use of trap crop like radish to attract the white butterfly.
4. Inter Cropping with coriander and rye in hills.

xii. Production constraints in agro-ecological region:

1. Poor marketing channel. Monkey and wild animal menace
2. Less availability of high quality seeds
3. High prices of hybrid seeds
4. Post-harvest losses are more due to non availability of
5. 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.

9B. Name of Vegetable Crop: Cauliflower

i. Existing varieties being used: Unknown varieties available in the mandi

ii. High yielding varieties:

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 :Region A- Early: May- June;
8. Mid: July – Aug; Late: Oct
9. 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.
10. Transplanting- Farmers practices improper planting distance.
11. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
12. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
13. 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.
14. 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 black moth, Tobacco caterpillar, Aphid

vi. IPM Module for management of insect pests :

Before Planting

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. 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 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 Insecticides	**(gm/ml)/ha**
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	600-1000
Bacillus thuringiensis serovar kurstaki serotype 3a,3b, SA II WG	500

Tobacco caterpillar (*Spodoptera litura*)

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

Cabbage/cauliflower Aphid

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

vii. Major disease associated with crop: *Sclerotenia* stem rot, *Xanthomonas* Black rot and Downy Mildew

viii. IPM Module for management of disease:

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

Downy Mildew:

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

Root rot/Collar rot (*Rhizoctonia solani*)

Name of Fungicides	**(gm/ml)/ha**
Mancozeb 75% WP (Drenching/ lit. water)	3

Biofungicides

Name of Biofungicides	**(g/kg) lit**	**Treatment**
Trichoderma viride 1% WP	10 g/lit. water 2.5 Kg/ha	Seedling Root dip Treatment: Mix 10 g of *Trichoderma viride* 1% WP in one litre of water and dip the cabbage seedling root for 30 minutes. Soil Treatment: Mix 2.5 Kg of *Trichoderma viride* 1% WP with 62.5 Kg FYM and broadcast uniformly over a hectare of land and irrigate the field immediately.

ix. Major weeds associated with crop:

Parthenium, Chenopodium album, Krishnil, Teepatiya

x. IPM Module for management of weeds:

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

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

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

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

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

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

xii. Production constraints in agro-ecological region:

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

9C. Name of the vegetable crop: Radish

i. Existing varieties being used: Mixture of varieties from unknown source

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Japanese White, Pusa Himani, Pusa Chetki, Pusa Reshmi, Arka Nishant, Punjab Pasand

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 Treatment- Mostly farmers of the state do not treat the seed materials.
4. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
5. Sowing time: Sept- Dec
6. Planting distance- Farmers practices improper planting distance and sown through broadcast.
7. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
8. Fertilizers: Farmer use imbalance fertilizer
9. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method..
10. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
11. Harvesting- The root harvesting should not follow as per maturity standards or as per object.

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

1. **Soil Testing-** Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. **Land Preparation-** The farmers are recommended to open the land before sowing the crop for sterilization.
3. **Seed Treatment-** For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or *Trichoderma viride* 4g/kg before sowing
4. **Seed Rate**- The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-

14 Kg/ha

5. **Planting distance**- Farmers should be sown the seed Asiatic type line to line 45 cm and plant to plant 8cm and European type line to line 30 cm and plant to plant 8 cm
6. **Manures and fertilizers**- should be used as per soil testing , General recommendation are **FYM**-250q/ha **Nitrogen**: 60 kg/ **Phosphorus**: 100 kg/ha and **Potassium:** 50kg/ha **Micronutrient:** should be used as per soil testing,
7. **Irrigation**- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winte**r** 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

vi. IPM Module for management of insect pests:

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

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

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

vii. Major disease associated with crop: White rust

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

Use of recommended pesticides in recommended dose

ix. Major weeds associated with crop: Not serious

x. IPM Module for management of weeds: Not applied

xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region: Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as:

1. Cauliflower early- Radish- Bottlegourd
2. Brinjal-Radish –Chilli
3. Bottle bourd-radish-French bean

xii. Production constraints in agro-ecological region:

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

9D. Name of the vegetable crop: Tomato

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

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: (Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852)

iii. Existing package of practices being used:

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

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

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

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

vi. IPM Module for management of insect pests:

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

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

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

Management strategies(white fly and other sucking pests)

A. Crop Hygiene

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

B. Other Cultural Control Practices

1. Use proper pre-planting practices.

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

C. Insecticidal Control Practices.

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

White fly

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

Leaf miner, *Liriomyza trifoli*

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

Aphid, *Aphis gossypii*

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

Thrips, *Thrips tabaci*

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

vii. Major disease associated with crop: Late blight, Early blight, Buck eye rot, Bacterial wilt and Powdery mildew

viii. IPM Module for management of disease:

Late blight :

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

Name of the Fungicides	(gm/ml) /ha	Waiting period (days)
Famoxadone 16.6%+ Cymoxanil 22.1% SC	500	3
Cymoxanil 8%+ Mancozeb 64% WP	1500	10
Ametoctradin + Dimethomorph 20.27% SC	800-1000	32
Azoxystrobin 23% SC	500	3
Cyazafamid 34.5% SC	200	3-5
Mandipropamid 23.4% SC	0.08%	5
Captan 50% WP	2500	
Copperoxychloride 50% WP	1250	
Mancozeb 75% WP	1500-2000	
Zineb 75% WP	1500-2000	
Azoxystrobin 18.2%+ Difenoconazole 18.2% SC	0.1%	5

Early Blight :

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

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

Buck eye rot:

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

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

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 Biofungicides	(g/Kg)/(ha/sqm)	Treatment
Pseudomonas fluorescens 0.5% WP (TNAU Strain Accession no. ITCCBE 0005	10 g/Kg seed	**Seed Treatment:** Mix required quantity of the seeds with the required quantity of *Pseudomonas fluorescens* 0.5% WP and

	2.5 Kg/ha	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 5 Kg/ha	**Seed Treatment:** Treat the seed with *Trichoderma harzianum* 1% WP **Nursery Treatment:** Treat the nursery beds with the *Trichoderma harzianum* 1% WP. **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.

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

x. IPM Module for management of weeds:

1. Cultural practices.
2. Through recommended chemicals.

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

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

xii. Production constraints in agro-ecological region:

1.Poor marketing channel. Monkey and wild animal menace, scattered land
2.Imbalance use of fertilizes.
3.More numbers of pesticides' spray

4.Increase incidences of Bacterial wilt.
5.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: K. Bahar, K Badshah, 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: K. Khyati, K. Pukhraj, K. Ashok, K. Sadabahar, K. Anand, etc.The seed of above listed varieties are not available or available in less quantity in different zones

iii.Existing package of practices being used:

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

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

1.Balanced nutrient fertilization, area specific time of planting, mulching with farm resedues
2.Dehaulming practise should be adopted for long duration storage of tubers.
3.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 tuber moth, Aphid, Epilachna beetle, Jassids, 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, Bacterial rot

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

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

ix. Major weeds associated with crop: Annual grasses and Broad leafed weeds

x. IPM Module for management of weeds:

1.Apply post emergence spray of paraquat dichloride @ 500 ml ai in 700-750 l water/ ha

2.Apply Pendimethalin 30 EC @ 1 kg a.i/ha or Metribuzin 70% WP @ 0.350 kg a.i/ha or Oxyflurofen 23.5 % EC @ 0.1-0.2 kg a.i/ha within 3 days after planting to control grassy and non

grassy weeds.
3.Apply Paraquat dichloride 24% SL @ 0.5 kg a.i/ha at 5% germination of potato.

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

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

xii. Production constraints in agro-ecological region:

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

9F. Name of the vegetable crop: Brinjal

i. Existing varieties being used: Pant Samrat, Pant Brinjal -4, Pant Rituraj

ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region: Navkiran, Brinjal 704 (SunGro Seed), Navina, VNR212 (VNR Seed), IndameSupriya (Indo-American), Pant Rituraj, Pant Samrat (Pantnagar), Kashi Taru, Kashi Sandesh (IIVR)

iii. Existing package of practices being used:

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

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

ecological region:

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

v. Major insect pests associated with crop: Shoot and fruit borers, Hadda beetle,Aphids, Thrips, Lace wing bug,

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

Lace wing bug

Name of the Insecticides	**(gm/ml) /ha**	**Waiting period (days)**
Phorate 10% CG	1500	15000

vii. Major disease associated with crop: Wilt, Powdery mildew, Blight, Fruit rot.

viii. 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.

Powdery mildew

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

Blight

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

Fruit rot: *Phomopsis vexans*

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

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

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

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

1. Intervention of improved varieties
2. Advanced plant protection measures
3. Reduce the pesticide loads to innovative interventions
4. Use of organic nutrients and pesticides.

xii. Production constraints in agro-ecological region:

1. Intervention of improved varieties
2. Advanced plant protection measures
3. Reduce the pesticide loads to innovative interventions
4. Use of organic nutrients and pesticides.

9G. Name of the vegetable crop: Chilli

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

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

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

1. Over crowding in planting stage
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. Grow high yielding varieties.
2. Treat the seed with copper containing fungicides before sowing.
3. Adopt soil testing.
4. Transplant one seedling at one place.
5. Transplant the seedlings when they attain 5-6 leaf stage.
6. Transplant the seedlings at proper spacing-
   Dwarf varieties like Kashi Anmol at 45 x 30 cm
   Tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm.
7. 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, Aphid, White fly, Mite, Fruit borer

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

Management strategies sucking pests

A. Crop Hygiene

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

B. Other Cultural Control Practices

Use proper pre-planting practices.

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

Use proper post-planting practices.

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

Chilli thrips, *Scirtothrips dorsalis* Hood

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

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

Aphid

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

White fly

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

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

Fruit borer/Pod borer

Name of the Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC -	150	3
Cyantraniliprole 10.26% OD	600	3
Emamectin benzoate 5% SG	200	3
Spinosad 480% SC	160	3
Novaluron 10% EC	375	3
Lufenuron 5.4% EC	600	5
Indoxacarb 14.5% SC	333-400	5
Indoxacarb14.5%+ Acetamiprid 7.7% SC	400-500	5
Methomil 40% SP	750-1125	5-6
Lambda cyhalothrin 4.9% CS	500	5
Deltamethrin 2.8% EC	400-500	5
Fipronil 5% SC	800-1000	7
Flubendamide 480% SC	100-125	7
Pyriproxyfen5%+ Fanpropathrin 15% EC	750	7
Thiodicarb 75% WP	625-1000	
Flubendamide 19.92%+Thiacloprid 19.92	200-250	5

vii. Major disease associated with crop: Fruit rot, Damping off, Wilt , Leaf curling and Mosaic curling

viii. IPM Module for management of disease:

1.Carbendazim 2g/l

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

Fruit rot

Name of the Fungicides	(gm/ml) /ha	Waiting period (days
Azoxystrobin 23% SC	500	5
Benomil 50% WP	200	
Difenoconazole 25% EC	0.05%	15
Hexaconazole 2% SC	3000	7
Tebuconazole 25.9% EC	500-750	5
Mancozeb 75% WP	1500-2000	
Captan 50% WG	1500	5
Captan 75% WP	2000	8
Copperoxychloride 50% WP	1250	
Copper sulphate 2.62% SC	1000	3
Zineb 75% WP	1500-2000	
Captan 70% +Hexaconazole 5%WP	500-1000	5
Azoxystrobin 11%+ Tebuconazole 18.3% SC	600-700	7

Damping off (*Pythium aphanideramatum*)
Biofungicides

Name of the Biofungicides	g/Kg	Treatment
Trichoderma viride 1% WP (TNAU Strain Accession no. ITCC 6914)	4 g/Kg seed	**Seed Treatment:** Mix required quantity of the seeds with the required of *Trichoderma viride* 1% WP And ensure uniform coating, shade dry and sow.
Pseudomonas fluorescens 0.5% WP (TNAU Strain Accession no. ITCCBE 0005	10 g/Kg seed	**Seed Treatment:** Mix required quantity of the seeds with the required quantity of *Pseudomonas flurescens* 0.5% WP and ensure uniform coating, shade dry and sow.

