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

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

**A.General information about Agroeco-region**
**District:** Almora
**Agro-ecological region:** Region A (up to 1000 m)
**Main Blocks in Region:** All Blocks
**Main village cluster in blocks:** 3-4 villages in each nyay panchayat
**Irrigated Clusters:** Habalbagh, Takula,chaukhutia,Dwarrahat,Bhisiyachana, Syalde
**Rainfed Clusters:** Habalbagh, Takula,chaukhutia,Dwarahat,Bhaisiyachana, Salt, Lamgara, Dhauladevi, Syalde, Tarikhet, Bhikiasain
**Existing rain water management facilities:**
1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj)
3. Village pond (Taal and Chaal)
4. Collection from hill slope (Khaal)
5. Hydrum as lift device
6. Roof water harvesting but limited

**B. Productivity Enhancement**
**1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region**
1. Roof water harvesting system
2. Poly tank for water storage for scattered fields
3. Low cost lining material to check seepage
4. Efficient water application systems (sprinkler and drip)
5. Rejuvenation and popularisation of traditional water harvesting systems (Naula)
6. Cost effective lifting devices
7. Roof top water harvesting system

**2. Existing practices for soil health improvement**
1. Use of undecomposed farmyard mannure/compost
2. Meagre/ no use of biofertilizers
3. Imbalanced/ insufficient nutrient use
4. Use of raw/partially decomposed FYM
5. Meagre/ no compost making/recycling of crop residue
6. Mixed cropping of cereal and legume
7. Soil health card scheme launched in 2015

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

**(ii) Pulses and soybean**

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

(iii) **Vegetables and spices**

1. Seed/ nursery soil inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture (each of 200 g/$m^2$ for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture at transplanting.
3. Soil test based balanced use of fertilizers; INM shall be preferred
4. Promotion of common minimum practices in vegetables(soil solarisation,value addition of compost/FYM,etc)
5. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost
6. Establishing soil testing labs at Block level or making mobile soil testing teams.
7. Soil health card campaign so that each farmer has his soil health card.
8. Training and demonstration of compost making as a campaign.
9. Making available the required recommended nutrients/ micro-nutrients at right time, place and quantity.
10. Promoting the use of organic fertilizers/ Bio fertilizers /green manuring in identified organic blocks.

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

1. No contingencies plan is used by farmers
2. Rainfed agriculture with low cropping intensity
3. Merely 6.6 % cultivable area of the district is irrigated, while rest area is rainfed.
4. Growing of vegetables and horticultural crops over very small area

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

1. The climatic projection suggesting increasing air temperature and erratic distribution of rainfall. Therefore following strategy should be followed to increased income under changing climatic scenario.
2. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
3. In event of decreased water availability (Approximately 1000 mm rainfall) in rainy season (June-September) the rain water should be properly stored (In polythene, to make bund) and harvested for Kharif season crops.
4. Share of millets (Finger millet, Barnyard millet) should be increased due to its better capability of tolerating adverse climatic condition.
5. Short duration varieties should be grown so that at least two crops in a year could be taken Growing of Cheti/spring rice variety viz., (VL 206, VL207, VL 208, VL 209). Another option may be Jethi rice VL 154 and VL 157 sown in the month of June
6. Organic mulch should be used for reducing frost risk.
7. The area of off season vegetable should be increased at least double by the year 2022.
8. The area having slope 10-30% should be used for growing of horticultural crop viz, Apple, pear, peach, plum, Apricot, walnut should be grown in temperate regions and Mango in Sub-tropical regions.
9. Use fodder crop i.e Sorghum, Lobia in Kharif and oat /berseem in Rabi as supplementary crop.
10. Transplanting of finger millet
11. Late sowing of horse gram
12. Sowing of radish /leafy vegetables as cash crop
13. Plantation of citrus / pomegranate

14. Late sown varieties of wheat
15. Cultivation of off season vegetable

**6 A. Name of Field Crop: Wheat**

**i. Existing varieties being used:** UP 2572, VL 829, VL 738, Dawatkhani 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:** VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953 and UP 2572

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

1. **Preparation of land**- 1 - 2 ploughing with local plough followed by planking.
2. **Manure and fertilizer-**
3. Use of un decomposed FYM in rain fed as well as irrigated areas with small doses of chemical fertiliser in irrigated valleys of the district
4. **Sowing time-**Rain fed – last week of October
   Irrigated- November
5. **Seed rate and seed sowing** -130-150 kg/ha, Broad casting
6. **Irrigation**-Usually maximum area is rain fed, while in irrigated areas, depending upon water availability 1-3 irrigation
7. **Weed Control-** In general, no weed control is done by farmers and they up root the grasses in Feb-March and use as fodder. However, a few farmer use 2,4- D in irrigated areas
8. **Plant Protection Measures-** No any PPM followed

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

1. **Preparation of land**- 2 ploughing + 1 harrowing with mould board plough followed by planking.
2. **Sowing time-**Rain fed – Mid of October
   Irrigated- Up to mid November
3. **Seed rate and seed sowing** -100-125kg/ha with a spacing of 18-21 cm.
4. **Manure and fertilizer**- 5-10 tonne FYM (Value added) , NPK 100-120:60:40 (Irrigated condition), 50-60:30:20 (Rain fed condition) with micronutrients. Apart from this seed treatment with bio fertiliser i.e. PSB and Azatobacter @ 10 g /kg seed
5. **Irrigation**-As per irrigation facility 1 irrigation at CRI, late jointing stage and 1 at flowering stage.
6. **Weed Control-** Irrigated condition- Clodinafop+Metsulsulfuron methyl @400.00/ha 30-35 DAS (Effective against broad and narrow leaves weed). Apart from this, Pendimethalin @ 1.00a.i./ha as pre emergence may also be used. Weed may also be controlled by manual weeding at 20-25 and 40-45 DAS.
7. Use of IPM practices

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

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

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

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

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

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

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

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

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

**vii. Major disease associated with crop:** Brown spot, Rust, Loose smut, Karnal bunt

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

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

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

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

**Biofungicides**

| Name of the Herbicides | (gm/Kg) /ha | Treatment |
|---|---|---|
| *Pseudomonas fluorescens* 1.75% WP (In house isolated Strain Accession no. MTCC 5176) | 5 g/Kg seed<br><br>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.<br>**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 |

**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:** *Ranunculus arvensis, Anagallis arvensis, Convolvulus arvensis, Chenopodium album , Asphodelus tenuifolius, Avena fatua,Phalaris minor*

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

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

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

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

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

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

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

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

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

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

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Clodinafop Propargyl 15% WP | 400 | 110 |
| Diclofop methyl 28% EC | 2500-3500 | 90 |
| Fenoxaprop-p-ethyl 10% EC | 1000-1200 | 110 |
| Isoproturon 50% WP | 2000 | |
| Isoproturon 75% WPs | 1330 | 60 |
| Methabenzthiazuron 70 %WP (PE: 2DAS) | 1500-2000 | 100 |
| Methabenzthiazuron 70 %WP (POE: 16-18DAS) | 1000-1250 | 100 |
| Metribuzin 70% WP (Medium soil) | 250 | 120 |
| Metribuzin 70% WP (Heavy soil) | 300 | 120 |

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

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

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

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

1. Organic cultivation
2. Adoption of low-cost based cultivation practices
3. Horse gram/Soybean - Wheat (rainfed) &

**Rice –Wheat(irrigated)**

1. Timely Sowing, Seed treatment, Use of HYV
2. Care soil & water conservation measures
3. INM (Maximum use of value added compost/FYM and soluble fertiliser)
4. Integrated weed management
5. IPM
6. Good storages conditions
7. Efficient marketing of value added produce

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

1. Rain fed and scatteres land holdings.
2. Poor availability of agriculture inputs
3. Use of imbalance and un decomposed FYM
4. Climate change
5. Big issue of Wild animal damages
6. Migration
7. Poor Irrigation facilities
8. SAAR practice(Shifting area practice)
9. Lack of ICT tools due to poor awareness and inter net connectivity

**6B. Name of Field Crop: Rice**

**i. Existing varieties being used:** China-4, Nandhani, Lal dhan ,Saket 4

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

Spring rice (VL Dhan 208 and VL Dhan 209 ) in Syaldey block

Jethi rice ( Vivek Dhan 154 and VL Dhan 157) in Bhikiasen and Syaldey blocks

Irrigated Rice (VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85*, Pusa Basmati 1509 and PRH 10) in Syaldey and Chaukhutia

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

1. **Preparation of land**- 1 - 2 ploughing with local plough followed by Manual puddling
2. **Seed rate and seed sowing** -150 kg/ha in direct seeding , and in transplanting 60-70 kg/ha
3. More than 55 days seeding used
4. **Manure and fertilizer**- use of un decomposed FYM( 1-2.0qt./nali) with small doses of chemical fertiliser by some progressive farmers (in irrigated conditions)as per availability
5. **Irrigation**-usually maximum area is rain fed and in valley –traditionally roaster system is practiced under which, individual farmer get the irrigation too late which affect the crop adversely.
6. **Weed Control** – Butaclor 50 EC @2-3 lt/ha at 0-3 DAT,
7. No IPM practices

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

1. **Preparation of land**- 2 ploughing + 1 harrowing with mould board plough followed by planking.
2. **Sowing time-**Rain fed – Mid of October
3. Irrigated- Up to mid November
4. **Seed rate and seed sowing** -100-125kg/ha with a spacing of 18-21 cm.
5. **Manure and fertilizer**- 5-10 tonne FYM (Value added) , NPK 100-120:60:40 (Irrigated condition), 50-60:30:20 (Rain fed condition) with micronutrients. Apart from this seed treatment with bio fertiliser i.e. PSB and Azatobacter @ 10 g /kg seed
6. **Irrigation**-As per irrigation facility 1irrigation at CRI, late jointing stage and 1 at flowering stage.
7. **Weed Control-** Irrigated condition- Clodinafop+Metsulsulfuron methyl @400.00/ha 30-35 DAS (Effective against broad and narrow leaves weed). Apart from this, Pendimethalin @ 1.00a.i./ha as pre emergence may also be used. Weed may also be controlled by manual weeding at 20-25 and 40-45 DAS.
8. Use of IPM practices

**v. Major insect pests associated with crop:** Stem borer, Leaf folder, Rice bug, Plant hopper

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

**Stem borer:**

1. In the stem borer endemic area raise the nursery away from light source.

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

**50 Days within transplating (2 inch water in field)**

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

**50 Days after tranplanting**

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

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

**Bio-insecticides**

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

**Leaf folder:**

Following insecticides may be used to control leaf folders of rice

**50 Days within transplating (2 inch water in field)**

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

**50 Days after transplating**

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

| | | |
|---|---|---|
| Dichlorovos 76% EC | 627 | |
| Chlorpyriphos 20 %EC | 2500 | 30 |
| Quinalphos 25% EC | 2000 | 40 |
| Quinalphos 25 %EC | 1000 | 40 |
| Flubendamide 4%+ Buprofezin 20 %SC | 175+700 | 30 |
| Flubendamide 3.5%+ Hexaconazole 5 %WG | 1000 | 20 |

**Bio-insecticides**

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

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

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

**Bio- insecticides**

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

**Rice bug: *Leptocorysa acuta***

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

| | | |
|---|---|---|
| Methyl parathion 2% DP | 500 | 25000 |

**Biological control**

**Parasitoids:**

*Gryon flavipes*, attacking: eggs

Predators:

*Micraspis discolor*, attacking: nymphs, adults

*Neoscona theisi*, attacking: nymphs, adults

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

*Orthetrum sabina*, attacking: nymphs, adults

**Pathogens:**

*Beauveria bassiana*, attacking: nymphs, adults

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

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

**During Nursery Sowing**

Deep summer ploughing or soil solarisation

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

**Fertilizers**

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

**Khaira disease: Due to Zinc deficiency)**

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

**Sheath blight: *Rhizoctonia solani***

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% | 0.07-0.1% | 46 |

| | | |
|---|---|---|
| EC | | |
| Tebuconazole 50% +Trifloxystrobin 25% WGs | 200 | 31 |

**Biofungicides:**

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

**Rice blast: *Magnaporthe grisea***

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

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

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

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

**Biofungicides**

| **Name of the Bio-Fungicides** | **gm/Kg** | **Waiting period (days)** |
|---|---|---|
| *Pseudomonas fluorescens* 1.5% WP (BIL-331 Accession No. MTCC 5866) | 5 gm/Kg seed | Seed Treatment: Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP with minimum volume |

| | | |
|---|---|---|
| | | of water and coat the seed uniformly, shades dry the seeds just before showing. |

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

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

**Biofungicides**

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

**False smut: *Ustilaginoidea virens***

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

**ix. Major weeds associated with crop:** *Oxalis latifolia, Cyperus* sp.*, Echinocloa* sp.*, Commalina benghalensis, Digitaria sanguinales, Eclipta* sp.

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

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

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Anilofos 30% EC (Transplanted rice) | 1000-1500 | 30 |
| Anilofos 18% EC (Transplanted rice) | 1660-2500 | |
| Anilofos 2% G (Transplanted rice) | 20000-25000 | 30 |
| Bispyribac Sodium 10% SC (Nursary) | 200 | |
| Butachlor 50% EC (Transplanted rice) | 2500-4000 | 90&120 |
| Butachlor 50% EW (Transplanted rice) | 2500-3000 | |
| Butachlor 5% G | 25000-40000 | 90&120 |
| Chlorimuron ethyl 25% WP (Transplanted rice) | 24 | 60 |
| Clomazone 50% EC (Transplanted rice) | 8000-10000 | 90 |
| Cyhalofop butyl 10% EC | 750-800 | 90 |
| 2,4-D Ethyl Ester 38% EC | 2500 | |
| 2,4-D Ethyl Ester 4.5% GR (Transplanted rice) | 25000 | |
| Fenoxaprop-p-ehtyl 9% EC (Transplanted rice) | 625 | 70 Post |
| Fenoxaprop-p-ehtyl 6.9% EC | 812-875 | 61 |
| Flufenacet 60% DF (Transplanted rice) | 200 | 90-110 |
| Orthosulfamuron 50% WG (Transplanted rice) | 150 | 65 Pre |

| | | |
|---|---|---|
| Oxadiargyl 80% WP (Transplanted rice) | 125 | 97 |
| Oxadiargyl 6% EC (Transplanted rice) | 1066 | 97 |
| Oxadiazon 25% EC (Transplanted rice) | 2000 | |
| Oxyflourfen 0.35.5% GR (Transplanted & Direct sown) | 30000-40000 | |
| Oxyflourfen 23.5% EC (Transplanted & Direct sown) | 650-1000 | |
| Pendimethalin 30% EC (Transplanted & Direct sown) | 3300-5000 | |
| Pendimethalin 5% G (Transplanted & Direct sown) | 20000-30000 | |
| Pretilachlor 37% EW (Transplanted rice) | 1500-1875 | 90 |
| Pretilachlor 30.7% EC (Wet Direct Seeding) | 1500-2000 | 110 |
| Pretilachlor 50% EC (Transplanted rice) | 1000-1500 | 75-90 |
| Anilofos 24%+ 2,4-D ethyl ester 32% EC | 1000&1500 | 90 (Transplanted rice) |
| Bensulfuron methyl 0.6% + Pretilachlor 6 G | 10000 | 88(Transplanted rice) |
| Clomazone 20%+ 2,4- D ethyl ester 30% EC | 1250 | 110 (Transplanted rice) |
| Cinmethylin 10% EC (Transplanted rice) | 750-1000 | 60 |
| Paraquat dichloride 24% SL (Before sowing) | 1250-3500 | |

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

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

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

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

| | | |
|---|---|---|
| Chlorimuron ethyl 25% WP (Transplanted rice) | 24 | 60 |
| 2,4-D Ethyl Ester 4.5% GR (Transplanted rice) | 25000 | |
| MCPA, Amine salt 40% WSC (Transplanted rice) | 2000-5000 | |
| Metsulfuron methyl 20 %WP (Transplanted rice) | 20 | 60 |
| Orthosulfamuron 50% WG (Transplanted rice) | 150 | 65 Pre |
| Bensulfuron methyl 0.6% + Pretilachlor 6% G | 10000 | 88 (Transplanted rice) |

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

1. Organic cultivation
2. Adoption of low-cost based cultivation practices
3. Jethi rice- Wheat/Lentil/Barley/oat (fodder) (rainfed)
4. Rice- Wheat /onion/berseem(irrigated),
5. Timely Sowing/Trans planting, Seed treatment
6. Use of HYV, Hybrid (120-125days), Basmati(120-125days)
7. Care soil & water conservation measures
8. INM (Maximum use of value added compost/FYM and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Marketing of value added produce
13. Avoid early Nursery raising practice and use of 25-35 days old seedling

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

1. Rain fed and scatteres land holdings.
2. Poor availability of agriculture inputs
3. use of imbalance and un decomposed FYM,
4. climate change,
5. Big issue of Wild animal damages
6. Migration
7. Poor Irrigation facilities
8. SAAR practice(Shifting area practice)
9. Lack of ICT tools due to poor awareness and inter net connectivity

**6C. Name of Field Crop: Finger millet**

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

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

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

1. Traditional seed variety ,
2. undecomposed FYM 1.0-2.0qt./nali,
3. 1-2 weeding

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

1. **Preparation of land**- 2-3 ploughing followed by planking
2. **Sowing time-** Last week of May-Ist fortnight of June
3. **Seed rate and seed sowing** -10-12kg/ha, line to line spacing- 20 cm with care of gap filling/thining/transplanting
4. **Manure and fertilizer-** -Well decomposed FYM @5-10 tonnes/ha , NPK 20:40:0 and seed treatment with bio fertiliser
5. **Irrigation-**usually maximum area is rain fed
6. Weed Control- 2-3 manual weeding; first at 15-20 and second at 40-45 DAS.