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

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

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

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

xii. Production constraints in agro-ecological region:

1. Non availability of quality seed.
2. Less irrigation facilities.
3. High cost of hybrid seeds.
4. Unaware about the insect-pest management.

9H. Name of the vegetable crop: Capsicum

i. Existing varieties being used: Local

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

iii. Existing package of practices being used:

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

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

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

vi. IPM Module for management of insect pests:

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

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

viii. IPM Module for management of disease:

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

ix. Major weeds associated with crop: Seasonal

x. IPM Module for management of weeds: Manual weeding

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

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

xii. Production constraints in agro-ecological region:

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

9I. Name of the vegetable crop: Pumpkin

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

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

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

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

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

v. Major insect pests associated with crop: Pumkin beetle

vi. IPM Module for management of insect pests:

Red pumpkin beetle

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

vii. Major disease associated with crop:

Wilt, mildew, mosaic

viii. IPM Module for management of disease:

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

Downy mildew

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

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

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

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

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

xii. Production constraints in agro-ecological region:

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

9J. Name of the vegetable crop: Okra

i. Existing varieties being used: Arka, Anamika, Parbhani Kranti

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

increasing yield in specific agro-ecological region: Existing package of practices being used: Arka, Anamika, Parbhani Kranti), brinjal (Hybrid Pant brinjal-, Pant Rituraj, Pant Samrat) and chilli (Agni, Ragini Kashi Anmol, Pant C-1)

iii. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Broadcasting/line sowing

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

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

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

Okra Shoot and Fruit borer *Earias vittella* (Fabricius) (Arctidae: Lepidoptera)

1. Remove of debris and all the alternate host plants from field is beneficial.
2. Collection and destroying of all the infested shoots and fruits may reduce the pest infestation.
3. Spray Neem Seed Kernal Extract @ 5 ml/l after flowering is useful.
4. If still the population is high use of fipronil 5%SC @800- 1000ml/ha or novaluron 10EC @750ml/ha or spinosad 45%SC @160g/ha. or emamectin benzoate 5%SG @200g/ha is useful.Bioinsecticides

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Chlorantraniliprole 18.5% SC -	125	5
Emactin benzoate 5% SG	135-170	5
Lambda cyhalothrin 5 % EC	300	4
Cypermethrin 25% EC	150-200	3
Deltamethrin 2.8% EC	400-600	1
Fenvalerate 20% EC	300-375	7
Pyridalyl 10%EC	500-750	3
Pyriproxyfen 5% + Fenpropathrin 15% EC	750	7

Whitefly – *Bemisia tabaci* (Aleyrodidae: Hemiptera)

1. Crop rotation is effective tool to prevent pest population. Use of same group of crop in same field for a long time should be avoided.
2. Sticky trap is effective to control pests population. Use imidacloprid 17.8 SL @ 0.25ml/l or acetamiprid 20%SP @100g/ha or thiamethoxam 25%WG@ 100g/ha. or metasystox@1.5ml/l within one month of transplanting.
3. Single white fly may transmit the viral disease. Detailed management practice for whitefly has been described in tomato crop.

Bioinsecticides

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Thiamethoxam 25% WSG	100	5
Tolefenpyrad 15% EC	1000	3
Pyriproxyfen 5% + Fenpropathrin 15% EC	750	7

Fruit borer (*Helicoverpa armigera*)

Name of Insecticides	(gm/ml) /ha	Waiting period (days)
Azadirachtin 0.03% WSP (Neem oil based)	2500-5000	7
Azadirachtin 5% Neem Extract Concentrate Containing	200	5
Bacillus thuringiensis var. galleriae 1593 M sero type H 59 5b, 1.3% FC	1000-1500	
Beauveria bassiana 1% WP Strain no. IPL/BB/MI/01	3750-5000	

vii. **Major disease associated with crop:** Yellow vein mosaic, Wilt

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

Immidacloropid (1 ml/lt of water)

Wilt (*Fusarium oxysporum*)

Name of Biofungicides	(g/Kg)/ha	Treatment
Pseudomonas fluorescens 1% WP (Strain no. IIHR-PF-2 Accession no. ITCC B0034)	20 g/Kg seeds 5 Kg/ha	**Seed Treatment:** Treat the seeds with *Pseudomonas fluorescens* 1%WP **Soil Treatment: Apply** *Pseudomonas fluorescens* 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 seeds 5 Kg/ha	**Seed Treatment:** Treat the seeds with *Trichoderma harzianum* 1%WP. **Soil Treatment:** Apply *Trichoderma harzianum* with enriched FYM @ 5 tons/ha to the soil before sowing.
Trichoderma harzianum 1.5% WP (Strain No. IIHR-TV-5 Accession no. ITCC6889)	20 g/Kg seeds 5 Kg/ha	**Seed Treatment:** Treat the seeds with *Trichoderma harzianum* 1.5%WP. **Soil Treatment:** Apply *Trichoderma harzianum* 1.5% WP with enriched FYM @ 5 tons/ha to the soil before sowing.

ix. Major weeds associated with crop: Seasonal weeds

x. IPM Module for management of weeds:

1. Howing/pendamethylene.
2. Deep ploughing

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

xii. Production constraints in agro-ecological region: Summer – germination problem

9K. 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: Existing package of practices being used: (Vivek Matar 10, Vivek Matar 12 & VL Ageti Matar 7)

iii. Specific package of practices to be suggested for increasing yield in specific agro-ecological region: Sowing by broadcasting method, no seed treatment, using own saved seeds to grow crop.

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

1. 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).
2. Sowing time: Oct & Mid Nov
3. Seed rate: 100 Kg/ ha
4. Treating the seed with 2 g Thiram /kg of seed and rhizobium culture if being sown in field for first time.
5. 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.
6. Water the crop as per need especially during flowering and pod setting.

v. Major insect pests associated with crop: Leaf miner , white fly, thrips, leaf eating caterpillar, fruit fly, cut worm

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: Wilt, powdery mildew, root rot

viii. IPM Module for management of disease:

1. Use TH colonized compost.
2. Seed biopriming with TH / PsF/ TH + PsF (10g/kg seed) or Seed treatment with Thiram + Carbendazim (2:1) @ 3.0 g/kg seed.
3. Cultivation of powdery mildew resistant varieties.
4. Two to three sprays of (TH + PsF) or mancozeb (2.5 kg/ha) at 7 to 10 days interval beginning with appearance of foliar diseases (need based)

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

x. IPM Module for management of weeds: Use pendimethaline @ 1kg ai/ha as pre-emergence and one hoeing 25-30 days after sowing.

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

1. Intervention of improved varieties,
2. Advanced plant protection measures,
3. Reduce the pesticide loads to innovative interventions,
4. Use of organic nutrients and pesticides.

xii. Production constraints in agro-ecological region:

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

9L. Name of the vegetable crop: Dhania

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: Existing package of practices being used:-

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

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

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

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

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

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

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

viii. IPM Module for management of disease:

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

ix. Major weeds associated with crop: *Cyprus, Oxalis*

x. IPM Module for management of weeds: Manual weeding

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

in specific agro-ecological region:

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

xii. Production constraints in agro-ecological region:

1. Lack of FYM and nutrients.
2. Lack of mechanization.

9M. Name of the vegetable crop: Leafy vegetable

i. Existing varieties being used: All green 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: Existing package of practices being used: All green , Hathikon

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

1. Seed sown through broadcasting.
2. Flood irrigation, if irrigation facility is available.
3. Rainfed farming in hills.
4. Somewhere in case of rye transplantation is done.

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

1. Use of area specific high yielding hybrid varieties in reference to multi cut varieties.
2. Intervention of INM/IPM
3. Intervention of organic intervention i.e. pesticides , organic nutrient, vermicompost. Installation of sprinkler.

v. Major insect pests associated with crop: Aphid, leaf minor, leaf defoliator, grasshopper

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: Mildew, Rust, white spot and black spot on leaves, Damping off, mosaic

viii. IPM Module for management of disease: Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

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

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

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

1. Intervention of improved varieties,
2. Advanced plant protection measures,
3. Reduce the pesticide loads to innovative interventions,
4. Use of organic nutrients and pesticides.

xii. Production constraints in agro-ecological region:

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

11A.Name of the Floriculture crop: Gerbera

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

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

increasing yield in specific agro-ecological region: Commercial varieties available with private companies but always include 4-5 different coloured varieties to meet the diverse demand of market. May be procured from KF Bioplants Pvt Ltd. Bangalore/ Sheel Biotech, New Delhi

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

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**Soil test based micronutrient application, 50% shade net to be used for better quality and yield, soil sterilization with formaldehyde (2%), depth of planting should ensure 25% collar portion to be above soil, drip system of irrigation

v. **Major insect pests associated with crop:** mite, white fly , leaf minor, thrips

vi. **IPM Module for management of insect pests:** As per requirement through recommended pesticides

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

viii. **IPM Module for management of disease:**As per requirement through recommended pesticides.

ix. **Major weeds associated with crop:** tipatia, krishaneel

x. **IPM Module for management of weeds:** Efficient and timely management through digging and weeding.

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

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

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

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

12B.Name of the Floriculture crop: Gladiolus

i. **Existing varieties being used:** Commercial/private 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:** White Prosperity, Nova Lux, Pink Friendship, Red Beauty, Snow Princess, Rose Supreme, American Beauty

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

1. Grown on flat land at a spacing of 30 cm x 30 cm,
2. Nitrogenous fertilizers are applying as a basal dose,
3. Poor knowledge about application of potashic fertilizers as well as commercial size of propagating materials (Corms),
4. Grading and packaging aspects

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

1. Soil type: Sandy loam with pH of 6.5-7.0
2. Planting time: September- October (plains) and March- April (hills)
3. Spacing: 30 cm x 20 cm (on raised beds of 15 cm high)
4. Treatment of corms: 0.2% bavistin (systemic fungicide) solution for at least half an hour before planting.
5. Corm size: 8-10 cm or 10-12 cm (circumference)
6. Planting depth: 6-8 cm

7. Nutrition: FYM- 5-10 kg/sq.m, N- 20 g/m2 each at three leaf stage and six leaf stage, P- 10 g/m2 (as basal dose), K-20 g/m2 (as basal dose)
8. Stage of harvest: Tight bud stage(First floret shows colour)
9. Post harvest treatments: Precooling: 4°C .
10. Packaging material: Corrugated fibre board boxes (size: 1.2 m x 0.6m x 0.3m) and bunches of 20 spikes should be packed in Head-Tail direction to prevent negative geotropism.
11. Transportation: Should be transported in refrigerated VAN under cool-chain management.

v. Major insect pests associated with crop: Thrips, Cut worm, Leaf caterpillar, Mite and Mealy bug

vi. IPM Module for management of insect pests:

Thrips:

1.Spray Acephate 0.1% 2-3 times at 10 days interval.
2.Storing of corms at 2ºC for 6 weeks and treating them in hot water at 46ºC, completely kills thrips on corms.

Cut worm:

1. Ploughing during summer exposes pupae to predators.
2. Poison bait consisting of Carbaryl or Malathion at 0.1% in wheat bran and molasses scattered in the field controls larvae.
3. Spray of Methyl Parathion or Quinalphos 0.05% protects foliage.

Leaf caterpillar:

1. Collection and destruction of eggs masses and leaves infested with early larval instars reduces pest built.
2. Deep ploughing during summer exposes pupae to predators. Spray of Quinalphos 0.05% or Chloropyriphos 0.05% or Carbaryl 0.2% give protection to foliage.
3. Neem seed kernel extract 4% is effective against early instar larvae.

Mite:

1. Cutting and burning of severely infested plant parts.
2. Sprays of Dicofol 0.05% and wettable sulphur 0.3% applied 2-3 times at 15 days interval give effective control.

Mealy bug:

1. Spray of Methyl Parathion 0.04% or Dimethoate 0.04% or Acephate 0.1% at fortnightly intervals.

Pongamia oil 2% also provides good control.

vii. Major disease associated with crop: Wilt, Neck rot, Corm rot, Leaf and flower blight, Viral diseases and Aster yellows(MLOs)

viii. IPM Module for management of disease:

Wilt:

1. Planting of healthy corms in pathogen-free soil,
2. Applying fertilizers away from corms,
3. Crop rotation and soil solarisation
4. Treating the corms and cormels in hot water (38º-40ºC) containing Carbendazim and Captaf for about 30 minutes are important.

Neck rot:

1. Excessive soil moisture and low temperature during night predispose the plants for infection.
2. Avoid water stagnation.

Corm rot:

1. The disease can be controlled effectively by hot water treatment and by spraying Carbendazim and Captaf.

Leaf and flower blight:

1. The infection can be controlled by spraying Mancozeb at weekly or 10 days interval.

Viral diseases:

1. Vectors like aphid and leafhoppers should be controlled with suitable insecticide.
2. Use of aluminium foil as mulch repels the vectors.
3. Continuous rouging of infected plants and discarding of corms and cormels from infected plants is very important measure of control.

Aster yellows(MLOs):

Disease can be controlled by eradicating the infected plants and corms. Since the disease is transmitted by leaf hopper this may be controlled using suitable pesticide.

ix. Major weeds associated with crop: Motha, Hirankhuri, Patharchatta,

x. IPM Module for management of weeds:

1. Manual weeding.
2. Spray Atrazine @ 1.50 kg a.i. ha-1 at pre-emergence stage.

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

1. Planting distance: 30 cm X 20 cm (for cut flower production):20 cm x 20 cm (for corm production).
2. Planting system: Double row planting system - Adopted for drip system irrigation.

xii. Production constraints in agro-ecological region:

1. High cost of planting materials
2. Non-availability of quality planting material
3. Lack of organised market
4. Transportation
5. Fluctuating prices
6. Lack of on farm storage facilities.

11C.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:

1. Plant density 6-9 plants per square meter area in polyhouse.
2. 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 comrot, 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:

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

xii. Production constraints in agro-ecological region:

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

11D. Name of the Floriculture crop: Lilium

i. Existing varieties being used: Asiatic and oriental type commercial 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:

1. Asiatic- Alaska(white),enchatment(red), Dreamland (yellow)
2. Oriantal- white mountain(white),Casecade(pink), Monalisa (pink)
3. Bulbs are available in private nurseries

iii. Existing package of practices being used:

1. Time of planting in plains- Oct- Nov, for hills –April-May
2. Fertilizers-well rotten FYM-6 kg /m2,CAN-50g/m2,DAP-30g/m2,MOP-30gm/m^2

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

1. Fertilizers should be apply as spray of 100g urea and 60 g/m2 area after three week of planting, planting distance for quality flower-25x15 as line and bulbs respectively.
2. Temperature should be maintained 15-22 ^oC.
3. Keep the crop moist after every spray of nitrogenous fertilizer and stop irrigation and fertigation when flowering started.
4. Drip irrigation is best. Uses of net house increase the quality of flower

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 comrot, 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:

1. Application of CAN 2.5g, KNO3 0.5g, Micronutrient 1.2g/m2/week for oriental lily increase the quality of flower.
2. Mixing of cocopeat @6kg/ m2 with FYM increase the soil texture and ultimately flower quality.

xii. Production constraints in agro-ecological region:

1. Unavailability of quality planting materials.
2. Frost, Storm and hails strongly affect the Quality of flower.
3. Planting material to be imported every year involving huge investment

11E. Name of the Floriculture crop: Rajnigandha

i. Existing varieties being used: Double, Prajwal, Suvasini, Shringar

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

Single: Bidhan Rajani-1, Shringar, Phule Rajani, Prajwal

Double: Suvasini, Vaibhav, Pearl Double

iii. Existing package of practices being used:

Planting in the plain fields, non-uniform size bulbs being used, non-recommended fertilizer application

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

ecological region:

1. Treatment of bulbs: Bavistein @0.2% for 30 min and drying in shade
2. Time of Planting: March-April (by April 10)
3. Bulb size: 1.5 to 2.5 cm diameter
4. Soil Type: Sandy to sandy loam soil with 6.5 to 7.5 pH planting on raised beds if water stagnation is there
5. Field Preparation: 2-3 Deep ploughing upto 30-40 cm, brought to fine tilth, left for 15 days
6. Depth of planting: 5-7 cm, drip system of irrigation,
7. Fertilizer: Basal dose FYM@5Kg/m2, SSP and MOP @80g/m2
8. Nitrogen@15 g/ m2 in three split doses; ⅓ as basal, ⅓ after 60 days of planting and rest ⅓ at flowering stage.
9. First hoeing after sprouting followed by light irrigation.
10. Harvesting: Morning or evening hours.

v. Major insect pests associated with crop: -

vi. IPM Module for management of insect pests: -

vii. Major disease associated with crop:-

viii. IPM Module for management of disease:-

ix. Major weeds associated with crop: Local weeds

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

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

1. Choice of variety specific to the purpose,
2. Selection of bulbs and depth of planting,
3. Soil test based fertilizer application,
4. Drip system of irrigation,
5. Post harvest handling practices with cool chain management,
6. Double row planting on bunds,
7. Uprooting and separation of bulbs in the month of December-January (when undergoes dormancy) of 2-3-year-old plantation and their replanting in March-April (upon breaking dormancy).

xii. Production constraints in agro-ecological region:

Lack of availability of quality planting material, varietal suitability for specific purpose (cut/loose/essential oil)

C1. Livestock: Cattle

1.A Existing breeds available: HF Cross, Jersey Cross, Sahiwal, Red Sindhi, Gir, Graded, Badri, Non Descript

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

2.A Existing feeds being used:

1. There is no Specially trained staff and technicians to calculate the exact availability of Tree leaves, Grasses, perennial herbs and Seasonal fodder crops therefore exact quantity of availability, requirement and deficient fodder can not be calculated.
2. As far as the availability of green fodder is concerned there is no scarcity of green fodder in the District because of sufficient Agriculture land and water availability throughout the year.
3. Due to sufficient availability of agriculture land two crops of paddy, one crops of wheat and different pulses are taken every year. In the season the ample amount of dry fodder is produced which is stored by the farmers for dry fodder requirement of their livestock.
4. The excess available dry fodder is supplied to other districts as per the demands.
5. The grasses available in the forest are grazed by the animals and are need not to be stored.
6. Some of the advance dairy farmers have their own production plants of concentrate feed.
7. Many farmers prepare their own concentrate by mixing different grains, oil cake, rice bran,

chunni etc.

8. Due to sufficient availability of wheat straws and concentrate there is no demand for compact feed blocks in the district, although the C.F.B. are being produced at ANCHAL.

2.B Specific feeds to be introduced / advised:

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

3.A Existing health services:F.M.D. - C.P., Routine Vaccination, General health camps by mobile Veterinary Hospital, Health and Infertility Camps

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.H.S., B.Q Control Programme.

4.A Existing management practices:

1. Traditional management practices with low height, not good ventilation, kachchha floor, no proper drainage, poor hygiene
2. Stall fed, lack of proper space & ventilation, poor hygiene, at times drainage absent.
3. Stall fed twice a day, water twice a day.
4. No proper feeding of concentrates, mineral mixture by most of the farmers, absence of balance feeding.
5. Only few of organised farmers are doing proper feeding practices.

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, Growing of fodder crops, disease management, etc.
2. Proper housing with ventilation, drainage & space.
3. Balanced feeding of green, dry & concentrates. Timely deworming, vaccination & control of ectoparasites.

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

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

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

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

C2. Livestock: Buffalo

1.A Existing breeds available: Murrah, Terai, Nili-Ravi, Bhadavari

1.B Specific breeds to be introduced:-

2.A Existing feeds being used:

1. There is no Specially trained staff and technicians to calculate the exact availability of Tree leaves, Grasses, perennial herbs and Seasonal fodder crops therefore exact quantity of availability, requirement and deficient fodder can not be calculated.
2. As far as the availability of green fodder is concerned there is no scarcity of green fodder in the District because of sufficient Agriculture land and water availability throughout the year.
3. Due to sufficient availability of agriculture land two crops of paddy, one crops of wheat and

different pulses are taken every year. In the season the ample amount of dry fodder is produced which is stored by the farmers for dry fodder requirement of their livestock.