7. Use IPM modules

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

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

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

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

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

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

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

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

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

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

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

Sale of value added products

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

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

**7A. Name of the Pulse crop: Horsegram**

**i. Existing varieties being used:** Pahari gahat

**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 Gahat 10, VL Gahat 15 and VL Gahat 19

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

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

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

1. **Preparation of land**- - 2-3 ploughing followed by planking **Seed rate and seed sowing** – 30-40 kg/ha, spacing 30*10cm
2. **Sowing time-** Ist fortnight of June
3. **Manure and fertilizer**- 5 -10 tonne FYM / ha, NPK20:40 :20 along with the use of bio fertiliser
4. **Irrigation**-usually maximum area is rain fed
5. **Weed control** – Two manual weeding at 20-25 and 40-45 DAS is quite effective for weed control. Herbicides i.e. Alachlor 50 Ec 4 lt/ha at 0-3 DAS, Imazethapyr 10SL @100 gm a.i./ha At 15-20DAS.
6. Use of IPM practcices

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

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

**vii. Major disease associated with crop:** Rot, Syam warn

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

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

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

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

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

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

**7B. Name of the Pulse crop: Lentil**

**i. Existing varieties being used:** Pahari masoor –small seeds

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Masoor 125, VL Masoor 126, VL Masoor 507, VL Masoor 514, PL 5 , PL 7, PL 8

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

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

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

1. **Preparation of land**- 2-3 ploughing followed by planking
2. **Seed rate and seed sowing** – 30-40 kg/ha, spacing 25*10cm
3. **Sowing time-** IInd fortnight of October
4. **Manure and fertilizer**-5-10 tonne FYM , NPK 20:40 :20 along with the use of bio fertiliser.
5. **Irrigation-U**sually maximum area is rain fed
6. **Weed control** – Pendimethalin 35 Ec 3.0 lt/ha as pre emergence. 1-2 weeding upto 45 DAS will also control the weeds.
7. Use of IPM practcices

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

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

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

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

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

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

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

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

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

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

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

**7C. Name of Pulse crop: Urd**

**i. Existing varieties being used:** Pan urd 19, Pant Urd 30

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

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

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.
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 :**

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

**Fruit Borer**

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

**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

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

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

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

**7D. 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. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment, poor weed management, imbalanced use of chemical fertilizer,
3. Lack of awareness about pest and disease management among farmers, difficulties to use heavy modern agriculture implement due to hilly terrain.
4. Proper marketing of agriculture produce is not available,
5. Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

**7E. Name of Pulse/oilseed Crop: Soyabean**

i. **Existing varieties being used:** Kala bhatt(Oval), Pahari soybean, VLS 47

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

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

1. Traditional seed variety,
2. Undecomposed FYM 1.0-2.0qt./nali.
3. No use of chemical fertiliser, 1-2 manual weeding.
4. No use plant protection measures

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

1. **Preparation of land**- 2-3 ploughing followed by planking ,
2. **Sowing time-** Ist fortnight of June
3. **Seed rate and seed sowing** – 75-80 kg/ha, line to line spacing- 45 cm
4. **Manure and fertilizer-** -Well decomposed FYM @5-10 tonnes/ha , NPK 20:60:40 and seed treatment with bio fertiliser
5. **Irrigation**-usually maximum area is rain fed
   Weed control – Two manual weeding at 20-25 and 40-45 DAS is quite effective for weed control.

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

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

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

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

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

| Insect pest | Resistant or tolerant variety |
|---|---|
| Stem fly | Dsb 25, Himso 1685, JS 20-89, MACS 1370, MACS 1410, NRC 97, JS 20-53,PS 1543, SL 983, Dsb 23-2 |
| Girdle beetle | MACS 1410, Dsb 23-2, Himso 1685, JS 20-89, KDS 726 |
| Defoliators | Dsb 23-2, KDS 726, PS 1543, PS 1569 |
| Pod borer | Dsb 25, SL 683, NRC 97, MACS 1370, JS 20-89 |
| Leaf miner | MACS 1370, Himso 1685, MACS 1370, MACS 1410 |
| Pest complex | DS 2708, Dsb 23-2, Dsb 25, Himso 1685, JS 20-53, JS 20-79, JS 20-89, KDS 726, MACS 1370, MACS 1410, NRC 97, SL 983, PS 1543 |

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

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

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

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

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

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

**Table 2: Major predators of insect pests of soybean**

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

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

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

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

**Table 4: List of insecticides recommended for soybean insect pests**

| Insect pests | Insecticides | Dosage |
|---|---|---|
| Sucking pests, stem fly | Thiamethoxam 30 FS (Seed treatment) | 10ml/kg seed |
| Sucking pests | Acetamiprid 20 SP | 100 ml/ha |
| Sucking pests | Spiromesifen 22.9 SC | 600ml/ha |
| Sucking pests | Imidacloprid 17.8 SL | 500 ml//ha |
| Sucking pests and girdle beetle | Triazophos 40 EC | 800ml/ha |

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

**Bio-insecticides**

**Tobacco caterpillar (*Spodoptera litura*)**

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

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

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

**Semilooper (*Chrysodeixis acuta*)**

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

**Soyabean leaf miner (*Odontota horni*)**

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

**vii. Major disease associated with crop:** YMV, leaf spot, blight, Collar rot, rust

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

**Rust: *Phakopsora pachyrhizi***

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

**Collar rot: *Sclerotium rolfsii***

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

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

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

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

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

1. Organic cultivation,

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

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

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

**7F. Name of oilseed crop: Toria/sarson**

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

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

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

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

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

1. Deep ploughing during summer months
2. **Land preparation:** One ploughing followed by 2-3 harrowings and planking; Using Zero till ferti- seed drill will increase farmers' income reducing the costs of planting and improving productivity.
3. **Sowing time to improve productivity and income:**

**a.** ***Toria***: Last week of September.

**b.** **Yellow *sarson* & *rai* (Mustard)**: First fortnight of October.

4. **Seed treatment**

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

5. **Seed rate and spacing:**

a. ***Toria*:** 4kg/ha about 3-4 cm deep in 30 cm apart rows

b. **Yellow *sarson* & *rai* (Mustard)**: 5 kg/ha with a row spacing of 30-45 cm.

6. **Thinning:** About 20-25 days after sowing maintaining a plant to plant space of 10 cm. The thinned out plants could be used as **green forage**.
7. **Nutrient management:**
   Vermicompost: 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.
8. Excess use of nitrogenous fertilizers should be avoided.
9. **Nitrogen:** 120kg/ha
   60-80 kg/ha for *toria*
   Half of the N as basal and remaining half be top dressed about 25- 30DAS

**Phosphorus**: 40 kg/ha as basal
**Potassium**: 20 kg/ha as basal
Phosphorus be applied as SSP; if SSP is not available, 20 kg/ha Sulphur shall be applied as basal.

10. **Water management:**
Rosette (25-30 days) and pre-flowering stages are the most sensitive to water deficit. Hence, irrigations shall be made at these stages wherever possible.

11. **Harvesting and threshing:**
The crop should be harvested when about 75 % of the siliquae turn yellowish brown. After threshing, seeds should be stored with less than 8% moisture.
Use of IPM

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

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

**Aphid *Lipaphis erysimi***

1. Sow tolerant varieties of *B.juncea* such as T6342, B85, RW-29-2.
2. As the cold and cloudy weather favours the pest multiplication, sowing the crop earlier than the normal sowing time escape the pest attack.
3. Removal of affected/ infected branches.
4. Conserve natural predators such as Coccinelid beetles and Syrphid flies
   - Timely sowing of crop
   - Removal & destruction of Aphid infested twigs at flowering and siliquae formation stages.
   - Release of larvae/adult of lady bird beetle (***Coccinella septempunctata***) @ 50,000/ha

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

**Mustard saw fly : *Athalia lugens proxima***

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

**Hairy caterpillar**

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

Emamectin Benzoate 5 SG 250ml/ha
Lufenuron 5EC 800ml/ha
Triazophos 40EC 750ml/ha
Monocrotophos 36 WSC 1250 ml/ha.

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

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

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

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

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

**White rust : *Albugo candida***

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

**Downy mildew:** ***Peronospora parasitica***

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

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

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

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

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

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

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

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

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

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

**8A. Name of the vegetable crop: Cabbage**

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

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

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

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.

7. Cultivars-In cabbage, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be head formation.
8. Transplanting- Farmers practices improper planting distance.
9. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
12. Harvesting- The harvesting should not follow as per maturity standards or as per object.

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

1. Soil Testing- Farmers should test their soils before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to go for deep ploughing before sowing the crop particularly during the hot season or before the snowfall
3. Seed- Farmers should adopt improved varieties/ hybrids
4. Soil solarisation practice should follow in nursery beds .
5. Seed Treatment- To combat the different seed borne diseases to treat the seed by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing
6. Seed Rate- It is recommended to use the seed quantity for different as follows-
7. (Early)-600-700g/ ha open pollinated
8. (Mid and Late)- 500-550g/ha open pollinated
9. (Hybrid)-350-400g/ha
10. Optimum sowing time :Mid Sept- Oct
11. Transplanting- Farmers should transplant seedlings properly as for early (40x45cm), medium (40x45cm),
12. Manures and fertilizers- Farmers should incorporate well rotten cow dung (20-25tonnes/ha) and NPK (120:60:60) in irrigated, half dose of NPK in unirrigated condition.
13. Irrigation- As per requirements. At critical stages such as head initiation and head development
14. 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.
15. Harvesting- The farmer must aware about the maturity stage of a particular crop variety so he can harvest the crop as per their object. In general the heads should be harvested when they attempt the size in between 500-750 gms.

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

**Bioinsecticides**

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

**Cabbage/cauliflower Aphid**

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

**Bioinsecticides**

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

**Painted bug**

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

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

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

***Sclerotenia* stem rot:**

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

***Xanthomonas* Black rot:**

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

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

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

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

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

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

**8B. Name of the vegetable crop: Cauliflower**

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

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

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

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

13. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

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

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

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

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

**Before Planting**

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

**After Planting**

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

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

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Chlorantraniliprole 18.5% SC | 50 | 3 |

| | | |
|---|---|---|
| Cyantraniliprole 10.26% OD | 600 | 5 |
| Indoxacarb 14.5% SC | 200-266 | 7 |
| Indoxacarb 15.8% EC | 266 | 5 |
| Spinosad 2.5% SC | 600-700 | 3 |
| Chhlorfenapyr 10% SC | 750-1000 | 7 |
| Emamectin benzoate 5% SG | 150-200 | 3 |
| Flubendamide 480% SC | 45-60 | 7 |
| Flubendamide 20% WG | 90-120 | 7 |
| Chlofluazuron 5.4% EC | 1500 | 7 |
| Diafenthiuron 50% WP | 600 | 7 |
| Lufenuron 5.4% EC | 600 | 14 |
| Novaluron 10% EC | 750 | 5 |
| Metaflumizone 22% SC | 750-1000 | 3 |
| Tolefenpyrad 15% EC | 1000 | 5 |
| Thiodicarb 75% WP | 1000-1330 | 7 |
| Fipronil 5% SC | 800-1000 | 7 |
| Cypermethrin 10% EC | 650-760 | 7 |

**Bioinsecticides**

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

**Cabbage/cauliflower Aphid**

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

**Bioinsecticides**

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

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

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

***Xanthomonas* Black rot:**

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

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

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

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

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

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

**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.

**8C. Name of the vegetable crop: Radish**

**i. Existing varieties being used:** Dunagiri, Chinese Pink and Pusa Himani

**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. Use of long white tapering varieties
2. Line sowing and use of less or non-pithy varieties
3. Use of round shaped varieties for culinary purpose.
4. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
5. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
6. 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
7. Seed Rate- The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha
8. 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
9. 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,
10. Irrigation- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at 7-8 days interval and in summer 3-4 days interval

11. 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 are problem

**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, Damping off, black rot

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

Use of recommended pesticides in recommended dose

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

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

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

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

**8D. Name of the vegetable crop: Tomato**

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

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VL Tamatar 4

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

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

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

1. 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:** Fruit borer and white flies in low or mid hills are serious pest

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

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

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

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

**Management strategies( white fly and other sucking pests)**

**A. Crop Hygiene**

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

**B. Other Cultural Control Practices**

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

9. Manage weeds within crops to minimize interference with spraying and to eliminate alternative whitefly and virus host plants.
10. Destroy old crops within 5 days after harvest, destroy whitefly infested abandoned crops.

**C. Insecticidal Control Practices**.

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

**White fly**

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

**Leaf miner, *Liriomyza trifoli***

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

**Aphid, *Aphis gossypii***

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

**Thrips, *Thrips tabaci***

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

**vii. Major disease associated with crop:** Buckeye fruit rot is a major serious disease.

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

**Buck eye rot:**

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

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

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

**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. Use of high yielding varieties grown under ventillated polyhouse using standardized technology

with fertigation technology in tomato can enhance the productivity of tomato manifold. Polyhouse technology is a boon for small and marginal farmers with fragmented holdings.

2. Reduce number of spray of pesticides.
3. Raise nursery on treated soil.
4. Treat seed with fungicide before sowing.
5. Manage fog during fruiting period.

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

1. Non-availability of reliable hybrid cultivars for continuous cultivation.
2. Poor nursery management in the crop
3. Poor staking and pruning techniques.
4. Poor technical knowhow
5. Imbalance use of fertilizes.
6. More numbers of pesticides' spay
7. Increase incidences of Bacterial wilt.
8. Intestine raising of tomato crop which leads inefficient management of nutrition in the soil.

**8E. 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

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

1. Use of big sized tuber or divion of tuber (50-60 g)
2. No Tuber treatment
3. Use of organic manures, sowing in flat bed.
4. Sowing time is March-April.
5. Limited or no IPM practices
6. Planting time:October
7. Spacing: 50-60 x 15-20 cm
8. Seed rate: 25-30 qtl/ha
9. 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. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with application of organic manures.
2. Fertilizer should be used on soil test basis. 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, Hadda beetle, Potato aphid, White grub is a serious and wide spread problem

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

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

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

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

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

| | | |
|---|---|---|
| Metalaxyl 3.3%+ Chlorothanil 33.1% SC | 0.02% | 34 |

**Potato scab: *Streptomyces scabiei***

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

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

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

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

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| 2,4 D Dimethyl amine salt 58% SL | 3440 | |
| Paraquat dichloride 24% SL (Post emergence) | 2000 | 100 |

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

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| 2,4 D Dimethyl amine salt 58% SL | 2000 | 3440 |

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

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

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

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| 2,4 D Dimethyl amine salt 58% SL | 2000 | 3440 |

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

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

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

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

**8F. Name of the vegetable crop: Brinjal**

i. **Existing varieties being used:** Non descriptive or non identified varieties, Pant Rituraj, Pant smrat. Locally available varieties

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Navkiran, Brinjal 704 (SunGro Seed), Navina, VNR212 (VNR Seed), 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. Availability of purple and round varieties in cropping system.
2. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
3. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
4. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
5. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed orTrichoderma viride 4g/kg before sowing
6. Seed Rate- The recommended seed rate of brinjal: Hybrid-250g/ha, Open pollinated-500-600g/ha
7. Transplanting- Farmers should transplant seedlings properly as for non spreading type varieties-60cm x 60cm, spreading type varieties - 75cm x 60cm.
8. 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,
9. 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.
10. 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.
11. Growth substances: Use 2,4-D @ 2ppm at flowering stage
12. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

**v. Major insect pests associated with crop:** Shoot and fruit borers

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

**Brinjal fruit & shoot borer: *Leucinodes orbonalis***

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

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

**vii. Major disease associated with crop:** Phomopsis blight and rot (*Phomopsis vexan*) is a serious problem in the hills.

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

1. Use healthy seed materials for sowing.
2. Seed should be extracted only from disease free fruits.
3. After extraction of seeds it should be dried for a week and then stored.
4. Avoid continuous cultivation of brinjal. A rotation of brinjal - paddy - gingelly will helps to check the disease development.
5. In the fields the affected plants and debris should be collected and burnt
6. During summer deep ploughing should be given.
7. Spray following insecticides

**Blight**

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

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

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

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

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

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

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

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

1. Wild animals problems
2. Marketing problem in rainy season
3. Non-availability of suitable hybrids and 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.