4. The excess available dry fodder is supplied to other districts as per the demands.
5. The grasses available in the forest are grazed by the animals and are need not to be stored.
6. Some of the advance dairy farmers have their own production plants of concentrate feed.
7. Many farmers prepare their own concentrate by mixing different grains, oil cake, rice bran, chunni etc.
8. Due to sufficient availability of wheat straws and concentrate there is no demand for compact feed blocks in the district, although the C.F.B. are being produced at ANCHAL)

2.B Specific feeds to be introduced / advised:

1.Livestock- Feed blocks, Nutritious grasses (Napier, Barseem, Oat, etc.), hay supplemented with grain, soy and other ingredients.

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

3.A Existing health services:F.M.D. - C.P., Routine Vaccination, General health camps by mobile Veterinary Hospital, Health and Infertility Camps

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. H.S., B.Q Control Programme.

4.A Existing management practices:

1. Traditional management practices with low height, not good ventilation, kachchha floor, no proper drainage, poor hygiene
2. Stall fed, lack of proper space & ventilation, poor hygiene, at times drainage absent.
3. Stall fed twice a day, water twice a day.
4. No proper feeding of concentrates, mineral mixture by most of the farmers, absence of balance feeding.
5. Only few of organised farmers are doing proper feeding practices.

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

1. Vaccination of animals, De-worming, De-horning, Use of chaff cutter for fodder management, Growing of fodder crops, disease management, etc.
2. Proper housing with ventilation, drainage & space.
3. Balanced feeding of green, dry & concentrates. Timely deworming, vaccination & control of ectoparasites.

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: Non Descript

1.B Specific breeds to be introduced: -

2.A Existing feeds being used:

1. There is no Specially trained staff and technicians to calculate the exact availability of Tree leaves, Grasses, perennial herbs and Seasonal fodder crops therefore exact quantity of availability, requirement and deficient fodder can not be calculated.
2. As far as the availability of green fodder is concerned there is no scarcity of green fodder in the District because of sufficient Agriculture land and water availability throughout the year.
3. Due to sufficient availability of agriculture land two crops of paddy, one crops of wheat and different pulses are taken every year. In the season the ample amount of dry fodder is produced which is stored by the farmers for dry fodder requirement of their livestock.
4. The excess available dry fodder is supplied to other districts as per the demands.
5. The grasses available in the forest are grazed by the animals and are need not to be stored.
6. Some of the advance dairy farmers have their own production plants of concentrate feed.
7. Many farmers prepare their own concentrate by mixing different grains, oil cake, rice bran, chunni etc.

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.Scientific grazing systems should be adopted on grazing lands and alpine grasslands

3.A Existing health services:

F.M.D. - C.P., Routine Vaccination, General health camps by mobile Veterinary Hospital, Health and Infertility Camps

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. Lack of proper space, poor hygiene.
2. Grazing, watering ad-lib
3. Machine shearing

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Can promote Goat farming by forming clusters. So that marketing doesn't remain a problem

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: Jamuna Pari, Sirohi, Barbari, Pantja, Black Bengal,

1.B Specific breeds to be introduced: -

2.A Existing feeds being used:

1. There is no Specially trained staff and technicians to calculate the exact availability of Tree leaves, Grasses, perennial herbs and Seasonal fodder crops therefore exact quantity of availability, requirement and deficient fodder can not be calculated.
2. As far as the availability of green fodder is concerned there is no scarcity of green fodder in the District because of sufficient Agriculture land and water availability throughout the year.

3. Due to sufficient availability of agriculture land two crops of paddy, one crops of wheat and different pulses are taken every year. In the season the ample amount of dry fodder is produced which is stored by the farmers for dry fodder requirement of their livestock.
4. The excess available dry fodder is supplied to other districts as per the demands.
5. The grasses available in the forest are grazed by the animals and are need not to be stored.
6. Some of the advance dairy farmers have their own production plants of concentrate feed.
7. Many farmers prepare their own concentrate by mixing different grains, oil cake, rice bran, chunni etc.

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. Scientific grazing systems should be adopted on grazing lands and alpine grasslands.

3.A Existing health services:

1. Routine Vaccination.
2. Deworming schedule at every 3 month.

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. Lack of proper space, poor hygiene.
2. Grazing, watering ad-lib
3. Machine shearing

4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district: Can promote Goat farming by forming clusters. So that marketing doesn't remain a problem

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

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

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

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

C5. Livestock: Pig

1.A Existing breeds available: Large White Yorkshire, Landrace, Desi, Cross

1.B Specific breeds to be introduced: Large White Yorkshire

2.A Existing feeds being used:

1.As per 2012 census only 1721 pigs are available in the district which is a negligible number.
2.They are mostly fed with hotel and home waste plus in the season they are fed with sugarcane maili from Kolhu's.
3.There is no organized pig farming in the district.

2.B Specific feeds to be introduced / advised:

Nutritious feed

3.A Existing health services:

1. Routine Vaccination.
2. Deworming schedule at every 3 month.

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. F.M.D Control Programme

4.A Existing management practices:

1. No proper housing is being adopted in the district.
2. Drainage management practices are very poor due to which proper hygiene are completely lacking.
3. Animals are mostly dependent on Hotel and Home waste.
4. In the season they are fed with sugarcane maili from Kolhu's.
5. Because there is no organised pig farming in the district and only marginal and poor farmers rear the pigs in small numbers, so no balanced ration or concentrates given.
6. There is no slaughter house available in the district. Animals are slaughtered by the retailers themselves.
7. Organised farming should be encouraged, for this easy and subsidy based loans for marginal to large scale farming should be given by the Govt.

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

1. No proper housing is being adopted in the district.
2. Drainage management practices are very poor due to which proper hygiene are completely lacking.
3. Animals are mostly dependent on Hotel and Home waste.
4. In the season they are fed with sugarcane maili from Kolhu's.
5. Because there is no organised pig farming in the district and only marginal and poor farmers rear the pigs in small numbers, so no balanced ration or concentrates given.
6. There is no slaughter house available in the district. Animals are slaughtered by the retailers themselves.
7. Organised farming should be encouraged, for this easy and subsidy based loans for marginal to large scale farming should be given by the Govt.

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

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

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

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

C5. Livestock: Poultry

1.A Existing breeds available: White Leghorn, Kuroiler, Ven Cobb, V.B.-300, Chabro,

1.B Specific breeds to be introduced: -

2.A Existing feeds being used:

1. Organized Poultry farmers are either producing their own feed or purchasing it from their regular suppliers on whom they trust.
2. US Nagar being an agriculture rich district there is no scarcity of feed in the district

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

3.A Existing health services:

1. Routine Vaccination.

2. Deworming schedule at every 45 days.

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. Proper commercial farming is being done.
2. There is no slaughter house available in the district. Animals are slaughtered by the retailers themselves.
3. Awareness campaigns in regards of bird flu should be run regularly to avoid any panic if and when bird flu occurs in any area within/ out of state.

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

More farmers can be encouraged to open commercial poultry farms in the 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: Fisheries

1.A Existing breeds available: Grass Carp, Common Carp, Rohu, Catla, Mrigal, Silver

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

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

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

3.A Existing health services: Nil

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

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

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

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

5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing: Poorly managed ponds, over stocking, poor feed management, absence of disease diagnostic lab

Vet. Health services

Information about Manpower and Infrastructure in Animal Husbandry

Resouces		**Manpower**							**Infrastructure**		
		No.	V. O.	LE O	Pharmacist	Lab. Tech.	Livestock Assistant	Para vets	Buildings	Equipments	Others
Vety. Hospita	Existin	22	25	72	23	-	40	-	22	X-Ray-2,Ultraso	-

ls	g									und-2P.M.Set-23A.I.Kit-46	
	Proposed	10	10	-	10	-	40	-	10	A.I.Kit-20 P.M.Set-23	-
Mobile Vety. Unit	Existing	1	1	-	1	-	2	-	-	-	-
	Proposed	7	7	-	7	-	14	-	-	-	
Vety. Dispen.	Existing	72	-	72	-	-	-	-	31	A.I.Kit-72	-
	Proposed	7	-	4	-	-	-	-	45	A.I.Kit-4	-
AI centres	Existing	269	23	72	22	-	-	174		A.I.Kit-294	-
	Proposed	14	10	4	10	-	-	-	-	A.I.Kit-24	-
Disease Diag. Labs	Existing	1	1J.D., 2V.O.	-	-	4	3	-	1	Elisa Reader-1 Auto Analyser-1	-
	Proposed	-	-	-	-	-	-	-	-	-	
Polyclinic	Existing	-	-	-	-	-	-	-	-	-	-
	Proposed	8	24	-	24	-	48	-	8	As per need	-
Ambu. Clinics	Existing	-	-	-	-	-	-	-	-	-	-
	Proposed	8	8	-	8	-	16	-	8	-	-

Availability of Medicines/ Vaccines

Specific health services to be required/ advised for doubling income in specific agro-ecological zone:

1. Mobile Veterinary Hospital and poly clinics with sufficient staff, all types of medicines and specific instruments for treatment and surgery should be available at every time.
2. To attend the emergencies like accidents, dystocia, fractures in animals and other types of emergencies an ambulance equipped with all necessary medicines and critical care instruments will be required.

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

1. To eradicate F.M.D, In F.M.D. Control Program levy should be waived off as it is being done in U.P. in F. M.D. Control Program

Problems of Animal Husbandry

Specific problems due to which income is not increasing	Poor accessibility	No
	Water scarcity	No
	Natural disasters	Floods and Fires
	Wild life conflicts	No
	Marketing of animals	Yes (No Livestock fares)
	Marketing of products	Yes
	Budget	Yes
	Manpower shortage	Yes
	Capacity building	Yes
	Equipment & Implements (old/ shortage, etc.)	Yes
	Mobility	Yes
	Risk cover (Insurance)	Pashudhan Beema Yojna is running in which the owners get insured their animals at half the cost of premium.
	Relook to policies	There is no any scheme by the Govt. to promote the big dairies, many farmers approach seeking loans for opening dairies of 100 or more cattle/ buffaloes. To encourage the establishment of big dairies farmers should be provided with easy loans.

D. Integrating Farming system

1.A Existing farming system: Crop+dairy

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

Crop+Horticultre+Dairy+Mushroom+Fishery+ Agroforestry

E. Reducing post harvest losses and value addition

1.A Existing grading facilities: Mannual operations are common

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

Automated facilities should be set up for sizing, sorting and grading.

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,

Colour grader for particular commodity.

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

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

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

For grains:

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

For horticultural crops:

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

Maintaining cold chain from farm to folk (depending upon the commodity)

3.A Existing packing facilities: Limited Packhouses

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

For grains:

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

For horticultural crops:

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

4.A Existing storage facilities: Cold storage

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

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

For grain:

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

For Horticultural crop:

1. Air/water pre-cooling chambers on farm level for removal of field heat

2. Evaporative cool chamber for chilling sensitive crops
3. Modified or control atmospheric storage structures
4. Cold storage structures
5. Zero energy cool chamber for hilly areas
6. Solar power cooling chambers
7. Jaggery storage bin

F. Waste land development and waste water

1.A Existing practices of soil water conservation: Plantation on eroded/waste lands, and check dams for gully control.

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

2.A Existing plantation: Plantation of suitable trees like Eucalyptus /brushes in waterlogged and eroded areas.

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

1. Rejuvenation/repair of faulty/abandoned terraces.
2. Stabilization of eroded land using biological/engineering measures.
3. All agricultural operations should be done on contours i.e. across the existing land slope.
4. 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.
5. 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.
6. Diversion of runoff through ditches from upper slopes to safer places.
7. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
8. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
9. Contour trenching (staggered/continuous).
10. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
11. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
12. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
13. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

3.A Existing fodder production: Sorghum, napier grass, oat , maize,

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

Guinea grass (*Panicum maximum*),
Guinea grass (*Panicum maximum*),
Setaria grass (*Setaria anceps*)
Spear grass (*Hetropogon contortus*)
Bermuda grass (*Cynodon dactylon*,
Rhode grass (*Chloris gayana*)
Marvel grass (*Dicanthium annulatum*)
Guinea grass (Panicum maximum),

1. Seed rate(Kg/ha)- 3-4.

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

Setaria grass (*Setaria anceps*)

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

Spear grass (*Hetropogon contortus*)

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

Rhode grass (*Chloris gayana*)

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

Marvel grass (*Dicanthium annulatum*)

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

Waste Land Development

1. Rejuvenation/repair of faulty/abandoned terraces;
2. Stabilization of eroded land using biological/engineering measures;
3. Plantation of suitable trees/brushes in waterlogged and eroded areas;
4. All agricultural operations should be done on contours i.e. across the existing land slope.
5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.

7. Diversion of runoff through ditches from upper slopes to safer places.
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
10. Contour trenching (staggered/continuous).

Waste Water Management

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

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

4.A Type of waste water:

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

4.BExisting treatment facilities: NA

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

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

2.Industrial wastewater should not be used for irrigation directly; and must be treated by the concerned industries at their factory level as per norms to make it suitable for irrigation or other uses.

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

4.Operationalization of ETPs.

G. Reduced cultivation cost

1.A Existing inputs being given:

Rice-wheat/Rice-pea-wheat/Rice-Sugarcane-Ratoon-wheat/Rice-Sugarcane-Lahi

1. Annexure–II is enclosed for N, P and K. however for every tonne of FYM application; reduce 5 kg N, 2.5 kg P_2O_5 and 5 kg K_2O. When azotobacter is used in nonleguminous crops reduce 20 kg N/ha and for P solubilizer reduce dose of P_2O5 by 20 kg/ha.
2. In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn)/ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop.
3. In Cu deficient soils, application of 4-5 kg $CuSO_4$ /ha or foliar spray of 0.25% $CuSO_4$ + 0.125% lime in standing crop.
4. In Mn deficient soils, application of 30 kg $MnSO_4$/ha, if Mn deficiency exist in field or two foliar spray of 0.5% $MnSO_4$ + 0.25% lime before first irrigation and one month after.
5. In deficient soils, application of 215 kg gypsum/ha, if S deficiency exist in field.
6. Foliar spray of 1% $FeSO_4$ in rice nursery and sugarcane ratoon.

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

If required then deficit fertilizers and micronutrients may be provided

2.A Existing mechanization:

Sugarcane

1. Seedbed preparation using disc harrow and ridge making by tractor drawn ridger.
2. Manual sett cutting / or by tractor PTO operator sett cutter.
3. Manual planting.

4. Tractor operated cultivator and manual weeding for Interculture.
5. Manually operated sprayer for plant protection.
6. Manual harvesting.

Wheat

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

Paddy

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

Rapeseed - Mustard

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

Soybean

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

Pea

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

Management of Orchards

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

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

Sugarcane

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

Wheat

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

Paddy

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

Rapeseed - Mustard

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

Soybean

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

Pea

1. Seedbed preparation by rotary plough.
2. Sowing by tractor drawn inclined plate planter.
3. Plant protection using ULV sprayer.
4. Chemical weed control.

5. Manual picking for vegetable pea.
6. Harvesting by self-propelled combine harvester for seed production.

Management of Orchards

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

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

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

Lower Hills

1. Common property resource management, Pasture
2. Fertilizer application should be based on soil test value at right time, right place and right method.
3. Basal application (50%N+100% P&K) at the time of sowing and 02 foliar application of N, secondary and micronutrients on standing crop.
4. Apply well decomposed organic manures and composts such as vermicompost, biofertilizer, green manure and crop residue incorporation to supplement costly fertilizers to reduce cost up to 25-30%.
5. Inclusion of pulses in crop rotation.
6. Need based and recommended concentration of plant protection chemicals using correct method of application.
7. Enhanced use of bio-agents to control disease and pests instead of costly chemicals.
8. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons.
9. Use optimum and recommended seed rate at optimum spacing and depth.
10. Use good quality water and avoid excessive irrigation.
11. Use of delivery pipe for irrigation to check seepage losses.
12. Sprinkler and drip methods for irrigation should be encouraged to save water.
13. Promote reduced tillage and avoid use of heavy machines.
14. Incorporate crop residue or green manure 15 days prior to sowing along with slight dose of N

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

1. No proper and timely supply of water in canal and govt. owned tube well systems under irrigated condition.
2. Faulty roistering system of water.
3. Unavailability of inadequate farm labourers in agricultural operations during sowing to harvesting of crops.
4. Non availability of proper farm machinery, tools and implements for small and marginal farmers as per their holding size.
5. Gentle to moderate slopes in farm lands causing surface runoff of soil and nutrients and depletion of soil fertility.
6. Timely non availability of farm inputs viz., seeds of HYV, N:P:K fertilizers, urea, DAP , MOP , micronutrient containing fertilizers, FYM and vermi compost, pesticides and effective insecticides.
7. Application of high rate of fertilizer without knowing the nutrient status of their soil.
8. Non/inadequate application of FYM/Vermi compost.
9. Negligence among farmers for testing of their soils for soil health and application of nutrients

as per crop needs.

10. Non availability of mobile soil testing lab van for spot testing of their soils.
11. No efficient irrigation and fertigation system in orchards.
12. Lack of storage facilities (cold rooms and houses) and processing units for their produce.
13. Involvement of middle man in crop trading system.
14. Lack of interest among govt. machinery for dissemination of technologies, input and subsidies to small and marginal farmers.

H. off-farm income

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

Dairying, Spices, Processing

Aman (Gaon Bajpur), Jaimatadi (NN Topa), Khushi (NN Topa), Jaima Kali (NN Topa), Jyoti (Gumsami), Ambedkar (Saijana), Ashish (Saijana), Bififatima (Saijana), Gurunanak (Najimabad), Nanak (Najimabad), Jailaxmi (Devkali), Ekta SHG (Devkali), Pooja (Haria), Viklang (Bichva), Jagriti (Sunkhari Khlan), Uttarakhand (Khragpur Devipur), Jai Bharat (Lalpur), Savera (Khnapur), Savitri (Langrabhoj), Jaisaibaba (Khanpur), Parvati (Chadeli), Kalika (Khetalsanda mustazer), Sagar (Bankatia), Radha (Mo. Purbhuria),

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

1. Poultry, Nursery raising, Dal making, Flour making, Mushroom Production, Vermi composting, Bee keeping
2. Promotion of buy back system from SHG of graded produce or any other kind of produce
3. SHG already formed and need to be encouraged:
4. Aman (Gaon Bajpur), Jaimatadi (NN Topa), Khushi (NN Topa), Jaima Kali (NN Topa), Jyoti (Gumsami), Ambedkar (Saijana), Ashish (Saijana), Bififatima(Saijana), Gurunanak (Najimabad), Nanak(Najimabad), Jailaxmi(Devkali), Ekta(Devkali), Pooja (Haria), Viklang(Bichva), Jagriti(Sunkhari Khlan), Uttarakhand (Khragpur Devipur), Jai Bharat(Lalpur), Savera(Khnapur), Savitri(Langrabhoj), Jaisaibaba(Khanpur), Parvati(Chadeli), Kalika(Khetalsanda mustazer), Sagar(Bankatia), Radha(Mo. Purbhuria)
5. 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.
6. 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.
7. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
8. 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.
9. 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.
10. Loan procedure should be made more flexible with less interest rate.
11. 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.
12. 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.
13. 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.

14. Enterprises need to be identified depending upon local resources- human and material.
15. Market linkages need to be developed so that people can sell their produce gainfully.
16. To encourage SHG's better planning, training and sustained efforts on long term basis are required.
17. 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:

Quilt making, Dairying, processing

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

1. Poultry, Nursery raising, Dal making, Flour making, Mushroom Production, Vermi composting, Bee keeping.
2. Jaspur, Kashipur, Bazpur, Gadarpur, Rudrapur, Sitarganj and Khatima
3. Entrepreneurship with ornamental fishes.
4. Ornamental fish culture is still dormant in Uttarakhand state where as such culture practice has got tremendous scope.
5. Through the developed technologies and extension services of ICAR-DCFR, ornamental farming in the state can be promoted thereby creating a scope of farmer's income.
6. Income-Rs. 100-125/- per square feet.

3.A Existing skill development facilities:

1. Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK.
2. NGOs
3. Office of Development commissioner (handicrafts).
4. Handicraft marketing, service and extension centre.

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

1. More training centres should be opened in all seven blocks.
2. Training centre, processing and packaging units as per the locally available resources.e resources

4.A Existing women skilling facilities:

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

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

agricultural income:

1. Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK,
2. NGOs
3. Training centre, processing and packaging units as per the locally available resources

5.A Existing youth skilling facilities:

1. R-SETI,
2. Industry deptt
3. KVK and other agencies

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

1. Training centres processing, packaging units and market outlet as per the locally available resources.
2. More focused programmes are to be initiated keeping in view the demand of youths and other stake holders.

Beekeeping

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

A good beekeeping management practices include:

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

Selection of a good site for an Apiary

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

8. Avoid spraying when the plants are on flower or during peak foraging periods, if bees placed nearby the commercial farm fields.

Knowledge of bee flora

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

Seasonal bee management

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

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

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

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

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

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

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

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

1. Provide sufficient shade, under trees or artificial structure.
2. Reduce heat by sprinkling water twice a day on gunny bag or rice straw put on the hives.
3. Increase ventilation by introducing a splinter between brood and super chamber.
4. Provide sugar syrup, pollen supplement, substitute and water.
5. Enough honey may be left in the hive to keep colony alive.
6. Unite weak colony with strong colony.

ii. Rainy season and monsoon management

1. Avoid dampness in apiary site and provide proper drainage.
2. In rains when bees are confined to the hive, provide sugar syrup feeding.
3. Remove empty combs and store in air tight container.
4. Use dummy division board to confine bees to small area.