**8G. 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. Growing local varieties.
2. No line transplanting.
3. Generally they plant two over aged seedling at one place.
4. No or very less use of fertilizer.
5. 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.
8. Use of seed treatment like Pant bioagent 3 for managing seed and soilborne diseases.
9. Earthening up of plants within 45 days after transplantation to get rid off waterlogging
10. Use of high dose of organic manure i.e. 200 q/Ha increases productivity and incidence of dieback and Anthracnose.

**v. Major insect pests associated with crop:** Thrips problem is major problem

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

**Chilli thrips, *Scirtothrips dorsalis* Hood**

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

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

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

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

**Dieback**

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

**Anthracnose**

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

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

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

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

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

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

1. High incidence of flower and fruit drop in chillies
2. Fruit losses due to high incidence of dieback and anthracnose.
3. Non availability of quality seed.
4. Less irrigation facilities.

5. High cost of hybrid seeds.
6. Unaware about the insect-pest management.

**8H. Name of the vegetable crop: Cucumber**

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

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

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

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

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

1. Use of traditional seeds,
2. Planting in rainy season,
3. Traditional stacking method,
4. Long harvest duration season,
5. Sale at local market
6. Absence of crop rotation.
7. Random selection of variety (May or may not be suited to Agroeco-region).
8. Untimely sowing / planting of crop.
9. Use of untreated seed.
10. Unbalanced use of fertilizers.
11. Use of plant protection chemicals having long wetting period.
12. Use of traditional irrigation system.
13. 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. 60-200 × 50-100 cm
5. Treating seed before sowing.
6. Balanced use of fertilizers (125: 155: 125 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).
7. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
8. Selection of optimum planting period.
9. Protected cultivation : Sept
10. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
11. Adoption of micro irrigation technologies for efficient use of available water.
12. Adoption of fertigation system for efficient use of fertilizers.

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

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

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

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

**Red pumpkin beetle**

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

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

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

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

**Downy mildew**

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

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

*Oxalis latifolia, Phyllanthus niruri ,Amaranthus viridis, Euphorbia hirata, Solanum* sp.

**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. 60-200 × 50-100 cm
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.

**8I. 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:** Pant Sabji Matar 3, Azad Pea 3, Pea 89

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

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

**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:** Powdery mildew in all agroecological situations
Fusarium wilt in autumn sown crop

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

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

**Powdery mildew**

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

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

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

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

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

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

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

1. Monkey Menace
2. Need to increase seed production program in distt.
3. Non-availability of quality seeds and lack of irrigation facilities.

**9A.Name of the fodder crop: Berseem**

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

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

iii. **Existing package of practices being used:** Only irrigated areas of valleys in small pockets

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

1. Soil : loam to clay soil
2. Field preparation: 3-4 Harrowing + Leveling the field.
3. HYVS. – Mescavi, Vardan. BL-10, 22,42, 180, Pusa Gaint & Bundel Berseem 243
4. Seed rate: 25-30 kg/ha
5. Sowing method:

a. Wet method-like rice in puddled field

b.Dry method: Without puddled.

6. Broad casting
7. Sowing time: First an week of October
8. Fertilizer: 30:60:70:: N:P2O5 K2O kg/ha
9. Irrigation: Field should remain at field capacity throughout the crop period after germination.
10. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.
11. Cutting management: First cut -45-50 DAS
12. Other cutting at 25-30 days interval- total 5-6 cutting are taken
13. Yield: 800-1000g/ha. Green forage.

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

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

vii. **Major disease associated with crop: IPM Module for management of disease:**

viii. **Major weeds associated with crop:** Kasni

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

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

1. Timely sowing,
2. Manage water availability,
3. Sale of green fodder

xi. **Production constraints in agro-ecological region:** lack of knowledge

**9B.Name of the fodder crop: Maize**

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:** African tall

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

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

1. Soil: Well drained alluvial soil with soil PH 5.5-7.5.
2. Field preparation: 4-5 harrowing + leveling
3. HYVS: African Tall, J-1006. Pratap Makka Chari-b.
4. Seed rate: 50kg/ha
5. Spacing : 30-45 cm (row to row distanced)
   10-15 cm (plant to plant)
6. Sowing time
   Rainfed: Onset of monsoon
   Irrigated : Feb to July
7. Sowing method : Line sowing is proposed over broadcasting

8. Fertilizer : 100-120 : 60:40: 20::: P2O5 : K2O: ZnSo4 kg/ha
9. Irrigation : Fodder maize grown under irrigated condition should be irrigated at 20 days interval. Spring/summer crop requires 5-6 irrigations.
10. Weed control: Pendimethalin @ 0.75 kg ai/ha (PE) application.
11. Harvesting: The crop should be harvested at tasseling /silling stage or 50-55 days after sowing.
12. Yield: Green fodder : 350-450q/ha.

**v. Major insect pests associated with crop:**
**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:** Seasonal weed
x. **IPM Module for management of weeds:**Hand weeding
**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of fodder variety
2. Judicious use of fertilizer
3. Cob use for concentrate

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

**9C.Name of the fodder crop: Oat**

**i. Existing varieties being used:** Kent
**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** UPO212
iii. **Existing package of practices being used:** Traditional methods
**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

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

**v. Major insect pests associated with crop:**
**vi. IPM Module for management of insect pests:**
**vii. Major disease associated with crop:**
**viii. IPM Module for management of disease:**
ix. **Major weeds associated with crop:** Local weeds
x. **IPM Module for management of weeds:** Hand weeding
**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of HYV
2. Timely sowing
3. Judicious use of fertilizer
4. Sale as green fodder

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

**C1. Livestock: Buffalo**

**1.A Existing breeds available:** Badri, Nd, CB
**1.B Specific breeds to be introduced:** Red sindhi and Sahiwal
**2.A Existing feeds being used:** Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)
**2.B Specific feeds to be introduced / advised:**

**Green fodder:**

1. Agro -based fodder plantation i.e. planting the trees outside the farm and main crop in the center. Increasing the tree density of fodder trees in the forest.
2. Motivating villagers to follow the scientific system of lopping
3. Planting the bunds of fodder grasses in between the fields.
4. By giving proper protection to the herbs, bushes and herbaceous plant.
5. Can be stored in form of silage/ hay. Treating them with the chemicals and maintaining the stores.
6. Generally farmers prefer to grow food crops rather than animal fodder, in this context farmers and livestock owners should be motivated that food grains can be easily procured from the local market according to their requirement but to procure fodder from the market is not possible at all. Hence, they must spare some of the agricultural land or the waste land for seasonal fodder crops production.

**Dry fodder:**

1. Wheat and paddy straws are left over or burnt and ploughed in the field, the leftover crop residues can be reaped, bailed, treated, stored and transported to deficit areas in hills.
2. Dry fodders and other cellulosic wastes may be treated with urea and bailed or they can be converted into compact feed blocks in to convenient size and weight, therefore transported to very remote areas of the hilly terrains and also required lesser place for storage. wheat, Paddy, Madua and Jhingora stalks and maize stovers can be fully utilized after chopping and feeding them in troughs and mangers.
3. Livestock owners should be motivated and educated to feed the stalks, stovers, dry grasses, green fodder and tree leaves after chopping them in small pieces, soaking in water and feeding such fodders in troughs, baskets or mangers. Enrichment of straws/ cellulosic wastes through urea.
4. By changing the change the attitude of farmers to not burn the crop residues and utilize them as livestock feed.
5. Grass production from forest areas can be increased many folds by introducing higher yielding varieties of grasses such as hybrid Napier, Setaria, Guinea, Deenanath, Anjan, Tall fescue, Brome and Rye grass etc.
6. By introducing the measures for higher bio mass production in Van Panchayats. Providing protection to the Fallow, wastelands and orchards.

**Complete feed blocks (qtl)**

1. Involving the NGOs in procuring the waste straws and other agro-industrial byproducts and non conventional feeds from tarai areas.
2. New variety of fodder plants needs to be introduced. Fodder Banks in remote areas and providing the feed and fodder at reasonable price to the farmers.

**Wastage of fodder (qtl)**

Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

**3.A Existing health services:**

Diseases covered under vaccination: FMD, PPR, BQ and HS

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

Other Disease Control Programs/ Health Camps (criteria, target): Infertility Camps

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

1. 3 times scheduled deworming before and after rainy season and during winters.
2. At least 4 health camp per hospital

**4.A Existing management practices:**

Housing, hygiene, drainage: Shed locally called as "GOTH", No proper system of drainage,

ventilation and lighting facilities.

Feeding & watering practice: Generally animals are taken to forest for grazing.Whole plant residues are given as feed to the animals.

Welfare aspects: Mainly producing for their hosehold consumption. The marketing approach is still lacking.

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

1. Practiced of Weaning should be adopted.
2. Different shed for the pregnant animal should be there.
3. Use of chaff cutter and manger to minimize the wastage of fodder and labour of the women should be promoted.

Use of Urea-Molasses-Mineral Block

**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:**

**C2. Livestock: Cattle**

**1.A Existing breeds available:** ND

**1.B Specific breeds to be introduced:** Murrah

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

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

**Green fodder:**

1. Agro -based fodder plantation i.e. planting the trees outside the farm and main crop in the center. Increasing the tree density of fodder trees in the forest.
2. Motivating villagers to follow the scientific system of lopping
3. Planting the bunds of fodder grasses in between the fields.
4. By giving proper protection to the herbs, bushes and herbaceous plant.
5. Can be stored in form of silage/ hay.
6. Treating them with the chemicals and maintaining the stores. Generally farmers prefer to grow food crops rather than animal fodder, in this context farmers and livestock owners should be motivated that
7. the food grains can be easily procured from the local market according to their requirement but to procure fodder from the market is not possible at all. Hence, they must spare some of the agricultural land or the waste land for seasonal fodder crops production.

**Dry fodder:**

1. Wheat and paddy straws are left over or burnt and ploughed in the field, the leftover crop residues can be reaped, bailed, treated, stored and transported to deficit areas in hills.
2. Dry fodders and other cellulosic wastes may be treated with urea and bailed or they can be converted into compact feed blocks in to convenient size and weight, therefore transported to very remote areas of the hilly terrains and also required lesser place for storage. wheat, Paddy, Madua and Jhingora stalks and maize stovers can be fully utilized after chopping and feeding them in troughs and managers.
3. Livestock owners should be motivated and educated to feed the stalks, stovers, dry grasses, green fodder and tree leaves after chopping them in small pieces, soaking in water and feeding such fodders in troughs, baskets or mangers.
4. Enrichment of straws/ cellulosic wastes through urea.
5. By changing the change the attitude of farmers to not burn the crop residues and utilize them as livestock feed.
6. Grass production from forest areas can be increased many folds by introducing higher yielding

varieties of grasses such as hybrid Napier, Setaria, Guinea, Deenanath, Anjan, Tall fescue, Brome and Rye grass etc.

7. By introducing the measures for higher bio mass production in Van Panchayats. Providing protection to the Fallow, wastelands and orchards.

**Complete feed blocks (qtl)**

1. Involving the NGOs in procuring the waste straws and other agro-industrial byproducts and non conventional feeds from tarai areas. New variety of fodder plants needs to be introduced.
2. Fodder Banks in remote areas and providing the feed and fodder at reasonable price to the farmers.

**Wastage of fodder (qtl)**

Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

**3.A Existing health services:**

Diseases covered under vaccination: FMD, PPR, BQ and HS

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

Other Disease Control Programs/ Health Camps (criteria, target): Infertility Camps

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

1. 3 times scheduled deworming before and after rainy season and during winters.
2. At least 4 health camp per hospital

**4.A Existing management practices:**

Housing, hygiene, drainage: Shed locally called as "GOTH", No proper system of drainage, ventilation and lighting facilities.

Feeding & watering practice: Generally animals are taken to forest for grazing.Whole plant residues are given as feed to the animals.

Welfare aspects: Mainly producing for their hosehold consumption. The marketing approach is still lacking.

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

1. Practiced of Weaning should be adopted.
2. Different shed for the pregnant animal should be there.
3. Use of chaff cutter and manger to minimize the wastage of fodder and labour of the women should be promoted.
4. Use of Urea-Molasses-Mineral Block

**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:**

**C3. Livestock: Sheep**

**1.A Existing breeds available: -**

**1.B Specific breeds to be introduced: -**

**2.A Existing feeds being used:** Green fodder, Dry fodder

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

**3.A Existing health services:**

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

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

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

1. The sheep house should always be protected from hot and cold wind, humidity, solar radiation and rain. The house should have east-west orientation.
2. Shed should be constructed on elevated land and free from water logging or marshy areas.
3. Adequate floor space (1.2 to 4.0 sq mt/ goat) may be provided to avoid overcrowding.

4. Breed improvement should be adopted.
5. Castration at the right age i.e. 1 to 2 months forbetter meat quality, higher market price and unwanted breeding in the flock.

**4.A Existing management practices:**

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

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

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

**C4. Livestock: Goat**

**1.A Existing breeds available:** Chaugarkha, ND

**1.B Specific breeds to be introduced:** Barbari

**2.A Existing feeds being used:** Green fodder, Dry fodder

**2.B Specific feeds to be introduced / advised:** Scientific grazing systems should be adopted on grazing lands and alpine grasslands

**3.A Existing health services:**

Diseases covered under vaccination: PPR

Deworming schedule: -

Other Disease Control Programmes/ Health Camps: PPR , Viral Exanthema

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

1. 3 times scheduled deworming before and after rainy season and during winters.
2. Regular treatment camps to be organized

**4.A Existing management practices:**

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

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

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

1. The goat house should always be protected from hot and cold wind, humidity, solar radiation and rain. The house should have east-west orientation.
2. Shed should be constructed on elevated land and free from water logging or marshy areas.
3. Adequate floor space (1.2 to 4.0 sq mt/ goat) may be provided to avoid overcrowding.
4. Breed improvement should be adopted.
5. Castration at the right age i.e. 1 to 2 months forbetter meat quality, higher market price and unwanted breeding in the flock.

**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:**

**C5. Livestock: Poultry**

**1.A Existing breeds available:** Croiler

**1.B Specific breeds to be introduced:** Very few broiler farms are in existence so it needs to be incorporated

**2.A Existing feeds being used:**

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

**3.A Existing health services:**

Diseases covered under vaccination: Fowl pox and RD

Deworming schedule: -

Other Disease Control Programmes/ Health Camps: The field is Scattered

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

**4.A Existing management practices:**

Housing, hygiene, drainage: Backyard rearing

Feeding & watering practice: Household waste, stones

Slaughtering & dressing, etc: Sold as live bird

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

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

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

**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:**

**C6. Livestock: Fisheries**

**1.A Existing breeds available:** Common Carp, Silver carp, Grass carp, Mahasheer

**1.B Specific breeds to be introduced:**

**2.A Existing feeds being used:**

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

**3.A Existing health services:**

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

**4.A Existing management practices:**

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

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

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

**Vet. Health services**

| **Resouces** | | **Manpower** | | | | | | | **Infrastructure** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | V. O. | LEO | Pharmacist | Lab. Tech. | Livestock Assistant | Para vets | Buildings | Equipments | Others |
| Vety. Hospitals | Existing | 37 | 34 | 48 | 15 | - | 86 | - | 27(Own) and 10(Rent) | Available | - |
| | Proposed | - | 3 | 59 | 24 | - | - | - | - | - | - |
| Mobile Vety. Unit | Existing | 1 | 1 | - | - | - | - | - | No | Not Available | - |
| | Proposed | 1/ block | 11 | - | 12 | 12 | - | - | - | Needs to be procured | |
| Vety. Dispen. | Existing | 107 | - | 48 | - | - | - | - | - | - | - |
| | Proposed | - | - | 59 | - | - | 107 | - | - | - | - |
| AI centres | Existing | 69 | 30 | 39 | - | - | - | | | Available | - |
| | Proposed | - | - | - | - | - | - | - | - | - | - |
| Disease Diag. Labs | Existing | 1(Divisional Level) | 1 | - | - | Vaccant | 1 | - | 1 | Available | - |
| | Proposed | - | - | - | - | 1 | - | | | | |
| Polyclinic | Existing | No | - | - | - | - | - | - | - | - | - |
| | Proposed | 2 | 2 | 4 | 2 | 2 | 4 | - | Required | Required | - |
| Ambu. Clinics | Existing | No | - | - | - | - | - | - | - | - | - |
| | Proposed | - | - | - | - | - | - | - | - | - | - |

**Availability of Medicines/ Vaccines**

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

1. Nutritional gap needs to be filled. Farmers should be provided feed & fodder supplements at subsidised rates.
2. Minimum support prize should be fixed for the farm products.
3. Improved market infrastrusture and market scope.

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

1. Need restructuring of the department especially for the hilly areas so as to fulfil the staff requirement.
2. Refresher course should be organised for the doctors.