5. Unite weak colonies and provide sugar syrup, pollen supplement and substitute.
6. Avoid bloodlessness in colonies, if pollen stores and fresh pollen is not available, feed the colonies either pollen substitute or pollen supplement.
7. If colonies are week and have poor food stores, provide candy or dry sugar instead of sugar syrup
8. Keep in check the attack of enemies like wax moth, ants, mites and wasps.
9. The hive is kept on stands sloping towards entrance in order to drain out water.

iii. Winter management: It includes the following practices.

1. Maintain strong and disease free colonies and provide new queen to the hives.
2. Provide winter packing in cooler areas or hilly regions.
3. Remove empty combs and store in air tight container.
4. Use dummy division board to confine bees to small area.
5. Unite weak colonies and provide sugar syrup, pollen supplement and substitute.

iv. Nutrition management or artificial feeding during dearth period

Paying awareness to honey bee diet is just one of the more important aspects of successful beekeeping. Honey bee collects a number of substances to ensure its survival viz., nectar, pollen, water, propolis etc. However, during the scarcity of above essential diet components bees may not able to survive. Shifting the hives to alternate floral sources will help them stay healthy.

Sugar Supplement syrup foods for Honey Bees: About 8-11 lts of 2:1 sugar syrup (2 parts sugar to 1 part water) is the usual feeding per colony. In spring feeding, the syrup mix may be reduced 1:1 (1 part sugar to 1 part water). 3:1 bee syrup mix is for winter. At this concentration there is little water to evaporate. It is also less likely to freeze. Use boiling water in making the syrup. Allow to cool before serving.

Protein Supplement Foods for Honey Bees: The adult bees of a colony obtain their dietary protein from the pollen the workers collect and bring back to the hive or from nitrogenous food-stuffs provided by the beekeeper. There is a multitude of different artificial diet available as substitute or supplement for pollen but the following provides a general guide: Pollen: 5% ,Sugar: 20–50%, Yeast (torula): 20–50%, Flour (soya): 20–50% and Vitamin supplement: 1–3%. Increasing the amount of pollen and sugar will make the supplement more attractive to the bees which contain the quality and quantity of proteins and amino acids, lipids, vitamins, and minerals required for growth and development of individuals and reproduction of the colony. Pollen patties or protein cakes may well be an attractive proposition.

Supplying bees with water: A supply of water must be available to bees at all times. A lack of it adversely affects the nutrition, physiology, brood rearing, and normal behavior.

Swarming : Causes and management

Swarming is a natural phenomenon that ensures the survival of the species through a colony reproducing itself. Swarming normally occurs in spring, allowing the colony to establish itself over the following summer and autumn before winter brings a serious reduction in flowering species from which food can be obtained.

Cause of swarm:

1. Reproductive swarm
2. Overcrowding - too many bees, food stores and no cell space for the queen to lay eggs in.
3. March-April is swarming season and healthy colonies develop strong swarm desire.
4. Inclement weather - crowded bees confined by cold, wet weather will build queen cells and swarm out on the first sunny, warm day. All colonies in similar condition will swarm as soon as weather becomes favorable.
5. Large amount of drone brood in early spring is a precursor to strong swarm impulse.

Management:

1. Allowing this form of reproduction often results in the loss of the more vigorous division.

The remaining colony may be so exhausted and set back due to the brood cycle disruption that it is unproductive for the season.

2. Beekeepers control swarming prior to the natural swarm time.
3. Place two or three drawn out combs in an empty super and place on top of the parent colony, separated by a queen excluder.
4. Examine all the frames from the brood nest of the bottom colony for queen cells.
5. If the old (caged) queen is worth saving, a small nucleus consisting of two combs of brood and adhering bees can be made for her accommodation.
6. Capture any subsequent swarms with the help of swarming bag and return to the old hive by simply shaking the bees in front of the hive entrance.
7. In case parent colony, from where swarm has been issued is not known, the captured swarm should be placed in the new empty hives.
8. Only one young queen will survive and the bees will no longer attempt to swarm. If they do swarm again, repeat this step.
9. Provision of sufficient nectar storage space.
10. Colonies should receive maximum sunlight early in the season
11. Requeening a colony can help minimize swarming tendencies. Young queens produce more pheromones, thus inhibiting swarm preparation by the workers.
12. Clipping a queen's wing is a good way to minimize swarming tendencies in colonies
13. Removing queen cells from colonies before they swarm, a technique called "cutting queen cells," is useful as a swarm behavior repressor.

Disease and enemies management

Brood Diseases: They are generally easier to recognize as a group than adult diseases but are more difficult to control.

Disease	**Causal Organism**	**Symptoms**	**Management**
Bacterial Diseases			
American Foulbrood (AFB)	Spore forming bacterium, *Paenibacillus larvae* in temperate and sub-tropical regions.	1. The dead pre-pupae lie straight with head towards the opening of the cell (Sealed Cell) 2. Cell capping of infected brood becomes darker in colour, sunken and perforated. 3. A tooth pick inserted into the body of prepupa and drawn out shows ropiness. 4. The putrefying brood turns brown and has fish glue odor. 5. Dead broods dry up into scales, adhere to the cell bottom.	1. Sterilize the combs and othe hive parts with Formalin @ 15(ml/ l or ethylene oxide @ 1 g/ water, for 48 h at 43°C i fumigation chambers. 2. Terramycine capsule @ 250 mg per 3 liter sugar syrup or 500 mg per 5 liter sugar syrup should b given as half lt sol / box an should be given at weekl interval for 1 month . 3. Breeding disease resistant strain of bees is one of the bes measures for the disease management. 4. Provide sufficient sugar syrup t the diseased bees. 5. Fumigate all the equipments wit formalin in a closed place. 6. Streptomycin , 0.2 gm per half l sugar syrup should be give twice a week to diseased bees.
European Foulbrood (EFB)	Non-spore-forming bacterium, *Melissococcus plutonius*	1. 3-5 days old are more susceptible to infection than older larvae 2. Bacteria, on swallowing with food, multiply in mid gut and are discharged with feces. 3. Diseased larvae become flaccid, turn brown and give	

		foul-sour smell.	
Fungal Diseases			
Chalk Brood	Spore-forming fungus, *Ascosphaera apis.*	1. The infected larvae (3-4 days old) are quickly covered by the white cotton-like mycelium which eventually fills the entire cell. 2. The white/grey mass soon hardensThe larva in the cell will resemble a lump of chalk, hence, the name of the disease chalkbrood	1. Removal of mummies by bees results in natural control. 2. Collect and burn the mummified larvae. 3. Replace old, blackened brood combs as these may harbor chalk brood spores. 4. If a colony lacks sufficient food stores, supplement with good-quality feed. 5. Replace queens with stock bred for hygienic behavior and/or disease resistance. 6. Put bee boxes at proper ventilated and clean place, these should not be placed at places with higher humidity. 7. Thymol (0.7 % sol) can be used to prevent the disease. 8. 5 % sol of Formalin (40 %) can be used for disinfection of frames and equipments.
Stone Brood	*Aspergillus flavus*	1. It only infects larvae that are three to four days old. 2. The larval body becomes harden and mummify.	
Viral Disease			
Sac Brood Virus (SBV) and Thai Sac Brood Virus (TSBV)	Disease symptoms for diagnosis of both the diseases are similar. SBV is infective on *Apis cerana,* while TSBV infects *Apis mellifera.*	1. Brood death in prepupal but in unsealed stage. 2. Dead larvae straightening out and lying on their backs, with tip of the head capsule turned upwards. 3. Dead pre-pupae that turn into sac like structure. 4. Affected larvae becoming yellow or grayish, later darkening to blackish; the change in colour first starts from mouth-parts and head. 5. Dead larvae and pre pupae drying up in brood cells forming loose scales.	1. For viral pathogens, there is no chemical control. 2. Affected colonies should be isolated beyond their flight range. 3. Check robbing, drifting and swarming. 4. Undertake selective breeding for natural resistance 5. 250 mg terramycin / 5 lt of sugar syrup should be given to diseased honey bees at weekly interval.

Adult diseases:

Disease	Causal Organism	Symptoms	Management
Protozoan Disease			
Nosema Disease	*Nosema apis* Zander	1. Bees become dysenteric with distended abdomens. 2. Young infected bees take up nursing duties as usual but soon stop rearing brood because food glands are affected and they shift to foraging. 3. Affected bees have disjointed wings and are found crawling in front of the hive. 4. Large number of spores can be observed in the mid gut contents of infected bees under microscope. 5. The disease is particularly severe during spring and winter and there is depletion of strength	1. Provide upward ventilation to reduce humidity. 2. Feed bees with fumagillin @ 10 mg/ lt water in concentrated syrup. It inhibits DNA replication of the pathogen. And Gramicidin may also be used for its treatment. 3. Disinfect the empty hives with ethylene oxide or acetic acid fumigation @ 120 ml / hive. 4. Wash hands with soap before inspecting the box and disinfect all the beekeeping equipments with Formalin to prevent the infection. 5. This disease is mainly due to dirty water of rainy season. Provide clean water in a pot and put it over a stand. Make one hole in pot and fix cotton plug along with wooden stick in the hole so to distrupt the rapid flow of water and bees can easily take the water.
Amoeba Disease:	*Malpighamoeba mellifecae*		1. Scarp off the bottom board and disinfect it with 2% carbolic acid or acetic Acid. 2. Spores can be destroyed by temperature treatment at 49°C for 24hr. 3. Feed bees with Fumagillin @10 mg per liter of sugar syrup.
Mite diseases			
Varroasis	An Ectoparsitic mite,*Varroa destructor*	1. Parasitize immature drone and worker bees within their cells. 2. Colonies severely infested appear restless and weakened. 3. Only a few bees remain along with the queen 4. Mites tear the integuments of the adult bees and suck the haemolymph. 5. Reduced adult bee population in the infested colonies queen supersedure,	1. Screened bottom board with sticky board. 2. Application of formic acid (as vapor or pads). 3. Thymol powder @ 0.25g/ hive dusted in the passages of frames. 4. Thirty two grams of crystal oxalic acid (dehydrate) is thinned in one liter of sugar water (1:1). 5. Lactic acid (8 ml of 15 % acid per comb) is clearly better tolerated by bees and does not cause problems in warmer climatic zones.
Brood mite	An ectoparasitic mite, *Tropilaelaps clareae*		

		spotty broods are common. 6. Affected young larvae turn in to light brown colour 7. The brood fails to develop in to adults or malformed adults are formed.	
Acarine diseases	Treacheal mite, *Acarapis woodi,* An endoparsitic mite	1. Mites pierce the wall of the tracheae and suck the haemolymph. 2. Infested bees have shorter longevity and reduced flight ability. 3. Irregular dark stains initially develop on the infested tracheae which ultimately blacken. 4. In severe cases, "K winged" shape can be is seen, where the two wings on one side of the thorax become unattached, such bees unable to fly.	1. Use of folbex strips (a mixture of potassium nitrate and chlorobenzilate) as a fumigant at the rate of 1-2 strips per colony. 2. Use of menthol crystals @ 50 g per hive or menthol strips. 3. Formic acid @ 5ml. per hive in glass vial.