**Problems of Animal Husbandry**

| | | |
|---|---|---|
| Specific problems due to which income is not increasing | Poor accessibility | yes |
| | Water scarcity | Almost in the whole district |
| | Natural disasters | Frequency is low |
| | Wild life conflicts | Yes frequency is very high due to which farming intensity is decreased to a significant level |
| | Marketing of animals | No availability of structured market |
| | Marketing of products | Low production due to which there is no surplus to be marketed and the transportation cost is also very high thus making is not feasible |
| | Budget | Allocation is low |
| | Manpower shortage | Yes. Monopoly gender role in livestock activity |
| | Capacity building | Para veterinary staff and refreshal courses of vetenarians is required |
| | Equipment & Implements (old/ shortage, etc.) | Adequate |
| | Mobility | Huge Problem. Dependence on the public vehicle is very high. Difficult terrain. Difficult road connectivity. |
| | Risk cover (Insurance) | Not given but should be given |
| | Relook to policies | - |

**D. Integrating Farming system**

**1.A Existing farming system:** Cattel+Crop/Vegetable

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

1. Protected cultivation+ Composting+Goatry/Backyard poultry
2. Fodder production+ Mini dairy+Composting+ Protected cultivation
3. Truthful self seed production(Jethi rice,Lentil, onion,radish,frenchbean,Pea)+ Planting material supply+Mushroom

**E. Reducing post harvest losses and value addition**

**1.A Existing grading facilities:** Mannual

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

Pulse -Automatic grading machine

Amaranths mandua , madira-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:** Few units available in fruits

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

Fruits –juice,squaes, candy, jam, finger millets,Soybean-flour, Soybean -tofu& soya chunk preparation , millets-biscuits

**For grains:**

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

**For horticultural crops:**

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

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

**3.A Existing packing facilities:** Few farmers

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

Fruit –juice,squaes, candy, jam, finger millets,Soybean-flour, Soybean –tofu & soya chunk preparation , millets-biscuits

**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

Shrink and wrapping packaging for fresh and minimal processed

**4.A Existing storage facilities:** Use of tradicitional bins only

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

**For grain**:

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

**For Horticultural crop:**

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

**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:**

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

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

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

**3.A Existing fodder production:** Berseem, Maize, oat

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

**Guinea grass (*Panicum maximum*),**

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

**Setaria grass (*Setaria anceps*)**

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

**Spear grass (*Hetropogon contortus*)**

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

**Rhode grass (*Chloris gayana*)**

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

**Marvel grass (*Dicanthium annulatum*)**

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

Packages of practices to be advised for

**Waste Land Development**

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

5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
7. Diversion of runoff through ditches from upper slopes to safer places.
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
10. Contour trenching (staggered/continuous).

**Waste Water Management**

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

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

**4.A Type of waste water:**

1. Effluent from kitchen and bathroom
2. Flowing springs

**4.B Existing treatment facilities:** NA

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

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

**G. Reduced cultivation cost**

**1.A Existing inputs being given:**

**Rice-wheat/Rice-Potato/Maize-Rajma/Mustard**

1. Annexure–II is enclosed for N, P and K.
2. In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn)/ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop
3. 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. Soil application of 215 kg gypsum/ha
5. Foliar spray of 1% $FeSO_4$ in rice nursery

**Tomato, Cabbage, Capsicum, French bean, Green pea, Radish**

1. In Zn deficient soils, application of 10 kg $ZnSO_4$ (21% Zn)/ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop
2. Foliar spray of 0.2% Borax
3. Soil application of 215 kg gypsum/ha

**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:**

**Paddy**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Conventional nursery raising.
3. Puddling by damala / peg type wooden puddler.
4. Manual transplanting.
5. Manual weed control.
6. Manual fertilizer application.
7. Manual harvesting.
8. Manual threshing.
9. Hand operated paddy thresher –cum-winnower.
10. Cleaning by winnowing fan.

**Wheat**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**Pulses**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting / line sowing / manual thinning.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**Millets**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting / line sowing / manual thinning or by animal drawn danala.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**Soybean**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual line sowing.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**Maize**

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

**Potato**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Furrow making manually or by animal drawn Nasuda.
3. Manual planting and ridge making.
4. Manual weed control.
5. Manual fertilizer application.
6. Manual harvesting / using animal drawn Nasuda.
7. Manual grading.

**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.

Manual grading.

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

**Paddy**

1. Seedbed preparation by using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Puddling by light weight power tiller / animal drawn improved Pant damala.
3. Weed control by conoweeder.
4. Manual harvesting / harvesting by power cutter / power tiller front mounted vertical conveyor reaper.
5. Threshing by Pant axial flow power hill thresher / hand operated paddy thresher-cum-winnower.

**Wheat**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by single or double row Pant zero-till drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe.
4. Plant protection by manually operated sprayers.
5. Manual harvesting / harvesting by power cutter / power tiller front mounted vertical conveyor reaper.
6. Threshing by Pant wheat thresher for hills.

**Pulses**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by single or double row Pant zero-till drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe.
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.
6. Pant axial flow power hill thresher.

**Millets**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Manual line sowing / improved millet seed drill.
3. Weed control by improved wheel hoe.
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.

6. Threshing by VPKAS millet thresher.

**Soybean**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by Pant zero-till single / double row seed drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.
6. Light weight soybean thresher / Pant multi-crop hill thresher.

**Maize**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Manual sowing / power tiller operated maize planter.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Manual earthing-up of plants
5. Plant protection by manually operated sprayers.
6. Manual harvesting using improved sickles.
7. Shelling by hand held maize sheller / power operated maize sheller.

**Potato**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Furrow making manually or by animal drawn Pant hill plough / furrower.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Earthining by power tiller operated or animal drawn ridger.
5. Plant protection by manually operated sprayers.
6. Harvesting by animal / power tiller operated potato digger.
7. Grading by mechanical potato grader.

**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. Fertilizer application should be based on soil test value at right time, right place, right stage with right method.
2. Basal application (50%N+100% P&K) at the time of sowing and 02 foliar application of N, secondary and micronutrients on standing crop.
3. Apply well decomposed organic manures and composts such as vermicompost, biofertilizer to supplement costly fertilizers to reduce cost up to 25-30%.
4. Inclusion of pulses in crop rotation.
5. Need based and recommended concentration of plant protection chemicals using correct method of application.
6. Enhanced use of bio-agents to control disease and pests; avoid use of costly chemicals.

7. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons.
8. Use optimum and recommended seed rate at optimum spacing and depth.
9. Use good quality of water and avoid excess use of water for irrigation.
10. Sprinkler and drip methods for irrigation should be encouraged to improve water use efficiency.
11. Promote reduced tillage operations.

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

**Irrigated valleys and lower hills**

1. Represent subtropical climate with moderating high temperature (18-30 $^{0}$C) medium rainfall, low humidity (40-50%) and experiences no snowfall. 80% of total precipitation is received during June to September.
2. Sal in outer Himalayas and pine and oak in middle and inner Himalayas are the predominant vegetation. Soils are alluvial sandy loam to loam.

**Rainfed lower hills**

1. Soils are gravelly and chirty, deep, sandy loam to silty clay loam.
2. Soils are slightly to moderately acidic in nature.

**Factors responsible for increasing cost of cultivation**

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

of weeds.

19. Severe infestation of insect-pest: white grubs and cut worms are the serious polyphagous pests, kill plants and reduce plant population up to 70-80 %. Due to non availability of suitable plant protection chemicals as well as high cost they are beyond the means of farmers. Besides, non availability of water for solution also poses problems.
20. Weeds; common weeds of the upland rainfed areas are Tipatiya (*Oxalis latifolia*), Pardeshi (*Galenso japarviflora*), Gajar grass ( *Parthenium* sp.) Kuni (*Lantena camera*) Kala bansa (*Eupatorium* sp.). The loss in general in food crops is high from 50-75 %.
21. Improper terrace management: most of terraces developed by farmers are on steep slopes with outward gradient.
22. Lack of proper drainage system for safe disposal of excess rainwater. The heavy runoff of water washes away the top fertile soil lead to steady depletion of nutrients and organic matter.
23. Coarse textured soils (charty/gravely) with low moisture and nutrient retention capacity.
24. Lack of proper storage facilities for crops (cold storage).
25. Lack of awareness for protected cultivation techniques and facilities for commercial high value crops (poly houses, poly tunnels, poly for raising nursery and cash crops.
26. No good marketing facilities.
27. Lack of proper irrigation facilities for minor irrigation and drip irrigation with fertigation.
28. Poor connectivity of road transport system.
29. Lack of farmer's participatory approach models for crop production technologies under hill agricultural system for the state.

**H. off-farm income**

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

Shahbhagita(Behgagil), Shanti(Behgagil), Kamdhenu(Shail), Chirag (Shail), Durga(Katarmal), Jai Devi(Katarmal), Jai Surya (Katarmal), Jai golu(Katarmal), Laxmi(Gnayee), Jagriti(Dhon), Gogata first (Gogata), Gogata second(Gogata), Gogata third(Gogata), Laxmi (Bachurari), bhagwati(Dholra), Bargav-2(Bargav), Golu(Bargav), Naveen(Pantkotli), Saral(Pantkotli), Eroli first(Eroli first), Pratiksha(Pilkholi), Deepika(Pilkholi), Pawan(Pilkholi), Prem second(Aliee), Maya(Aliee), Jaidurga (Daso), Swayam deveta (Bhetadangi), Jaigoludeveta(Bhetadangi), Bhagwatimata (Bhetadangi), Jagran(Simalgaon), Navjyoti(Simalgaon), Sakhi (Bhandergaon), Jyoti(Bhandergaon), Saral(Adbora), Siddhi (Adbora), Jalali SHG(Jalali), Ekta(Jalali), Muniyachora first (Muniyachora), Jai bhumiya (Neikana), Shiv shakti(Pali), Nav Jyoti (Pali), Ma jagdamba(Chani), Ma saraswati(Chani), Laxmi (Rampur), Rampur second(Rampur), Priyanka(Erari), Bhagwati (Bajkhet), Lakshmi(Kapkot), Suman(Kapkot), Kali(Goona), Aart (Goona)

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

Shahbhagita(Behgagil), Shanti(Behgagil), Kamdhenu(Shail), Chirag (Shail), Durga(Katarmal), Jai Devi(Katarmal), Jai Surya (Katarmal), Jai golu(Katarmal), Laxmi(Gnayee), Jagriti(Dhon), Gogata first (Gogata), Gogata second(Gogata), Gogata third(Gogata), Laxmi (Bachurari), Bhagwati(Dholra), Bargav-2(Bargav), Golu(Bargav), Naveen(Pantkotli), Saral(Pantkotli), Eroli first(Eroli first), Pratiksha(Pilkholi), Deepika(Pilkholi), Pawan(Pilkholi), Maya (Aliee), Jaidurga (Daso), Swayam deveta(Bhetadangi), Jaigoludeveta(Bhetadangi), Bhagwatimata(Bhetadangi), Jagran (Simalgaon), Navjyoti(Simalgaon), Sakhi(Bhandergaon), Jyoti (Bhandergaon), Saral(Adbora), Siddhi(Adbora), Jalali SHG(Jalali), Ekta(Jalali), Muniyachora first(Muniyachora), Jai Bhumiya (Neikana), Shiv Shakti(Pali), Nav Jyoti(Pali), Ma Jagdamba(Chani), Ma Saraswati (Chani), Laxmi(Rampur), Rampur second(Rampur), Bhagwati(Bajkhet), Lakshmi(Kapkot), Suman(Kapkot), Kali (Goona), Aart(Goona),

1. There is need to have regular monitoring and follow up of SHG's by the forming agencies and time to time evaluation of the group.

2. Regular monitoring by the concerned agency must be ensured like ensuring regular meeting of the SHG, checking their register, regular collection of the money, help during conflicts, solving problems occurring during banking etc. and submitting the monitoring report to their concerned officials so that steps can be taken by the high officials to ensure regular continuity of the SHG.
3. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
4. A large number of groups discontinued as they were not having knowledge regarding income generating activities that can be started (what activities can be taken up, how to operate it, where to market the produce etc.) So there is need of encouragement, motivation along with imparting knowledge, skills and linking them to market.
5. Trainings should be provided to the rural women on income generating activities as per the need of rural women, marketing potential and availability of locally available resources.
6. Loan procedure should be made more flexible with less interest rate.
7. As there were problems like non-cooperation among members, confusion regarding money matter, lack of confidence on office bearers with respect to group money etc., there is need of organizing training on good governance, democratic election and how to solve financial and administrative issues.
8. SHG's formed should be grouped into clusters, federations and registered cooperatives so as to converge with govt. schemes, facilitate collective purchase of input and marketing of products.
9. To encourage people to form and sustain SHG's so that new enterprise developed, intensive work needs to be done with them in sustainable manner.
10. Enterprises need to be identified depending upon local resources- human and material. Market linkages need to be developed so that people can sell their produce gainfully.

**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:**

1. Dairying, Copper, wood carving,
2. Burans fruit juice, woollen articles, carpet weaving, preparation of shawl etc. from Bicchu grass weaving,
3. Processing of pulses,
4. Bal mithai, Bakery unit etc.

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

1. Farm machinery bank, Lively hood activities
2. Copper, wood carving, buranse fruit, woollen articles, carpet weaving,
3. Aipan designing, nettle fibre craft (bichu grass) are local crafts of the area which can be further promoted for generation of income and employment, Processing of pulses, Bakery unit etc.

**3.A Existing skill development facilities:** Zila Udyog Kendra, Educational institute and NGOs

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

1. Demonstration , Exposure visit, Farmer exhibition, Workshop
2. Training centre, processing and packaging units as per the locally available resources

**4.A Existing women skilling facilities:** Zila udyog Kendra, Educational institute and NGOs

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

1. Demonstration ,Training , Exposure visit, Farmer exhibition, Workshop ,SHG formation
2. Nursery , Mushroom, Beekeeping,
3. Dairy, Fodder production, Preservation/Value addition,Boutique
4. Training centres processing, packaging units and market outlet as per the locally available resources

**5.A Existing youth skilling facilities:** Zila udyog Kendra, Educational institute and NGOs.

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

1. Nursery, Mechanic, Mushroom, Beekeeping, Dairy, Fodder production, Preservation/Value addition
2. Training centres processing, packaging units and market outlet as per the locally available resources

**Beekeeping**

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

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

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

Beekeeping in Uttarakhand: Beekeeping has been an integral part of human society since centuries in hill regions of Uttarakhand state. The state of Uttarakhand has a predominantly agrarian economy and large number of small and marginal farmers in the mountainous state call for augmenting agricultural production by organic means. The indigenous bee sub-species *Apis cerana indica* commonly is ideal pollinator for organically grown mountain crops, with the capacity to significantly enhance agricultural productivity with an indirect but vital role in combating soil

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

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

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

Flora suitable for *Apis cerana indica* in Almora, Uttrakhand region is given below:

| Bee flora (common name) | Scientific name | Source of food |
|---|---|---|
| Simbal | *Bombax ceiba* | Nectar/Pollen |
| Beol | *Grewia* | Nectar/Pollen |
| Ritha | *Sapindus edetergens* | Nectar |
| Onion | *Alium cepa* | Nectar/Pollen |
| Dharak | *Melia azadiracta* | Nectar |
| Sarson | *Brassica compestis* | Nectar |
| Raya | *B. juncea* | Nectar/Pollen |
| Bottle Brush | *Callistemon lanceolatus* | Nectar |
| Amaltas | *Cassia fistula* | Nectar |
| Dhania | *Coriandrum sativum* | Nectar/Pollen |
| Shishum | *Dalbergia sisoo* | Nectar/Pollen |
| Safeda | *Eucalyptus spp.* | Nectar/Pollen |
| Sunflower | *Helianthus annuus* | Nectar/Pollen |
| Guava | *Psidium guajava* | Nectar/Pollen |
| Behda | *Terminalia bellerica* | Nectar/Pollen |
| Hirda | *Terminalia chebula* | Nectar |

| | | |
|---|---|---|
| Toon | *Toona ciliata* | Nectar |
| Ber | *Ziziphus mauritiana* | Nectar/Pollen |
| Bhang | *Cannebis sativa* | Pollen |
| Malta | *Citrus aurantifolia* | Nectar/Pollen |
| Apple | *Malus domestica* | Nectar/Pollen |
| Badam | *Prunus amygdalus* | Nectar/Pollen |
| Til | *Sesamum indicum* | Nectar/Pollen |
| Apricot | *Prunus armeniaca* | Nectar/Pollen |
| Plum | *P. domestica* | Nectar/Pollen |
| Pear | *Pyrus pashia* | Nectar/Pollen |
| Peach | *Pyrus persica* | Nectar/Pollen |
| Tipatia | *Trifolium sp* | Nectar/Pollen |
| Paja | *Prunus puddum* | Nectar/Pollen |
| Buckwheat | *Fagopyrum aurantifolia* | Nectar/Pollen |
| Almora weed | *Rumex spp.* | Nectar |
| Goosberry | *Ribes grossularia* | Nectar/Pollen |
| Rose apple | *Eugenia jambus* | Nectar/Pollen |
| Mango | *Mangifera indica* | Nectar/Pollen |
| Citrus | *Citrus sinensis* | Nectar/Pollen |

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

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

**3. Management of apiary:**

**A. Placement of colonies in apiary**

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

Hives used for traditional beekeeping in hilly areas are

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

**Log hives:** Two types of log hives are found, Type I: These are made up of cylindrical hollowed pieces of tree trunk 60-100cm long and 20-40 cm in diameter; however size depends upon the circumference of available trunks. This type of log hives is usually made from the trunk of *Quercus leucotrichophora, Q. floribunda, Rhododendron arboreum and Pinus roxburbhii.* The entrance is

made at the mid front side. Both sides are plastered with a mixture of cow dung and clay. Type II: Old cooperages locally known as 'Pariya' or 'Dokha' when rendered useless for milk products, are used as hives. These are about 70-90 cm long with the diameter at top from 25-35 cm and thickness of log 3-5cm. An entrance is made towards the outside and the hive is placed horizontally on a raised platform of stones or the wall of a courtyard. It is mainly made up of the wood of *Ougeinia oogeinesis, Rhododendron arboreum, Toona* spp. A stripe of old comb is fixed to the upper part, inside the hive, and is plugged with a wooden or metal cover, then sealed with a mixture of clay and cow dung. The wooden lid is fixed at the top with an entrance on it.

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

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

**B. Inspection of colonies**

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

**C. Provision of fresh water in the apiary**

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

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

**D. Dearth period management**

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

should be provided when pollen stores in the colonies is not adequate and pollen is not available in the area
7. Provide fresh water near the colony in shallow vessels
8. Extra frames should be stored in air tight chambers and fumigated with sulphur powder regularly
9. Old and dark combs should be discarded

**E. Care during honey extraction**

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

**F. Care during migration**

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

**G. Seasonal management of apiary**

a**) Summer Management**

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

**b) Monsoon management**

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

**c) Post monsoon season management**

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

**(d) Winter management**

1. Examine the colonies and provide winter packings in weak colonies specially in hilly areas
2. Feed sugar/pollen substitute to weak colonies as stimulative feeding to provide energy and

initiate brood rearing
3. Shift the colonies to sunny places
4. Protect the colonies from chilly winds by using wind breaks
5. Unite the weak colonies with stronger ones

**e) Spring management**

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

**H. Protecting colonies from pesticides**

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

**I.Methods of attracting and catching swarms**

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

**J. Management of Honey Bee Diseases and pest**

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

1. Select good site to locate the apiary preferably in an open, dry place with shade.

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

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

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

**K. Honey Extraction**

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

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

**Mushroom cultivation**

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

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

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

**Steps of cultivation process**

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

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

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

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

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

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

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

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

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

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

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

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

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

**Short method of composting :** Compost prepared by short method of composting is superior in

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

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

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

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

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

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

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

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

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

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

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

**2. Oyster mushroom**

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

**Steps of cultivation process**

**Substrate and its preparation**

The tropical wastes like rice straw, wheat straw, corncobs, dried water hyacinth, sugarcane bagasse, banana leaves, cotton waste or sawdust are used as substrate for cultivation. The straw should be cut into small pieces (3-5cm long) to facilitate proper wetting as well as to increase surface area.

Although this mushroom can be cultivated on simple water soaked straw but there are chances of crop failure due to presence of contaminants. In order to avoid contaminations the straw should be treated by hot water and chemical.

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

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

**Proper timing for cultivation** Feb-April & Aug.-Oct. (02 crops)

**Cultivated spices:** *P. sajor-caju, P. florida, P. sapidus, P. eryngii, P. cornucopiae, P. flabellatus, P. djmore, P. eous, P. ostreatus*

**Spawning and crop management :** Oyster mushroom spawn should be about 15-20 days old when mycelium has formed complete coating around the grain. The normal rate of spawning in a pasteurized substrate is 2-3% of the wet substrate. The spawning is usually done by mixing the spawn throughout substrate. Before filling the substrate in polythene bags, holes of about 1 cm diameter are made at 10-15 cm distance all over the surface for free diffusion of gases and heat generated inside. The optimum temperature for growth of mycelium is 23 ±2$^{o}$C. Relative humidity in growing room should be range between 85-90% during spawn-run. Spawn run usually takes about 15-20 days. After complete spawn run, polythene removed completely with help of sharp knife carefully. Usually 3-4 days after opening the bags, mushroom primordial (pin heads) begin to form. After opening the bags water should be sprayed 2-3 time per day regularly.

**Harvesting and yield:** Mature mushrooms become ready for harvesting in another 2-3 days. An average biological efficiency (fresh weight of mushrooms harvested divided by dry substrate weight x 100) can range between 70-80% and sometimes even more. To harvest the mushrooms, they are grasped by the stalk and gently twisted and pulled. A knife should not be used.

**3. Milky Mushroom**

*Calocybe indica* is commonly known as milky mushroom or dudhiya mushroom due to its milky white appearance of the fruit body. It can be easily cultivated at the temperature range between 25-35$^{o}$C and relative humidity 70-90 per cent.

**Substrate and its preparation**

The tropical wastes like chopped paddy straw and wheat straw are used as substrate for cultivation. To avoid contaminations the straw should be treated by hot water and chemical as like oyster mushroom.

**Proper timing for cultivation:** April-Sept. (02 crops)

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

**Spawning and crop management**: About 18-20 days old spawn is used for spawning. Spawning should be done @ 4 per cent of ready substrate. The spawning is usually done by mixing the spawn throughout substrate. The spawned substrate should be filled in polythene bags 4-5kg per bag. The bags should be folded at the top and covered up. The optimum temperature for growth of mycelium, ranges between is 20-37$^{o}$C. Relative humidity in growing room should be range between 80-85% during spawn-run. Spawn run usually takes about 15-20 days.

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

**Harvesting:** The fruit bodies should be harvested before spore release by twisting so that stubs are not left on substrate. After harvesting lower portion of stalk with adhering casing soil should be cut

with sharp knife. About 70 kg fresh mushroom can be harvested per quintal of dry substrate.

**I. Enabling Policies**

**1.A Existing policies related with agriculture and animal husbandry:**

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

1. Selection of crop and area specific crop production programme.
2. Timely and assured supply of agricultural inputs to farmers at door.

**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:** Establishment of food processing units at distt/thesil/block level to procure and marketing of surplus

**3.A Existing Incentives:**

**3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district:** An assured bonus to farmers to grow new crop or higher production potential

**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:** Risk coverage may be applicable for all agricultural products and animals

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

**1.A Existing marketing facilities:**

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

1. Contractual farming,
2. Linkages with MNCs and NCs,
3. Mahila hat, local hat, weekly bazaar and local mandi,
4. AC van,
5. Online portal for sale

**2.A Existing grading facilities:**

**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

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

**3. Existing marketing and value addition problems in the specific agro-ecological region:** No marketing facility, No value addition facility, High transportation cost

**K. Online Management and Evaluation**

**1.A: Existing online management structure available:** Internet etc.

**1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district:** DBTL,Adhar, Pan, On line registration

**2.A: Existing evaluation procedure:** Manual

**2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district:** Internet , GPS, Email, Whatup, ITC tools

**3.A: Existing monitoring system:** Physical

**3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district:** GPS, E-mail, Whatsup, ITC tools

**4.A: Existing feedback system:** Manually

**4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district:** Internet portal and proper software for evaluating ongoing activities

**5.A: Existing reading system:** Literature, Booklets, Hindi Extension Journals etc

**5.B: Reading system required for online management and evaluation in specific agro-climatic region of district:** Farm advisory portal, online helpdesk services, mobile advisory

**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. Popularisation of high yielding varieties of major crops viz.
2. Finger millet (VL Mandua 315, VL Mandua 324, VL Mandua 347 and VL Mandua 352) in Syaldeh, Sult and tarikhet blocks.

3. Barnyard millet (VL Madira 172 and VL Madira 207) in Syaldeh, Sult and tarikhet blocks.
4. Soybean (VL Soya 47, VL Soya 59, VL Soya 63 and VL Bhat 65) in Syaldeh, Sult and tarikhet blocks.
5. Horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19) in Syaldeh, Sult and tarikhet blocks.
6. Spring rice (VL Dhan 208,VL Dhan 209 and VL Dhan 210) in Syaldeh block
7. Jethi rice ( Vivek Dhan 154 and Vivek Dhan 157) in Bhikiasen and Syaldeh blocks
8. Irrigated Rice (VL *Dhan 65,* VL Dhan 86, VL Dhan 68, Vivek *Dhan 85*, Pusa Basmati 1509 and PRH 10) in Syaldeh and Chaukhutia
9. Wheat ( VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953 and UP 2572) in Syaldeh and Chaukhutia
10. Barely (VL Jau 118 and VL Jau 130) in Syaldeh, Sult and tarikhet blocks.
11. Lentil ( VL *Masoor* 103, VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, PL 5 , PL 7, PL 8) Syaldeh and Sult blocks.
12. Pili sarson (PPS1) Syaldeh and Sult blocks.
13. Vegetable pea (Vivek Mattar 10, Vivek Mattar 11 and Vivek Mattar 12) in Tarikhet block.
14. French bean (VL Boni Bean 1 and VL Bean 2) in Tarikhet block.
15. Tomato (VL Tamatar 4) in Tarikhet and Syaldeh block.
16. Onion (VL Piyaz 3) in Tarikhet block.
17. Garlic (VL Garlic 1 and VL Lahsun 2) in Tarikhet block.

**Strengthening of traditional water storage structure**

1. Creation of additional water storage tank in*, Salt*, Dawarahat, Syaldeh and *Tarikhet* block for lean season.
2. Promotion of rain water harvesting and drip-fertigation system in *vegetable* clusters in this region.
3. Creation of trenches for high percolation of water in slope/ terraces in all blocks of this region.
4. Promotion of water conservation techniques like mulch, sprinkler and drip for juvenile plants in Dawarahat, Syaldeh*, Salt* and *Tarikhet* blocks of this region.
5. Popularisation of roof water harvesting system in all blocks of this region.
6. Rejuvenation and popularisation of traditional water harvesting systems (Naula) in all blocks of this region.

**Adoption of cluster approach for holistic development**

1. Strengthening of old fruit belt of *Syalde, Salt* and *Chaukhutia belts* by introduction of new cultivars of stone fruits and pickling type mango (Late maturity).
2. Mass cultivation of Cinnamon plants at low hills in *Salt, Dawarahat and Chaukhutia* block.
3. Promotion of Ginger/Turmeric cultivation in rainfed areas in all blocks of this region.
4. Promotion of off season vegetable such as tomato, capsicum, radish,potato, onion, garlic(protected/openfield) cultivation in all blocks of this region .
5. Organic cultivation of chilli in *Salt, Tarikhet ,parts of Bhikiyasen* areas of this region.
6. Promotion of organic cultivation of traditional crops (finger millet, Barnyard millet, horse gram, bhatt) through the use of HYVs in Salt Block.
7. Fallow land development under agro-forestry in all blocks of region.
8. Promotion of hybrid/basmati rice particularly in irrigated areas of *Chaukhutiya, Bhaisiyachanna, Someswar valley, Dawarahat, Syalde valleys* and pulses, oilseeds in rainfed areas of all blocks.
9. Irrigated areas of *Syalde, Chaukhutia, Someswar valley and Seraghat* should be used for seed production of rice and wheat.
10. Promotion of common minimum programme technology in vegetables to reduce the cost of cultivation and quality produce.

**Management of wild animal problem**

1. Promotion of lime/lemon in fruits, lady finger in vegetable, ginger or turmeric in spices, dual purpose varieties of barley, wheat and oats or Lemon grass at larger scale in cultivated field in

all blocks to minimize the damage from wild pigs, monkeys and cows.
2. Enacting legislative measures for protection of crop from wild animals.
3. Promotion of protected cultivation in all blocks.
4. Promotion of bio fencing on trench bunds.

**Adoption of Farm mechanisation (Power tiller, thresher etc)**

1. Promotion of serrated sickle, wheel hoe, handle fork, handle kutla, power tiller, small wheat thresher, winnowing fan, small reaper, Vivek mandua thresher for reduction of drudgery in farm women.
2. Popularization of manually operated mini crop harvesters for rice, wheat and millets.

**Management of soil health in low or valley areas**

1. Organic cultivation of traditional crop viz., fingermillet, barnyard millets, black soybean, horsegram, traditional rice in all blocks of this region.
2. Promotion of Bio-fertiliser/soluble fertiliser based farming specially in rainfed areas of this region.
3. Adoption of pulse based crop rotation and maximum use of value added compost/FYM in all blocks of this region.
4. Making available the required recommended nutrients/ micro-nutrients at right time, place and quantity.
5. Adoption of integrated nutrient management in irrigated areas of rice and wheat for *Chaukhutiya, Bhaisiyachanna,Someswarvalley, Dawarahat, Syalde valleys* .
6. Popularization of soil and water conservation measures by pulse based intercropping, contour farming and shoulder bunds in particular rainfed areas of all blocks.
7. Promotion of soil testing kits in all blocks of this region.

**Strategy 2 : Livestock: Goatary, Poultry, Fisheries**

1. Selection of high milk breeds in buffaloes (*Murrah*) and cattle (*Jersy, Red Sindhi ,Gir and Shaiwal*).
2. Establishment of Fodder Bank in each block to meet fodder requirement of area.
3. Establishment of milk chilling plant at *Salt/Syaldeh* block of this region.
4. Establisment of Mollases/Multinutrient feed block at Tarikhet
5. Promotion of Urea, Mollasses, Multinutrient Blocks at *Nyaypanchayt* level.
6. Establishment of hatcheries for need of broilor or croilor at block level like at *Salt* and *Chaukhutiya*.
7. Introduction and promotion of cross Heiffer by Artificial Insemination (AI) for increasing income of marginal farmer in all blocks.
8. Improvement of cattle health through vaccination and proper feeding.
9. Strengthening of traditional water bodies/rivulets with Mahaseer or carps at *Mohan areas* and *Gaggas* areas.
10. Popularisation of green fodder crops ie sorghum, lobia, maize, oat, berseem in all blocks.
11. Community pasture development at village level.
12. Planning for establishment of *Gaushala* at block level to rear unproductive cattles to avoid the damage crops in cultivated areas.

**Strategy 3 : Integrating Farming system**

**Promotion of different Integrated Farming System modules for 20 nali's or 0.4 ha such as:**

**Vegetable based –**

18 nali protected cultivation + 2 nali composting and Goatry/ Poultry

18 nali Protected cultivation (100 $m^2$ low cost polyhouse / shadenet/poly tunnel ) Capsicum, cucumber, Tomato, nursey raising and cole crops/ off season vegetable/ growing vegetable seedlings ; + 2 nali Composting (30$m^2$) + Goatry (4F+1M) /backyard poultry (50birds)

**Live stock based-**

10 nali green fodder + 5 nali Dairy, composting and Goatry/ Poultry+ 5 nali Protected cultivation

**Fodder production** (10 nali; Sorghum, lobia-Oat in rainfed or berseem in irrigated) + Mini dairy (Crossbreed05) + Composting (50sqm) + Protected cultivation; 5 nali

**Crop based-** 15 nali crop and vegetable+ 5 nali Dairy, composting and Goatry/ Poultry.

15 nali Truthfull seed production (Jethi rice, horsegarm,bhatt, Lentil, onion, radish, frenchbean, Pea); + Planting material supply 2 nali + Mushroom + Composting

Crop 14 nali (Gahat, madua, soyabean, lentil- 7 nali + vegetable- Cucurbits, French bean, veg pea, tomato, capsicum and leafy vegetables (7 nali)- 5 nali dairy/backyard poultry; +composting (50sqm).

**Strategy 4 : Reducing post harvest losses and value addition**

1. Establishment of processing units for pickle making in *Chaukhutia/ Salt/ Saylde/ Bhikiasein block of* this region.
2. Establishment of Food and Processing Units /Value addition centre at fruit/vegetable belt of the block *Tarikhet, Salt and Syalde*
3. Establishment of procurement centre for efficient marketing of surplus fruit, vegetables in *Chaukhutia, Salt,Saylde, Tarikhet block of* this region.
4. Establishment of marketing chain for efficient/timely supply of produce/product.
5. Promotion of common resources on custom hire basis viz. Mini thresher / mini tractor in *Syalde, Chaukhutia and Salt* block of this region.
6. Establishment of packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities.

**Strategy 5 : Waste land development and waste water**

1. Contour making for arable purpose in waste land in *salt* and other area.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% sloppy area of this region.
3. Popularization of plantation of mulberry, wild fruit plants and fodder trees (*Bheemal, Alnus, Celtis, Oak etc.*).
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland.
5. Popularization of trenches for percolation of water to avoid surface run off.
6. Construction of check dam and artificial structure to maximize water percolation rate in marginal and denudated areas.
7. Construction of tank for storage of water for lean season.
8. Storage of rain water in monsoon season.
9. Development of pasture on waste land.

**Strategy 6 : Reduced cultivation cost**

1. Promotion of well decomposed FYM, vermi-compost and bio-fertilizers to minimize the use of costly chemical fertilizers.
2. Promotion of line sowing and recommended dose of 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. Promotion of use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers in all blocks of this region.
7. Adoption of mulching (bio or degradable plastic) in vegetable and fruit crops to maintain moisture and reduce intercultural operation cost.
8. Promotion of pressurized irrigation techniques in horticultural crops.
9. Promotion of tillers and other garden tools for reduction of drudgery.