Enemies of honey bees:

Enemy	**Important Features**	**Management**
Wax Moth		
Greater wax moth (*Galleria mellonella*)	Observed throughout the year but its occurrence is severe during July to Oct and Nov to Dec. Empty combs, rendered wax, comb foundation and bee collected pollen, if not properly stored and left unattended, almost always suffer considerable damage from wax-moth infestation	1. The entrance should be reduced to avoi the entry of adult moths. 2. A water soluble concentrate of spores o *Bacillus thuringiensis* Serotype provides an excellent protection o stored combs without affecting th organoleptic properties of the honey. 3. Stack the empty combs in supers (up t 8-9 super) leaving some empty space i lower most super. Make it airtight b using mixture of mud and dung. 4. Avoid fumigation with naphthalene ethylene die-bromide and PDB

Lesser wax moth (*Achroia grisella*)	The lesser wax moth is generally smaller than the greater wax moth, except when the latter is dwarfed owing to poor diet during its larval stage.	5. Fumigate the empty combs with sulphur powder @ 230g/m3 and after that seal them properly.
Wasps &Hornets (*Vespa orientalis, V.cincta, V. magnifera* etc)	They appear after spring and continue during monsoon season and cause maximum damage to colonies during July-September in Uttarakhand.	1. Keep the colonies strong and ensure proper food in the colonies. 2. Reduce the hive entrance or use queen gate or protective screens. 3. Destroy the wasp combs and use wasp traps with honey/ sugar/ Gur.
Ants	Ants may destroy whole colony within few hrs by robbing honey, pollen, predating on eggs, brood & adults. Attack is usually observed in rainy season.	1. Keep apiary clean by removing old and rotton woods, stones, weeds etc. 2. Place the hive stand post on the water filled bowl or earthen pots. And clean the bowl regularly.

Other enemies :

1. Wax beetle, *Platybolium* sp. (Tenebrionid beetle) and small hive beelte, *Aethina tumida*.
2. Birds: King crow, *Dicrurus* sp; Bee eater, *Merops* sp.
3. Lizards, termites, toads and frogs.
4. Others like death's head hawk moth, *Acherontia styx;* robber flies; dragon flies, praying manids. Some mammals: bears, badgers and off course man

Migration management

Migration of bee colonies from one place to another where sufficient bee flora is available for the survival of bees and better honey production is an essential task in beekeeping. For example plains to forests, hills to farms and orchards in the adjacent plains in order to utilize the local bee flora and improve bee forage availability to bee colonies. Migratory beekeeping in the *Tarai* region of Uttarakhand could enhance honey production and colony multiplication. The suitable areas identified for migration in Tarai region are as follows:

Sl. No.	Location	Period	Honey crop
1.	Pantnagar	April, May and June	Papaya, Maize and Sunflower
2.	Haldi, N- block Pantnagar	December and January	Berseem and Mustard
3.	Pilibhit	November, December and January	Mustard
4.	Melaghat, Khatima	January – February	Eucalyptus
5.	Pattharchatta, Pantnagar and Ramnagar	March	Litchi
6.	Sitarganj	May- June	Jamun
7.	Moradabad	July	Maize
8.	Sambhal	August –October	Bajra

Preparing colonies for migration:

1. Provide proper ventilation by using entrance screens and even top screen in place of inner cover during hot weather
2. Nail all the movable parts of the hive properly or tie with migratory belts
3. Before packing the colony, remove frames of honey which are more than half sealed since honey combs cannot bear much jolts. However, the colonies should have sufficient food during the journey
4. Close the entrance in the evening when all bees have returned.
5. Colonies should be moved during night .For deciding migrating site, the beekeeper should have a detailed knowledge of honey flow sources and density of bee colonies in the surrounding area. Avoid areas which already have lot of bee colonies.
6. Migration can involve shifting of one truck load of bees up to 200 Km or even more. If journey cannot be undertaken in one night during hot periods then the truck should be parked in the shade during day, entrances opened and provision of water should be made. Journey can be started in the evening after closing hive entrance.
7. On arrival at the destination, colonies are unloaded and placed at the desired site. Then the entrance screens are removed

Other Management Practices for successful beekeeping

Practice judicious methods

1. Monitor colony strength and unite weak colonies.
2. Use logical services for ideal colony assessment.
3. Ensure frames of brood for planned strength to coincide with honey flow season.
4. Do not combine weak collapsing colonies with healthy colonies

Managing Stock:

1. Maintain genetic quality to meet out all objectives:
2. Maintain stocks that are prolific disease and pest resistant.
3. Encourage high drone densities to provide well-mated queens and genetically diverse colonies.
4. Discourage stocks that are excessively defensive.
5. Select stock by propagating colonies that flourish when other colonies exhibit symptoms of stress.

Hive Maintenance:

1. Keep your equipment in good condition.
2. Check apiary for hive condition.
3. Inspect for rotten, loose or broken boards and frames.
4. Reconstruct, tighten or replace frame parts.
5. Paint supers with light colors to beat summer heat.
6. Take advantage of the bee flora/honey season to do maintenance and prepare for the new season.

Hygiene:

1. Practice good hygiene with hands, gloves, and other equipment to reduce transmission of pathogens between colonies.
2. Replace comb with new foundation to minimize residual chemicals in old wax.
3. Develop a comb replacement schedule.

Hive Security: Hive security can minimize economic losses.

1. Be aware that the probability of theft has increased with the increased value of pollinating crops.
2. Secure a signed contract when entering into a honey flow season.
3. Practice discretion when showing where your hives are located.

Final steps

1. Inspection of surroundings to place the apiaries in appropriate areas.

2. Observation of quarantine measures for all new introductions that have to be made in the apiary.
3. Regular verification of the health status of the colonies during the year.
4. Frequent renewal of honeycombs (every 2 yrs) and regular replacement of queens (every 1-2 yrs).
5. Selection of queens who show resistance to diseases, hygienic behaviour, low tendency to swarm and high productivity.
6. Ensuring that hive capacity is sufficient to discourage swarming.
7. Preventing acts of looting (not having in apiary highly diseased, weakened colonies).
8. Feeding colonies having no food stocks or in case of unfavorable weather conditions.
9. Providing adequate water supplies particularly in hot periods.
10. Appropriate use of the bee smoker (respecting the bees welfare and avoiding using toxic material that can contaminate the honey).
11. Elimination of the use of toxic substances or paints for hives (e.g. disinfectants, chemical treatments for wood, etc.).
12. Exclusive application of drugs registered for use in bees respecting instructions, maintenance of beekeeping equipments in good order and cleaning and, when necessary, renewing the materials.

Mushroom cultivation

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

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

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

Steps of cultivation process

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

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

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

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

Day 0: At the stage, there should be around 75% humidity content in the wheat straw, to which wheat bran, calcium ammonium nitrate, urea, murate of potash, and super phosphate are mixed thoroughly and evenly. The material is then piled 1.5m thick x1.25m high with the help of wooden

rectangular block. The blocks are removed. Once the entire material has been stacked up or piled up. Water is sprayed twice or thrice to keep the substrate moist. Temperature should be in the range of 70-750C.

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

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

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

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

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

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

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

8*th 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. **1.A Existing policies related with agriculture and animal husbandry:** Ban on trash burning, PMFBY.

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

1. Implementation on ban of trash burning,
2. Creation of grading and drying facilities at village level ,
3. Introduction of contract farming of high value crops.

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, NGOs

3.A Existing Incentives:-

1. **3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district:**
   1. Incentives to the farmers adopting new and scientific technologies.
   2. Incentives to innovators.

4.A Existing risk coverage facilities: Crop and Animal Insurance Schemes

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

1. Inclusion of fire incidence beyond human control under PMFBY.
2. Liberal and farmers friendly procedure for claim settlement under PMFBY.

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

1.A Existing marketing facilities: Mandis exist

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

1. Setting up of primary processing facilities at village level.
2. Cool chain and grading facilities at nyay panchayat level.

2.A Existing grading facilities: Most manual at farmers level

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

For grains:

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

For horticultural crops:

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

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

For grains:

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

For horticultural crops:

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

Maintaining cold chain from farm to folk (depending upon the commodity)

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

For grains:

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

For horticultural crops:

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

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

1. Local marketing.
2. Non issuance of receipt to farmers.
3. Dominance of middle mans and exploitation of farmers in mandies.

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:

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

3.A: Existing monitoring system: Physical

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

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

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 evaluation

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 for increasing productivity

1. Promotion of high yielding varieties of wheat (VL Gehun 953, DBW-16, DBW-17, PBW-373, PBW-502, PBW-527, PBW-550, HD-2687, HD-2967, UP-2526, UP-2554, UP-2565, UP-2784,

UP-2785, WH-542, UP-2684, UP 2628, UP 2748, UP 2584, RAJ-3765, RAJ-3077.

2. Promotion of high yielding varieties of Paddy (Pant Sankar Dhan-3, Pant Dhan-12, Pant Dhan-23, Pant Dhan-26, Narendra Sankar Dhan -2, Pusa Sankar Dhan -10, Pant Sugandh Dhan-25, Pant Sugandh Dhan-26, Pant Sugandh Dhan-27, Pusa Sugandh -5, VL Dhan – 85, VL Dhan-65, PR-113, Pant Basmati-1, Pant Basmati-2, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355 plus).
3. Promotion of improved varieties of speciality corn (CMVL Sweet Corn 1 and CMVL Baby Corn 2)
4. Promotion of high yielding varieties of Sugarcane
   COP99214, CO-0238 COP 5224, COP3220 and CO5011 COLK97184
   Early Varieties : Co Pant 84211, Co Pant 94211, Co Pant 03220, CoS 88230, CoJ 85, CoS 96268, Co 238
   Mid-late varieties : Co Pant 84212, Co Pant 90223, Co Pant 96219, Co Pant 97222, Co Pant 99214, Co Pant 05224
5. Promotion of high yielding varieties of Urd (PU-31, PU-35, PU-40, Shekhar-2) and Moong (Pant Moong-4, Pant Moong-5, Pant Moong-7, Pant Moong-8, PDM-11,Samrat, Narendra Moong-1).
6. Promotion of high yielding varieties of Arhar (Pant Arhar-3, Pant Arhar-291, UPAS-120, Pusa-992, Bahar, Amar, Narendra Arhar-1).
7. Promotion of high yielding varieties of Chickpea (Pant Kabli Chana-1, GNG-1969, Aman, GNG-1958, Aadhar, Pusa-547, Pusa-256, Pusa-1053, JGK-1).
8. Promotion of high yielding varieties of Lentil (PL-4, PL-7, PL-8, DPL-15, DPL-62).
9. Promotion of high yielding varieties of Toria/Sarson (PT-30, PT-303, 507, Uttara, PPS-1, Pant Sweta, Type-9, Bhawani, VL Toria-3, Urvashi, Rohini, Vardan, Vasanti, PR-20).
10. Promotion of high yielding varieties of Litchi (Rose scented, calcuttia, gandaki Sampada, Gandaki lalima, Gandaki yogita (suitable for high density plantation) .
11. Promotion of high yielding varieties of Mango (Dushari, Langra, Chausa, Amrapali, Mallika, Bombay green, Pusa surya, Pusa Arunima, Arunika, Pusa shreshta, Pusa Lalima).
12. Promotion of high yielding varieties of Tomato (Avinash-2), Himsona, Pusa Hybrid-4, Pusa Hybrid-2, Rakshita, Manisha, Vaishali, DRL-304, NS-852).
13. Promotion of high yielding varieties of Okra (Arka, Anamika, Parbhani Kranti), brinjal (Hybrid Pant brinjal-, Pant Rituraj, Pant Samrat) and chilli (Agni, Ragini Kashi Anmol, Pant C-1).
14. Promotion of high yielding varieties of pea (Vivek Matar 10, Vivek Matar 12 & VL Ageti Matar 7) and garlic (VL Lahsun 2).