**Strategy 7 : Off-farm income**

1. Promotion of subsidiary occupations like handicraft articles (aipen, jute bags, Woolen clothes), candle making, squash, pickles, mushroom production, home made/ value added products (bari,

papad, namkeen, biscuit).
2. Promotion of apiculture for small and landless farmers in *Chaukhutia and Salt* block of this region.
3. Promotion of sericulture in *Chaukhutia and Salt* block of this region.
4. Promotion of cultivation and collection of medicinal plants.
5. Strengthening of SHG/ Federation for specific skill development in income generation activities in women and youth and also for better price realization.

**Strategy 8 : Enabling Policies**

1. Increasing institutional support by providing subsidises and incentives to small and marginal farmers.
2. Labelling of organic inputs and certification mechanism for various crops.
3. Popularization of Udhyan and Krishak Cards for widespread use of government incentives/subsidies to farmers.
4. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
5. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
6. Compulsion of Soil Health Card Scheme, Kisan Credit Card and Crop Insurance for all farmers.

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

1. Creation of better transportation facilities with cool chain van at Block level.
2. Creation of direct linkages with food processing industries for better prices.
3. Establishment of strong linkages with various stake holders to furnish information on crop produce and surplus.
4. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
5. Installation of mini grading machines at village level.
6. Establishment of cold room in different clusters in Chaukhutiya and Salt.

**Strategy 10 : Online Management and Evaluation**

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

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

**A.General information about Agroeco-region**
**District:** Almora
**Agro-ecological region:** Region B (1000 m-1500m)
**Main Blocks in Region:** All Blocks
**Main village cluster in blocks:** 3-4 villages in each nyay panchayat
**Irrigated Clusters:** Habalbagh, Takula,chaukhutia, Dwarrahat,Bhaisiyachana, Syalde
**Rainfed Clusters:** Habalbagh, Takula, chaukhutia, Dwarahat, Bhaisiyachana, Salt, Lamgara, Dhauladevi, Syalde, Tarikhet, Bhikiasain
**Existing rain water management facilities:**
1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj)
3. Village pond (Taal and Chaal)
4. Collection from hill slope (Khaal)
5. Hydrum as lift device
6. Roof water harvesting but limited

**B. Productivity Enhancement**
**1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region**
1. Roof water harvesting system
2. Poly tank for water storage for scattered fields
3. Low cost lining material to check seepage
4. Efficient water application systems (sprinkler and drip)
5. Rejuvenation and popularisation of traditional water harvesting systems
6. Cost effective lifting devices
7. Roof top water harvesting system

**2. Existing practices for soil health improvement**
1. Use of undecomposed farmyard mannure/compost
2. Meagre/ no use of biofertilizers
3. Imbalanced/ insufficient nutrient use in irrigated areas and no/less use in rainfed
4. Use of raw/partially decomposed FYM
5. Meagre/ no compost making/recycling of crop residue

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

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

**Vegetables and spices**
1. Seed/ nursery soil inoculation with Azotobacter/ Azospirillum inoculant and Phosphorus

solubilising microbial culture (each of 200 g/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
5. Promotion of common minimum practices in vegetables(soil solarisation,value addition of compost/FYM,etc)
6. Establishing soil testing labs at Block level or making mobile soil testing teams.
7. Soil health card campaign so that each farmer has his soil health card.
8. Training and demonstration of compost making as a campaign.
9. Making available the required recommended nutrients/ micro-nutrients at right time place and quantity. Promoting the use of organic fertilizers/ Bio fertilizers /green manuring in identified organic blocks.

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

1. Rainfed agriculture with low cropping intensity
2. Merely 6.6 % cultivable area of the district is irrigated, while rest area is rainfed.
3. Growing of vegetables and horticultural crops over very small area and horticultural crops over very small area

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

1. The climatic projection suggesting increasing air, temperature and erratic distribution of rainfall. Therefore following strategy should be followed to increased income under changing climatic scenario.
2. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
3. In event of decreased water availability (Approximately 1000 mm rainfall) in rainy season (June-September) the rain water should be properly stored (In polythene, to make bund) and harvested for Kharif season crops.
4. Share of millets (Finger millet, Barnyard millet) should be increased due to its better capability of tolerating adverse climatic condition.
5. Short duration varieties should be grown so that at least two crops in a year could be taken
6. Growing of Cheti/spring rice variety viz., (VL 206, VL207, VL 208, VL 209).
7. Organic mulch should be used for reducing frost risk.
8. The area of off season vegetable should be increased at least double by the year 2022.
9. The area having slope 10-30% should be used for growing of horticultural crop viz, Apple, pear, peach, plum, Apricot, walnut, citrus, promegranate should be grown in temperate regions and Mango in Sub-tropical regions.
10. Use fodder crop i.e Sorghum, Lobiain kharif and dual purpose barley wheat, oat in rabi as supplementary crop
11. Transplanting of finger millet
12. Late sowing of horse gram
13. Sowing of radish /leafy vegetables as cash crop
14. Plantation of citrus / pome granate
15. sowing late sown varieties of wheat
16. Cultivation of off season vegetable

**6 A. Name of Field Crop: Wheat**

**i. Existing varieties being used:** UP 2572, VL 829, VL 738, Dawatkhani 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:** VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953 and UP 2572

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

1. **Preparation of land**- 1 - 2 ploughing with local plough followed by planking.
2. **Manure and fertilizer-**
   Use of un decomposed FYM in rain fed as well as irrigated areas with small doses of chemical fertiliser in irrigated valleys of the district
3. **Sowing time-**Rain fed – last week of October
   Irrigated- November
4. **Seed rate and seed sowing** -130-150 kg/ha, Broad casting
5. **Irrigation**-Usually maximum area is rain fed, while in irrigated areas, depending upon water availability 1-3 irrigation
6. **Weed Control-** In general, no weed control is done by farmers and they up root the grasses in Feb-March and use as fodder. However, a few farmer use 2,4- D in irrigated areas
7. **Plant Protection Measures-** No any PPM followed

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

1. **Preparation of land**- 2 ploughing + 1 harrowing with mould board plough followed by planking.
2. **Sowing time-**Rain fed – Mid of October
   Irrigated- Up to mid November
3. **Seed rate and seed sowing** -100-125kg/ha with a spacing of 18-21 cm.
4. **Manure and fertilizer**- 5-10 tonne FYM (Value added) , NPK 100-120:60:40 (Irrigated condition), 50-60:30:20 (Rain fed condition) with micronutrients. Apart from this seed treatment with bio fertiliser i.e. PSB and Azatobacter @ 10 g /kg seed
5. **Irrigation**-As per irrigation facility 1 irrigation at CRI, late jointing stage and 1 at flowering stage.
6. **Weed Control-** Irrigated condition- Clodinafop+Metsulsulfuron methyl @400.00/ha 30-35 DAS (Effective against broad and narrow leaves weed). Apart from this, Pendimethalin @ 1.00a.i./ha as pre emergence may also be used. Weed may also be controlled by manual weeding at 20-25 and 40-45 DAS.
7. Use of IPM practices

**v. Major insect pests associated with crop:** Aphid, Cutworm, 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 |

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

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

**vii. Major disease associated with crop:** Brown spot, Rust, Loose smut, Karnal bunt

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

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

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

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

**Biofungicides**

| Name of the Bio-fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| *Pseudomonas fluorescens* 1.75% WP (In house isolated Strain Accession no. MTCC 5176) | 5 g/Kg seed<br><br>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.<br>**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 |

**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:** *Ranunculus arvensis, Anagallis arvensis, Convolvulus*

*arvensis, Chenopodium album , Asphodelus tenuifolius, Avena fatua,Phalaris minor*

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

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

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

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

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

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

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

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

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

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

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

| | | |
|---|---|---|
| Methabenzthiazuron 70 %WP (POE: 16-18DAS) | 1000-1250 | 100 |
| Metribuzin 70% WP (Medium soil) | 250 | 120 |
| Metribuzin 70% WP (Heavy soil) | 300 | 120 |
| Pendimethalin 30% EC(Light soil) | 3300 | |
| Pendimethalin 30% EC (Medium soil) | 4200 | |
| Pendimethalin 30% EC (Heavy soil) | 5000 | |
| Pinoxaden 5.1 %EC (POE: 30-35DAS) | 800+900 | 90 |
| Sulfosulfuran 75%WG | 33.3 | 110 |
| Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP | 400 | 100 |
| Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC | 1250 | 110 |
| Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG | 400 | 96 |
| Sulfosulfuran 75%+Metsulfuron methyl 5%WG | 40 | 110 |

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

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

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

1. Organic cultivation
2. Adoption of low-cost based cultivation practices
3. Horse gram/Soybean - Wheat (rainfed) &

**Rice –Wheat(irrigated)**

1. Timely Sowing, Seed treatment, Use of HYV
2. Care soil & water conservation measures
3. INM (Maximum use of value added compost/FYM and soluble fertiliser)

4. Integrated weed management
5. IPM
6. Good storages conditions
7. Efficient marketing of value added produce

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

1. Rain fed and scatteres land holdings.
2. Poor availability of agriculture inputs
3. Use of imbalance and un decomposed FYM
4. Climate change
5. Big issue of Wild animal damages
6. Migration
7. Poor Irrigation facilities
8. SAAR practice(Shifting area practice)
9. Lack of ICT tools due to poor awareness and inter net connectivity

**6B. Name of Field Crop: Rice**

**i. Existing varieties being used:** China-4, Nandhani, Lal dhan ,Saket 4

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

1. Spring rice (VL Dhan 208 and VL Dhan 209 )
2. Jethi rice ( Vivek Dhan 154 and VL Dhan 157)
3. Irrigated Rice (VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85,* Pusa Basmati 1509 and PRH 10)

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

1. **Preparation of land**- 1 - 2 ploughing with local plough followed by Manual puddling
2. **Seed rate and seed sowing** -150 kg/ha in direct seeding , and in transplanting 60-70 kg/ha
3. More than 55 days seeding used
4. **Manure and fertilizer**- use of un decomposed FYM( 1-2.0qt./nali) with small doses of chemical fertiliser by some progressive farmers (in irrigated conditions)as per availability
5. **Irrigation**-usually maximum area is rain fed and in valley –traditionally roaster system is practiced under which, individual farmer get the irrigation too late which affect the crop adversely.
6. **Weed Control** – Butaclor 50 EC @2-3 lt/ha at 0-3 DAT,
7. No IPM practices

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

1. **Preparation of land**- 1 -2 ploughing followed by puddling
2. **Sowing time-Nursery-** Mid may
   **Transplanting-**Mid June- First week of July
3. **Seed rate and seed sowing** -100-125/ha in direct seeding rice , and in transplanting 40-50 kg/ha, basmati 25kg/ha, hybrid 20kg/ha should be used
4. **Manure and fertilizer-** 5-10 tonne FYM , Irrigated- NPK 100-120:60:40, rainfed -50-60:30:20 with micronutrients(Zn, Fe)
5. **Irrigation**-usually maximum area is rain fed and in valley condition irrigation (3-4) as per availability of roaster
6. IPM practices
7. Modern technique of DSR (direct seeded rice) should be followed in rainfed conditions.
8. Water harvesting tank need to be created in rain fed areas to provide timely irrigation.
9. Balanced use of nutrients to be applied in the soil as per the soil testing analysis. Quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.

**v. Major insect pests associated with crop:** Stem borer, Rice leaf folder, Rice hopper, Rice bug

**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:

VII. Apply insecticide only when necessary, not regularly.

VIII. Apply insecticide only when the pest population reaches Economic Threshold Level.

IX. Applying a selective insecticide which is less toxic to natural enemy.

X. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.

XI. Use selective formulation and application method.

XII. Application of granular formulation is less harmful to natural enemy

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

**50 Days within transplating (2 inch water in field)**

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

**50 Days after tranplanting**

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

**Bio-insecticides**

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

**Leaf folder:**

Following insecticides may be used to control leaf folders of rice

**50 Days within transplating (2 inch water in field)**

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

**50 Days after transplating**

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

| | | |
|---|---|---|
| Flubendamide 20 %WG | 125 | 30 |
| Chromafenozide 80% WP | 94-125 | 32 |
| Fipronil 80%WG | 50-62.5 | 30 |
| Acephate 75 %SP | 666-1000 | 15 |
| Acephate 95 %SG | 592 | 30 |
| Monocrotophos 36 %SL | 1400 | |
| Dichlorovos 76% EC | 627 | |
| Chlorpyriphos 20 %EC | 2500 | 30 |
| Quinalphos 25% EC | 2000 | 40 |
| Quinalphos 25 %EC | 1000 | 40 |
| Flubendamide 4%+ Buprofezin 20 %SC | 175+700 | 30 |
| Flubendamide 3.5%+ Hexaconazole 5 %WG | 1000 | 20 |

**Bio-insecticides**

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

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

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

**Bio- insecticides**

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

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

**Rice bug: *Leptocorysa acuta***

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

**Biological control**

**Parasitoids:**

*Gryon flavipes*, attacking: eggs

Predators:

*Micraspis discolor*, attacking: nymphs, adults

*Neoscona theisi*, attacking: nymphs, adults

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

*Orthetrum sabina*, attacking: nymphs, adults

**Pathogens:**

*Beauveria bassiana*, attacking: nymphs, adults

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

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

**During Nursery Sowing**

Deep summer ploughing or soil solarisation

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

**Fertilizers**

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha

K2O = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

**Khaira disease: Due to Zinc deficiency)**

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

**Sheath blight: *Rhizoctonia solani***

Drain of water to check spread of sheath blight.

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Carbendazim 50 %WP ( Seed Treatment) | 2 | |
| Carbendazim 50 %WP | 250-500 | |
| Propiconazole 25% EC | 500 | 30 |
| Hexaconazole 5% EC | 1000 | 40 |
| Hexaconazole 5% SC | 1000 | 40 |
| Difenoconazole 25% EC | 0.05% | 25 |
| Flusilazole 40% EC | 300 | 24 |
| Tebuconazole 250% EC (25.9%) | 750 | 10 |
| Validamycin 3% L | 2000 | 14 |
| Iprodione 50% WP | 2250 | 35 |
| Pencycuron 22.9% SC | 150-188 | 600-750 |

| | | |
|---|---|---|
| Thifluzamide 24% SC | 375 | 28 |
| Cresoczim-methyl 44.3 %SC | 500 | 30 |
| Tebuconazole 50% +Trifloxystrobin 25% WG | 200 | 21 |
| Carbendazim 12%+Flusilazole 12.5 %SE | 800-960 | 54 |
| Iprodione 25% + Carbendazim 25% WP | 500 | |
| Propiconazole 13.9%+ Difenoconazole 13.9% EC | 0.07-0.1% | 46 |
| Tebuconazole 50% +Trifloxystrobin 25% WGs | 200 | 31 |

**Biofungicides:**

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

**Rice blast:** ***Magnaporthe grisea***

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

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

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

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

**Biofungicides**

| Name of the Fungicides | gm/Kg seed | Waiting period (days) |
|---|---|---|

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

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

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

**Biofungicides**

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

**False smut: *Ustilaginoidea virens***

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

**ix. Major weeds associated with crop:** *Oxalis latifolia, Cyperus* sp.*, Echinocloa* sp.*, Commalina benghalensis, Digitaria sanguinales, Eclipta* sp.

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

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

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Anilofos 30% EC (Transplanted rice) | 1000-1500 | 30 |
| Anilofos 18% EC (Transplanted rice) | 1660-2500 | |
| Anilofos 2% G (Transplanted rice) | 20000-25000 | 30 |
| Bispyribac Sodium 10% SC (Nursary) | 200 | |
| Butachlor 50% EC (Transplanted rice) | 2500-4000 | 90&120 |
| Butachlor 50% EW (Transplanted rice) | 2500-3000 | |
| Butachlor 5% G | 25000-40000 | 90&120 |
| Chlorimuron ethyl 25% WP (Transplanted rice) | 24 | 60 |
| Clomazone 50% EC (Transplanted rice) | 8000-10000 | 90 |
| Cyhalofop butyl 10% EC | 750-800 | 90 |
| 2,4-D Ethyl Ester 38% EC | 2500 | |
| 2,4-D Ethyl Ester 4.5% GR (Transplanted rice) | 25000 | |
| Fenoxaprop-p-ehtyl 9% EC (Transplanted rice) | 625 | 70 Post |
| Fenoxaprop-p-ehtyl 6.9% EC | 812-875 | 61 |
| Flufenacet 60% DF (Transplanted rice) | 200 | 90-110 |
| Orthosulfamuron 50% WG (Transplanted rice) | 150 | 65 Pre |
| Oxadiargyl 80% WP (Transplanted rice) | 125 | 97 |
| Oxadiargyl 6% EC (Transplanted rice) | 1066 | 97 |
| Oxadiazon 25% EC (Transplanted rice) | 2000 | |

| | | |
|---|---|---|
| Oxyflourfen 0.35.5% GR (Transplanted & Direct sown) | 30000-40000 | |
| Oxyflourfen 23.5% EC (Transplanted & Direct sown) | 650-1000 | |
| Pendimethalin 30% EC (Transplanted & Direct sown) | 3300-5000 | |
| Pendimethalin 5% G (Transplanted & Direct sown) | 20000-30000 | |
| Pretilachlor 37% EW (Transplanted rice) | 1500-1875 | 90 |
| Pretilachlor 30.7% EC (Wet Direct Seeding) | 1500-2000 | 110 |
| Pretilachlor 50% EC (Transplanted rice) | 1000-1500 | 75-90 |
| Anilofos 24%+ 2,4-D ethyl ester 32% EC | 1000&1500 | 90 (Transplanted rice) |
| Bensulfuron methyl 0.6% + Pretilachlor 6 G | 10000 | 88(Transplanted rice) |
| Clomazone 20%+ 2,4- D ethyl ester 30% EC | 1250 | 110 (Transplanted rice) |
| Cinmethylin 10% EC (Transplanted rice) | 750-1000 | 60 |
| Paraquat dichloride 24% SL (Before sowing) | 1250-3500 | |

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

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

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

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

| | | |
|---|---|---|
| Bensulfuron methyl 0.6% + Pretilachlor 6% G | 10000 | 88 (Transplanted rice) |

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

1. Organic cultivation
2. Adoption of low-cost based cultivation practices
3. Jethi rice- Wheat/Lentil/Barley/oat (fodder) (rainfed)
4. Rice- Wheat /onion/berseem(irrigated),
5. Timely Sowing/Trans planting, Seed treatment
6. Use of HYV, Hybrid (120-125days), Basmati(120-125days)
7. Care soil & water conservation measures
8. INM (Maximum use of value added compost/FYM and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Marketing of value added produce
13. Avoid early Nursery raising practice and use of 25-35 days old seedling

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

1. Rain ded and scatteres land holdings.
2. Poor availability of agriculture inputs
3. use of imbalance and un decomposed FYM,
4. climate change,
5. Big issue of Wild animal damages
6. Migration
7. Poor Irrigation facilities
8. SAAR practice(Shifting area practice)
9. Water scarcity
10. Wild animals
11. Lack of mechanization
12. Lack of rain water harvesting structures

**6C. Name of Field Crop: Finger millet**

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

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

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

1. Traditional seed variety ,
2. Undecomposed FYM 1.0-2.0qt./nail, 1-2 weeding
3. Due to lack of proper knowledge, majority of the farmers do not adopt proper plant protection measures which adversely affect the productivity.

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

1. **Preparation of land**- 2-3 ploughing followed by planking
2. **Sowing time-** Last week of May-Ist fortnight of June
3. **Seed rate and seed sowing** -10-12kg/ha, line to line spacing- 20 cm. take care of gap filling/Thining/Transplanting
4. **Manure and fertilizer-** -Well decomposed FYM @5-10 tonnes/ha , NPK 20:40:0 and seed treatment with bio fertiliser
5. **Irrigation-**usually maximum area is rain fed
6. Weed Control- 2-3 manual weeding ; first at 15-20 and second at 40-45 DAS.
7. Use IPM modules

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

vi. **IPM Module for management of insect pests(except organic areas):**
For management of stem borer, cartop hydrochloride 4 G @ 20-25 kg may be applied 10-15 days after planting.

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

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

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

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

x. **IPM Module for management of weeds(except organic areas):** Manual weeding2-3 and gap filling to maintain plant population

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

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

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

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

**6D. Name of Field Crop: Barnyard millet**

i. **Existing varieties being used:** Non described

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

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

1. Traditional seed variety ,
2. Undecomposed FYM 1.0-2.0qt./nail, 1-2 inter culture

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

1. **Preparation of land**- 2-3 ploughing followed by planking
2. **Sowing time-** Last week of May-Ist fortnight of June
3. **Seed rate and seed sowing** -10-12kg/ha, line to line spacing- 20 cm. take care of gap

filling/Thining/Transplanting

4. **Manure and fertilizer-** -Well decomposed FYM @5-10 tonnes/ha , NPK 20:40:0 and seed treatment with bio fertiliser
5. **Irrigation-**usually maximum area is rain fed
6. Weed Control- 2-3 manual weeding ; first at 15-20 and second at 40-45 DAS.
7. Use IPM modules

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

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

**vii. Major disease associated with crop:** Blast, Smut

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

**Smuts**

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

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

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

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

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

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

1. Less availability of agriculture inputs,
2. use of imbalance and un decomposed FYM,
3. climate changing,
4. Wild animal damages
5. Migration,
6. Poor Irrigation facilities
7. Water scarcity
8. Wild animals
9. Lack of mechanization
10. Lack of rain water harvesting structures

**7A. Name of the Pulse crop: Horsegram**

**i. Existing varieties being used:** Pahari gahat

**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 Gahat 10, VL Gahat 15 and VL Gahat 19

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

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

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

1. **Preparation of land**- - 2-3 ploughing followed by planking **Seed rate and seed sowing** – 30-40 kg/ha, spacing 30*10cm
2. **Sowing time-** Ist fortnight of June
3. **Manure and fertilizer**- 5 -10 tonne FYM / ha, NPK20:40 :20 along with the use of bio fertiliser
4. **Irrigation**-usually maximum area is rain fed
5. **Weed control** – Two manual weeding at 20-25 and 40-45 DAS is quite effective for weed control. Herbicides i.e. Alachlor 50 Ec 4 lt/ha at 0-3 DAS, Imazethapyr 10SL @100 gm a.i./ha At 15-20DAS.
6. Use of IPM practcices

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

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

**vii. Major disease associated with crop:** Rot, Syam warn

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

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

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

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

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

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

1. Less availability of agriculture inputs
2. Use of imbalance and un decomposed FYM
3. Climate changing
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities
7. Water scarcity
8. Wild animals
9. Lack of mechanization
10. Lack of rain water harvesting structures

**7B. Name of the Pulse crop: Lentil**

**i. Existing varieties being used:** Pahari masoor –small seeds

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Masoor 125, VL Masoor 126, VL Masoor 507, VL Masoor 514, PL 5 , PL 7, PL 8

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

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

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

1. **Preparation of land**- 2-3 ploughing followed by planking
2. **Seed rate and seed sowing** – 30-40 kg/ha, spacing 25*10cm
3. **Sowing time-** IInd fortnight of October
4. **Manure and fertilizer**-5-10 tonne FYM , NPK 20:40 :20 along with the use of bio fertiliser.
5. **Irrigation-U**sually maximum area is rain fed
6. **Weed control** – Pendimethalin 35 Ec 3.0 lt/ha as pre emergence. 1-2 weeding upto 45 DAS will also control the weeds.
7. Use of IPM practcices

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

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

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

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

**(Wilt and Rust)**

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:** *Rannunculus arvensis, Anagallis arvensis, Convolvulus arvensis, Chenopodium album , Asphodelus tenuifolius*

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

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

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

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

1. Water scarcity
2. Wild animals
3. Lack of mechanization
4. Lack of rain water harvesting structures

**7C. Name of Pulse crop: Urd**

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

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

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

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

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

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

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

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

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

**Fruit Borer**

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

**White fly**

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

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

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

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

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

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

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

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

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

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

**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.

**7D. Name of Pulse Crop: Moong**

**i. Existing varieties being used:** Pant moong 2, narendra moong-1

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

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

**v. Major insect pests associated with crop:** White fly, Fruit borer, 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 suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management,
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables,

oilseeds and pulse crop,
4. Cluster based farming, Inter cropping. Needs to promote local germplasm.

**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.

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

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

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Pant Arhar-291, VLA-1, Pant Arhar-3

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

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. 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 from mid of May to June.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born diseases.
3. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

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

**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:**

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

**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.

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

**i. Existing varieties being used:** Kala bhatt(Oval), Pahari soybean, VLS 47

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

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

1. Traditional seed variety ,
2. Undecomposed FYM 1.0-2.0qt./nail.
3. No use of chemical fertiliser, 1-2 manual weeding.
4. No use plant protection measures
5. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
6. They also do not follow balance use of chemical fertilizers. It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

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

1. **Preparation of land**- 2-3 ploughing followed by planking ,
2. **Sowing time-** Ist fortnight of June
3. **Seed rate and seed sowing** – 75-80 kg/ha, line to line spacing- 45 cm
4. **Manure and fertilizer-** -Well decomposed FYM @5-10 tonnes/ha , NPK 20:60:40 and seed treatment with bio fertiliser
5. **Irrigation**-usually maximum area is rain fed
   Weed control – Two manual weeding at 20-25 and 40-45 DAS is quite effective for weed control.

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

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

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

management of soybean insect pests.

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

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

| **Insect pest** | **Resistant or tolerant variety** |
|---|---|
| Stem fly | Dsb 25, Himso 1685, JS 20-89, MACS 1370, MACS 1410, NRC 97, JS 20-53,PS 1543, SL 983, Dsb 23-2 |
| Girdle beetle | MACS 1410, Dsb 23-2, Himso 1685, JS 20-89, KDS 726 |
| Defoliators | Dsb 23-2, KDS 726, PS 1543, PS 1569 |
| Pod borer | Dsb 25, SL 683, NRC 97, MACS 1370, JS 20-89 |
| Leaf miner | MACS 1370, Himso 1685, MACS 1370, MACS 1410 |
| Pest complex | DS 2708, Dsb 23-2, Dsb 25, Himso 1685, JS 20-53, JS 20-79, JS 20-89, KDS 726, MACS 1370, MACS 1410, NRC 97, SL 983, PS 1543 |

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

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

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

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

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

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

**Table 2: Major predators of insect pests of soybean**

| **Insect pests attacked** | **Predator** |
|---|---|

| | |
|---|---|
| Whiteflies | Lady bird beetles:<br>*Coccinella septumpunctata*<br>*Coccinella transversalis* |
| Lepidopterous caterpillars | Pentatomid bug *Eocanthecona furcellata* |
| Lepidopterous caterpillars and Whiteflies | Spiders: *Lynx* spider and Orb weaver spider |

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

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

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

**Table 4: List of insecticides recommended for soybean insect pests**

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

**Bio-insecticides**

**Tobacco caterpillar (*Spodoptera litura*)**

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

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

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

**Semilooper (*Chrysodeixis acuta*)**

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

**Soyabean leaf miner (*Odontota horni*)**

| Name of the Bio-insecticides | (gm/ml) /ha |
|---|---|

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

**vii. Major disease associated with crop:** YMV, leaf spot, blight, Collar rot, rust

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

**Rust: *Phakopsora pachyrhizi***

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

**Collar rot: *Sclerotium rolfsii***

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

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

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

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

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

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

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

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

**7G. Name of oilseed crop: Toria/sarson**

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

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

**yield in specific agro-ecological region:** PPS-1

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

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

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

1. Deep ploughing during summer months
2. **Land preparation:** One ploughing followed by 2-3 harrowings and planking; Using Zero till ferti- seed drill will increase farmers' income reducing the costs of planting and improving productivity.
3. **Sowing time to improve productivity and income:**

**a.** ***Toria***: Last week of September.

**b.** **Yellow *sarson* & *rai* (Mustard)**: First fortnight of October.

4. **Seed treatment**

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

5. **Seed rate and spacing:**

a. ***Toria*:** 4kg/ha about 3-4 cm deep in 30 cm apart rows

b. **Yellow *sarson* & *rai* (Mustard)**: 5 kg/ha with a row spacing of 30-45 cm.

6. **Thinning:** About 20-25 days after sowing maintaining a plant to plant space of 10 cm. The thinned out plants could be used as **green forage**.
7. **Nutrient management:**
8. Vermicompost: 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.
9. Excess use of nitrogenous fertilizers should be avoided.
10. **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.
11. **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.
12. **Harvesting and threshing:**
    The crop should be harvested when about 75 % of the siliquae turn yellowish brown. After threshing, seeds should be stored with less than 8% moisture.
    Use of IPM

**v. Major insect pests associated with crop:** Aphid, Hairy caterpillar

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

**Aphid *Lipaphis erysimi***

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

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

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

**Mustard saw fly :** ***Athalia lugens proxima***

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

**Hairy caterpillar**

1. Mechanical destruction of egg masses and early instar larvae which feed gregariously.
2. Spray with
   Emamectin Benzoate 5 SG 250ml/ha
   Lufenuron 5EC 800ml/ha
   Triazophos 40EC 750ml/ha
   Monocrotophos 36 WSC 1250 ml/ha.

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

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

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

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

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

**White rust :** ***Albugo candida***

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

**Downy mildew:** ***Peronospora parasitica***

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

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

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

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

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

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

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

1. Organic cultivation,

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

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

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

**8A. Name of Fruit Crop: Apple**

**i. Existing varieties being used:** Royal Delicious, Red Delicious, Rymer, fanny, Green Sweet etc. 90% used Delicious Group (Red delicious, Royal Delicious, Golden delicious) 10% of spur varieties i.e. Red Chief, organ spur, Galegala, Summer red 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:** Need to introduce low chill or colour mutants and spur varieties suitable for different agroecological situations viz. Early red one, Washington spur Pink Lady, Oregeon spur, Superchief and other new stains.

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

1. Use of old and traditional varieties
2. Less use of pollinizer cultivars
3. Growing apple without proper lay out
4. Less or no use of mulch for water conservation
5. Poor Orchard management, no proper pruning and training, improper nutrient management
6. High incidence of wooly aphis
7. Use of organic manures
8. High stem and barky cankers
9. No use of IPM
10. No Grading or packing system or facilities
11. No facilities for under sized or cull fruits
12. Wastage due to improper Post Harvest Management

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

1. Use of low chill cultivars like Red Velox, Washimgton spur, Pink Lady, Super chief, Red spur, walspur with suitable pollizers arrangement for apple.
2. High density orchard with proper lay out, nutrient management, drip, mulch and IPM Management.
3. Adaptation of advance technology for training and pruning.
4. Training of farmers regarding holistic approach of apple cultivation.
5. Moisture conservation through poly mulching sheets.
6. Creation of water bodies for irrigation means.
7. Adequate use of available water through micro irrigation systems.
8. Plantation of adequate no. of pollinizing variety.

9. Beekeeping for enhancing the pollination.
10. Use of anti hail/ anti bird net.
11. High density and ultra high density plantation of new varieties with clonal root strock with treliis system with micro irrigation. Promotion of organic apple cultivation.

**v. Major insect pests associated with crop:** Wooly aphis , San jose scale, Tent caterpillar, Codlling moth

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

**San Jose Scale:**

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, Encarsia perniciasi with Aphytis diaspidis may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,Chilocorus bijugus Mulsant,Chilocorus rubidus Hope Pharoscymnus flexibilies Mulsant
5. Spray trees with Thiamethoxam (0.05%) or melathion (0.05%) or oxy demeton methyl (0.07%) and use Imidacloprid (0.007%) or Chlorpyriphos (0.05%) or around tree basin

**Tent Caterpillar:**

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

**Codling Moth/ Fruit borer:**

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

**Apple wolly aphid: *Eriosoma lanigerum***

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Phorate 10% CG (per tree) | 10-15 | 100-150 |
| Carbosulfon CG (per tree) | 5 | 166 |
| Chlorpyriphos 20% EC | 0.05% | 3750-5000 |
| Oxydemetonmethyl 25% EC | 0.025% | 1500-2000 |
| Quinalphos 25% EC | 0.05% | 3000-4000 |

**San jose scale: *Diaspidiotus perniciosus= Aspidiotus perniciosus***

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

**vii. Major disease associated with crop:** Canker, collar rot, Powdery mildew, apple scab, leaf fall

disease.

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

**Powdery mildew of Apple:** ***Podosphaera leucotricha***

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

**Apple scab:** ***Venturia inaequalis***

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

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

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

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

1. Use of high yielding cultivars with and suitable placement of pollinizer in high density planations with sufficent irrigation facility as drip and mulch for establishment of model and commercial orchards.
2. Intercropping of leguminous crops like rajma, bhat and gahat etc.
3. Cultivation of potato as inter crop during the period of beginning of orchard of normal spacing.
4. Cultivation of some vegetable crop as an intercrops i.e. cabbage, cauliflower, French bean etc in normal spacing.

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

1. 90% orchard in rainfed areas.
2. Most of the orchards on south and east slopes where soil is poor.
3. Adverse weather during season hits the spraying schedule of pesticides in apple.
4. Negligence of drainage causes the root rot disease.
5. Lesser attention on sanitation of orchard which leads the infection of diseases.
6. Lesser adoption of proper technical know-how during training and pruning in high /ultra high density orchard.

**8B. Name of Fruit Crop: Peach**

**i. Existing varieties being used:** Paradelux, July Elberta, Red June, Alaxender

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Alaxnder, Red globe, crest heaven, glo heaven etc. Nectarine-snow Queen, Alberta, Saharanpur prabhat, red june, fLA-1633, nectarine, paradelux

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

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

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

1. Need to introduce non-clingstone varities with maturity indices on or before June. Use of High denisty plantation with mulch and supplemetation of drip irrigation.
2. Adaptation of advance technology for training and pruning.
3. Training of farmers regarding holistic approach of apple cultivation.
4. Moisture conservation through poly mulching sheets.
5. Creation of water bodies for irrigational means.
6. Adequate use of available water through micro irrigation system.
7. Plantation of adequate no. of pollinizing varieties during layout of orchard.
8. Promotion of other means of pollinating agent to enhance the yield.
9. Use of anti hail net.
10. High and ultra high density plantation is required.