Strengthening of traditional water storage structure

Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants of all the blocks of this region.

Adoption of cluster approach for holistic development

1. Rejuvenation of existing senile orchards of mango and litchi in *Kashipur and Rudrapur* block.
2. Establishment of high density orchards of mango, guava, litchi, banana in *Kashipur and Rudrapur* block.
3. Promotion of organic cultivation of turmeric in popular plantation in all blocks
4. Promotion of onion and garlic cultivation as intercrop crop in autumn cane
5. Promotion of off season vegetables cultivation in *protected cultivation*
6. Adoption of high yielding varieties and hybrids for vegetables production like okra, chilli, brinjal and cucurbits in nearby areas of *Kashipur, Rudrapur, Dineshpur, Kichha, Sitarganj.*
7. Promotion of production of uniform maturing vegetable pea and okra *in all blocks.*
8. Promotion of production of black gram in late kharif in tribal cluster of *Bajpur, Sitarganj, Khatima, and Gadarpur* block.
9. Promotion of production of lentil and blackgram in in tribal cluster of *Bajpur, Sitarganj,*

Khatima, and Gadarpur block.

Adoption of efficient irrigation techniques

1. Surface irrigation in laser levelled land
2. Micro- irrigation system in Sugarcane, Mango, Litchi, Guava and in Vegetables
3 Drip Irrigation in Green House Cultivation for Cut Flowers and Vegetables

Management of soil health

1. Promotion of vermi compost unit and green manuring in all the villages of this region.
2. Promotion of cultivation of green manuring crops like Sesbania, Sunhemp, and lobia in all blocks.
3. Management of soil health through balanced use of chemical fertilizers, liquid fertilizers and judicious use of pesticides.

Others

1. Cluster approach for holistic development.
2. Adoption of Soil health improvement practices.
3. Selection of right crop & variety.
4. Adoption of only well decomposed FYM/ value added compost.
5. Seed treatment through bio agent/ chemical means strictly in the cluster.
6. Judicious use of fertiliser.
7. Improvement of moisture conservation practices.
8. Drip irrigation
9. Protected cultivation in vegetable crops
10. Poly tunnel for nursery raising of vegetable crops
11. Promotion to focus on timely weed management
12. Promotion and Adoption of IPM techniques
13. Adoption of Farm mechanisation.
14. Promotion of common resources centre for availability of implements on custom hire basis viz. Paddy dryer, combine, laser leveller etc
15. Canopy management of Guava, Mango and Litchi in all blocks
16. Rejuvenation of old and senile orchards in all blocks

Strategy 2 : Livestock: Goatary, Poultry, Fisheries

1. Pure genetic breed of dairy (Sahiwal, Gir and Red Sindhi) goat(Pantja, Jamuna Par) and poultry (Layers for big farmers, Broiler for medium farmer and croiler for small and marginal farmers under backyard system) in all blocks.
2. Proper use of suitable mineral mixture, protienaceous green fodder, timely deworming and vaccination of livestock and poultry birds in all blocks.
3. Proper housing facilities and proper maintaining the records.
4. Supply of quality fish seed , hybrid species & species specific affordable formulated feed
5. Promotion of high milk breeds of cows, buffaloes and goats in all the blocks.
6. Promotion of Urea, Molasses, Multinutrient Blocks at *Nyaypanchayat* level.
7. Establishment of hatcheries for need of broilor or croilor at block level
8. Introduction and promotion of cross Heiffer for increasing income of marginal farmer.

Fisheries

1. Mono culture with fast growing cat fish spp.
2. Intensification of composite fish culture along with newly developed high yielding hybrids
3. Integration of fish culture with duck & poultry etc.

Strategy 3 : Integrating Farming system

Promotion of different Integrated Farming System modules in all blocks such as :

1. Protected cultivation+ Composting+ Goatry/backyard poultry
2. Fodder production+ Mini dairy + Composting + Protected cultivation
3. Seed production + Planting material supply + Mushroom at block level

4. Cereals + mushroom + bee keeping + vegetables
5. Fisheries + livestock + vegetables+ fruits
6. Cereals + Agro Forestry + Fisheries+ Horticultural crops
7. Cereals + vegetables + livestock + fruits
8. Cereals + pulses + livestock + fruits

Strategy 4 : Reducing post harvest losses and value addition

1. Grading, packing, storage warehouse and processing facilities need to be established to reduce post harvest losses and value addition at nayayapanchayat/block level.
2. Establishment of mini fruit grading plant at all blocks.
3. Establishment of small Processing Units at *Kashipur, Gadarpur and Rudrapur* block for *Mango, Litchi and Guava fruit.*
4. Promotion of cluster approach for efficient procurement and disposal of surplus vegetables pea in *Gadarpur, Rudrapur and Sitarganj* block.
5. Promotion of straw baler for easy storage of crop residues and to tackle the problem of burning crop residue and trash.
6. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all the blocks.
7. Promotion of common resources on custom hire basis viz. Mini Thresher and other equipments at Nyay Panchayat level in all blocks.

Strategy 5 : Waste land development and waste water

1. Plantation of fruit crops ,Control of soil erosion at river catchment areas of kosi, plantation of forest and fodder trees, plantation of perennial fodder,
2. Use of drip irrigation for orchards.
3. Water treatment plants to be established near *Rudrapur, Sitarganj Sidkul* to check the discharge of pollutant into the soil & natural water resources.
4. Some of the major towns/cities are situated close to perennial rivers like *Sharada, Gola, Kosi and Phikka*. A battery of shallow tube wells may be constructed along these rives to augment domestic water supply and irrigation. This will help to reduce stress on groundwater.
5. Plantation of *bamboo on river banks* and other water erosion prone areas.
6. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

Strategy 6 : Reduced cultivation cost

1. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in all *blocks*.
2. Promotion balanced fertilizers application in crops.
3. Promotion of recommended seed rate, spacing and depth.
4. Promotion of need based application of pesticides and other agricultural inputs.
5. Promotion of hand tools in agricultural and horticultural operations.
6. Power weeders, Paddy threshers, Wheat threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers
7. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
8. Promotion of pressurized irrigation techniques in horticultural crops.
9. Adoption of mechanization techniques in land preparation, inter cultural operations
10. Paddy: Direct seeding may be promoted to reduce cost of cultivation
11. Summer ploughing
12. Deep tillage.
13. Promotion of line sowing in tribal belts of Bazpur & Sitarganj.
14. Promotion of recommended seed rate, spacing and depth.
15. Promotion of need based application of pesticides and other agricultural inputs.

16. Promotion of hand tools in agricultural and horticultural operations.
17. Promotion of use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Wheel hand hoe, Manual/ power operated Wheat/Paddy reapers.

Strategy 7 : Off-farm income

1. Promotion of subsidiary occupations like poultry, goatry, fish farming and mushroom production and poultry, fish farming in all blocks.
2. Promotion of apiculture for small and landless farmers in *Kashipur and Jaspur.*
3. Promotion of skill development in women and youth in all the blocks.
4. Encouragement to existing SHGs for collective farming, opening small scale enterprise like Pickle makingof different fruits, Jam making, dal and dalia making, papad and murrabba making, masala making & packing, etc. may be provided for better performance in all blocks.
5. Creation and strengthening of new SHGs in other villages of all the blocks.
6. Promotion of SHGs for value addition and primary processing and linking them to market (Buy back system).
7. Increasing awareness towards education which is helps in getting employment to the rural youth, farm women.
8. Promotion of subsidiary occupations like poultry, fish farming, mushroom production and sericulture in *Gadarpur and Rudrapur block.*
9. Promotion of skill development among women and youth through training centres to be established with renowned institutes like *GBPUAT Pantnagar*.

Strategy 8 : Enabling Policies

1. Increasing institutional support by providing production based incentive to small and marginal who are producing more than district average on production basis in *all the blocks*.
2. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
3. Recharge of all reservoirs (*Sharda, Nanak Sagar, Gola, Dhawra, Haripura, Kalagaarh, Tumariya*) in the district through run off management in their catchment area of hilly regions in Nainital, Champawat and Pauri district.
4. Ban on deepening of natural water ways through mining to maintain the ground water recharge.
5. Promotion of farmer's producers organizations.
6. Implementation of Soil Health Card Scheme in each block.
7. Proper infrastructure need to be developed for hi-tech grading especially for fruits, vegetables and spices in all the blocks
8. In the district, paddy is grown intensively, leading to over exploitation of groundwater. The local farmers should be encouraged to adopt cultivating of other less water consuming crops along with paddy.
9. High density plantation of mango

Others

1. Inclusion of pulse crop in cropping system
2. Balanced fertilization and deep tillage
3. Green manuring (Sasbenia/sanhemp)
4. Promoted use of bio fertilizers
5. Ban on summer rice.
6. Complete check on trash burning

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

1. Block level.
2. Creation of direct linkages with food processing industries for better prices.
3. Establishment of market chain of medicinal crop like mentha, alovera, artimicia, satavar, ashwagandha etc in all locks of this region.

4. Establishment of strong linkages with various stake holders to furnish information on crop produce and surplus.
5. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
6. Installation of mini grading machines at village level.
7. Establishment of cold room of all blocks.
8. To check the interference of middle men in marketing of agricultural produce of the farmers, proper marketing network to be developed.

Strategy 10 : Online Management and Evaluation

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