**v. Major insect pests associated with crop:** San jose scale, Tent caterpillar, Codlling moth, Peach leaf curl, Peach fruit fly

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

**San Jose Scale:**

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

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

**Tent Caterpillar:**

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

**Codling Moth/ Fruit borer:**

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

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

**Peach Leaf Curl Aphid:**

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

**Peach leaf curl aphid**

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

**Peach Fruit Fly:**

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

**vii. Major disease associated with crop:** Gummosis, peach leaf curl (taphrina)

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

**Peach leaf curl**

| Name of the Insecticides | (gm/ml) /ha |
|---|---|
| Lime sulphur 22% SC | 1% |

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

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

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

1. High density plantation with (3x3mts) supplemented with drip irrgation system.
2. Intercropping of leguminous crops like rajma, bhat and gahat crops etc.
3. Cultivation of potato as inter crop during the period of beginning of orchard.
4. Cultivation of some vegetable crops as an intercrops i.e. cabbage cauliflower, French bean etc.

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

1. Availability of Quality planting material
2. Need to delineate the table and canning type varieties.
3. Water scarcity
4. Wild animals
5. Lack of mechanization
6. Lack of rain water harvesting structures
7. Excess rainfall, adverse weather during season hits the spraying schedule of apple.
8. Negligence of drainage causes the root zone decrease.
9. Lesser emphasis on sanitation of orchard which leads the infection of diseases.
10. Lack of adaptation of proper technical knowhow during training and pruning in high /ultra high

density orchard.
11. No proper facilities of cold chain.
12. Disaster during monsoon hit the specific workable and sustainable intensification yields.
13. No easily access to marketing facilities

**8C. Name of Fruit Crop: Pear**

**i. Existing varieties being used:** Gola, Victoria, China, Baggugosha, Kashmiri, Thumb pear etc

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

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

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

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

1. Use of new strains or occidental pears are needed for high hills
2. Introduction of new strains with less gritcells in fruits
3. Need to develop Postharvest management system with minimum losses.
4. Processing facilities needs to be strengthened.
5. Training of farmers regarding holistic approach of apple cultivation.
6. Moisture conservation through poly mulching sheets.
7. Creation of water sources for irrigational mean.
8. Adequate use of available water through micro irrigation system.
9. Plantation of adequate no. of plants pollinizing variety during layout of orchard.

**v. Major insect pests associated with crop:** San jose scale, Tent caterpillar, Codlling moth, Peach leaf curl, Peach fruit fly

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

**San Jose Scale:**

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

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

**Tent Caterpillar:**

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

**Codling Moth/ Fruit borer:**

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

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

**Peach Leaf Curl Aphid:**

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

**Peach leaf curl aphid**

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

**Peach Fruit Fly:**

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

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

**viii. IPM Module for management of disease(except organic areas):** Applications of contact and systematic fungicides

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

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

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

1. Introduction of New Strain *viz*. Anjou, Starkrimson in high hills.
2. Cultivation of Filler/ Intercrops during initial period of orchard.

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

1. Availability of quality planting material
2. Water scarcity
3. Wild animals
4. Lack of mechanization
5. Lack of rain water harvesting structures
6. No availability of elite planting material

**8A. Name of the vegetable crop: Cabbage**

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

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

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

1. Use of organic manures
2. No knowledge of crop geometry
3. Use of hybrid varieties only
4. Serious weed management problem
5. Soil Testing-Farmers do not test their soil
6. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
7. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
8. Nursery- Nursery soil generally not sterilize by the farmers.
9. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
10. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
11. Cultivars-In cabbage, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be head formation.
12. Transplanting- Farmers practices improper planting distance.
13. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
14. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
15. 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.
16. Harvesting- The harvesting should not follow as per maturity standards or as per object.

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

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

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

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

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

**After Planting**

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

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

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

**Bioinsecticides**

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

**Cabbage/cauliflower Aphid**

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

**Bioinsecticides**

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

**Painted bug**

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

**vii.Major disease associated with crop:** Damping off in nursery and Black rot

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

1. Change the place for nursery
2. Maintain proper drainage
3. Seed treatment with Streptocycline or hot and cold water treatment (30 min each).

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

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

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

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

1. Use of hybrid varieties suitable for year round production system for mid or high hills.
2. Growing crop at right spacing as recommended above.
3. Solarization of nursery before sowing of seed
4. Seed treatment with Streptocycline or hot and cold water
5. Soil testing and application of Boron if needed
6. Use of Chloropyriphos for control of cut worm

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

**8B. Name of the vegetable crop: Cauliflower**

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

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Partial irrigated Mid- Snow Crown Late- pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2

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

1. Soil Testing-Farmers do not test their soil.
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.

6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Optimum sowing time
   Early: May- June
   Mid: July – Aug
   Late: Oct
8. Cultivars-In cauliflower, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be curd formation.
9. Transplanting- Farmers practices improper planting distance.
10. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
11. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
12. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
13. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

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

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

**v. Major insect pests associated with crop:** Thrips, Tobacco caterpillar, Diamond back moth, Cut worms.

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

**Before Planting**

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Growing of African bold seeded mustard as trap crop at 22:2 ratio to attract DBM for oviposition

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

**After Planting**

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

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

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

**Bioinsecticides**

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

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

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

***Xanthomonas* Black rot:**

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

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

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

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

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

1. Reduce number of spray of pesticides.

2. Raise nursery on treated soil.

**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.

**8C. 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: (**Partially irrigated) 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.
   Regin B: Sept- Oct
5. **Planting distance-** Farmers practices improper planting distance and sown through broadcast.
6. **Manures-** Farmers incorporated cow dung in undecomposed stages in the field.
7. **Fertilizers-** Farmer use imbalance fertilizer
8. **Irrigation-** Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method.
9. **Weed control-** Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
10. **Harvesting-** The root harvesting should not follow as per maturity standards or as per object.

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

1. **Soil Testing-** Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. **Land Preparation-** The farmers are recommended to open the land before sowing the crop for sterilization.
3. **Seed Treatment-** For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing
4. **Seed Rate-** The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha
5. **Planting distance-** Farmers should be sown the seed Asiatic type line to line 45 cm and plant to plant 8cm and European type line to line 30 cm and plant to plant 8 cm
6. **Manures and fertilizers-** should be used as per soil testing , General recommendation are FYM-250q/ha Nitrogen: 60 kg/ Phosphorus: 100 kg/ha and Potassium: 50kg/ha Micronutrient: should be used as per soil testing.
7. **Irrigation-** Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at 7-8 days interval and in summer 3-4 days interval
8. **Harvesting-** Depending upon the cultivars, the roots become ready for harvesting in about 25-35 days after sowing. 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 are problem

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

**vii. Major disease associated with crop:** Damping off, black rot

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

Use of recommended pesticides in recommended dose

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

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

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

1. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as
2. Cauliflower early- Radish- Bottlegourd
3. Brinjal-Radish –Chilli
4. Bottle bourd-radish-French bean

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

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

**8D. Name of the vegetable crop: Tomato**

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

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VL Tamatar 4, Manisha, Himsona, Navin 2000

**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.
4. Use of hybrid seeds.
5. Availability of area specific hybrid varieties.
6. Promotion of poly house cultivation.
7. Promotion of organic fertilizer and organic pesticides.
8. Advance INM and IPM technology is required.
9. Replacement of wooden staking, which can save the forest.
10. Marketing facilities.
11. Installation of sprinkler with facilities of liquid fertilizers.

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

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

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

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

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

**Management strategies( white fly and other sucking pests)**

**A. Crop Hygiene**

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

**B. Other Cultural Control Practices**

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

6. Use proper post-planting practices.
7. Apply an effective insecticide to kill whitefly adults prior to cultural manipulations such as pruning, tying, etc. Rogue tomato plants with symptoms of TYLCV.
8. Plants should be treated for whitefly adults prior to rouging and, if nymphs are present, should be removed from the field, preferably in plastic bags, and disposed of as far from production fields as possible.
9. Manage weeds within crops to minimize interference with spraying and to eliminate alternative whitefly and virus host plants.
10. Destroy old crops within 5 days after harvest, destroy whitefly infested abandoned crops.

**C. Insecticidal Control Practices**.

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

**White fly**

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

**Leaf miner, *Liriomyza trifoli***

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

**Aphid, *Aphis gossypii***

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

**Thrips, *Thrips tabaci***

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

**vii. Major disease associated with crop:** Buckeye fruit rot is a major serious disease.

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

**Buck eye rot:**

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

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

**ix. Major weeds associated with crop:** *Trifolium alaxenderum, 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. Use of high yielding varieties grown under ventillated polyhouse using standardized technology with fertigation technogy in tomato can enhance the productivity of tomato manifold.
2. Polyhouse technogy is a boon for small and marginal farmers with fragmented holdings.
3. Reduce number of spray of pesticides.
4. Raise nursery on treated soil.
5. Treat seed with fungicide before sowing.
6. Manage fog during fruiting period

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

1. Imbalance use of fertilizes.
2. More numbers of pesticides' spray
3. Increase incidences of Bacterial wilt.

**8E. Name of the vegetable crop: Potato**

**i. Existing varieties being used:** Tumari Local and Kufri Jyoti

**ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Kufri Jyoti, Kufri chandramukhi, Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3

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

1. Use of big sized tuber or divion of tuber (50-60 g)
2. No Tuber treatment
3. Use of organic manures, sowing in flat bed.
4. Sowing time is March-April.
5. Limited or no IPM practices
6. Planting time:October
7. Spacing: 50-60 x 15-20 cm
8. Seed rate: 25-30 qtl/ha
9. 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. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with application of organic manures.
2. Fertilizer should be used on soil test basis. 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:** White grub is a serious and wide spread problem

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

**White grub**

1. Use of VL Kurmula trap,
2. Use of WGPSB2 Bio-Formulation @ 10 gm/kg vermicompost or FYM,
3. Drenching of Chlorpyriphos @ 2ml/L

**vii. Major disease associated with crop:** Late blight and common scab disease in the crop and tuber.

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

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

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

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

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

**Potato scab: *Streptomyces scabiei***

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

**ix. Major weeds associated with crop:** *Ranunculus* sp.,*Cyperus* sp. and *Chenopodium* etc.

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

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

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

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

1. Early mature varieties.
2. Use of Kufri Girriraj
3. supplementation with use of optimal tuber size,

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

1. Timely and adequate seed supply.
2. Facility of poor seed storage in the distt.
3. Water scarcity
4. Wild animals
5. Lack of mechanization
6. Lack of rain water harvesting structures

**8F. Name of the vegetable crop: Brinjal**

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

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

(Pantnagar), Kashi Taru, Kashi Sandesh (IIVR)

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

1. Poorly managed nurseries infected with damping off.
2. Overaged or less vital seedling utilization
3. Tranplanting is done on or before monsoon shower
4. Round and long puple variety use
5. No control measure for shoot and fruit borers and phomopsis blight.
6. Soil Testing-Farmers do not test their soil
7. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
8. Nursery- Nursery soil generally not sterilize by the farmers.
9. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
10. Seed Rate- Farmers practices to use uncounted/ un amounted seed quantity.
11. Sowing time:
    Region B: Jan- Feb
12. Transplanting- Farmers practices improper planting distance.
13. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
14. Fertilizers: Farmer use imbalance fertilizer
15. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method.
16. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
17. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

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

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

**v. Harvesting- Major insect pests associated with crop:** Shoot and fruit borers

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

**Brinjal fruit & shoot borer: *Leucinodes orbonalis***

Only cultural practices can be used.

**Brinjal fruit & shoot borer: *Leucinodes orbonalis***

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

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

**vii. Major disease associated with crop:** Phomopsis blight and rot (*Phomopsis vexan*) is a serious problem in the hills.

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

1. Use healthy seed materials for sowing.
2. Seed should be extracted only from disease free fruits.
3. After extraction of seeds it should be dried for a week and then stored.
4. Avoid continuous cultivation of brinjal. A rotation of brinjal - paddy - gingelly will helps to check the disease development.
5. In the fields the affected plants and debris should be collected and burnt
6. During summer deep ploughing should be given.
7. Spray following insecticides

**Blight**

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

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

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

1. Hand weeding.

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

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

1. Use of hybrids can increase productivity 2 to 3 times higher.
2. Use of mulch in rainy season.
3. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Brinjal- Radish-Bottle gourd, Brinjal- spinach-cowpea, Brinjal- Turnip-Amaranthus, Brinjal- Spinach-Bitter gourd etc.

**xii. Production constraints in agro-ecological region:**

1. Non-availability of suitable hybrids
2. Wild animals problems
3. Poor technical knowhow
4. Marketing problem in rainy season

**8G. Name of the vegetable crop: Chilli**

**i. Existing varieties being used:** Jwala, Pant C1, Yellow mirch(Lakhaur mirch) local strains and non descriptive varieties

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Agni, Shikha and other hybrids.

**iii. Existing package of practices being used:**

1. Growing local varieties.
2. No line transplanting.
3. Generally they plant two over aged seedling at one place.
4. No or very less use of fertilizer.
5. Sowing of untreated seed.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Use of seed tretment like Pant bioagent 3 for managing seed and soilborne diseases.
2. Earthening up of plants within 45 days after transplantation to get rid off waterlogging
3. Use of tall and cluster bearing type like local strain Lakhaur mirch.
4. Use of high dose of organic manure i.e. 200 q/Ha increases productivity and incidence of dieback and Anthracnose.

**v. Major insect pests associated with crop:** Thrips problem is major problem

**vi. IPM Module for management of insect pests:**

**Chilli thrips, *Scirtothrips dorsalis* Hood**

1. Thrips *Franklinothrips vespiformis* (Crawford) and *Erythrothrips asiaticus* R. &. M. are predaceous in nature and their population may be encouraged by avoiding chemical sprays.
2. Yellow or blue sticky trap is effective for controlling this pest.
3. If still the population persist spraying of imidacloprid 70% WG @ 0.25ml/l or acetamiprid 20%SP @ 0.2g/l or thiomethoxam 25%WG @ 0.2g/l or metasystox@1.5ml/l is effective.

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Thiamethoxam 30% FS (Seed Treatment) | 7/Kg | |

| | | |
|---|---|---|
| Imidacloprid 70% WS (Seed Treatment) | 10-15/Kg | |
| Cyantraniliprole 10.26% OD | 600 | 3 |
| Emamectin benzoate 5% SG | 200 | 3 |
| Spinosad 480% SC | 160 | 3 |
| Acetamiprid 20% SP | 50-100 | 3 |
| Thiacloprid 21.7% SC | 225-300 | 5 |
| Indoxacarb 14.5%+ Acetamiprid 7.7% SC | 400-500 | 5 |
| Flubendamide 19.92%+ Thiacloprid 19.92% | 200-250 | 5 |
| Methomil 40% SP | 750-1125 | 5&6 |
| Lambda cyhalothrin 5% EC | 300 | 5 |
| Ethion 50% EC | 1500-2000 | 5 |
| Fipronil 5% SC | 800-1000 | 7 |
| Imidacloprid 17.8% SL | 125-250 | 40 |

**vii. Major disease associated with crop:** Dieback and anthracnose is major disease of block.

**viii. IPM Module for management of disease:**

**Dieback**

1. Use of disease-free seeds is important in preventing the disease. Seed treatment with Thiram or Captan 4g/kg is found to be -effective in eliminating the seed-borne inoculum.
2. Good control of the disease has been reported by three sprayings with Ziram O. 25% Captan 0.2% or miltox 0.2%. Chemicals like wettable Zineb 0.15% not only reduced the disease incidence but also increased the yield of fruits.

**Anthracnose**

1. Seeds should be obtained from spotless fruits.
2. Debris of diseased crop should be collected and burnt.
3. Seed treatment with thiram or captan at the rate of 2.5 g/kg of seed.

**ix. Major weeds associated with crop:** *Euphobia hirta, Cynadon dactylon ,Cyprus and Oxalis*

**x. IPM Module for management of weeds:** Manual weeding

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. 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. Less availability of high quality seeds
2. High prices of hybrid seeds
3. Post-harvest losses are more due to non availability of storage facility
4. High prices of fertilizers
5. Low prices of farm produce
6. Lack of knowledge about the cultivation practices
7. Lack of processing facilities
8. So far no minimum support price is fixed for the crop.

**8H. Name of the vegetable crop: Cucumber**

i. **Existing varieties being used:** Kalyanpur Green, Japanese Long Green, Poona Khira, Pant Khira-1, Poinsette, Japanese Long Green, Straight Eight, Swarna Sheetal, Swarna Poorna, Swarna Ageti etc.

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**

**For open field condition:** Pusa Udhay, Pusa Barkha,Shubhangi, Himangi, Punjab Naveen, Tasty, Ruchi, Mandakini, Kumud, Noori, Alamgir, Rani, Don etc,

**For protected condition:** Pant Parthenocarpic Cucumber-2 & 3, Hilton, Kian, Isatis, Malini etc.

**iii. Existing package of practices being used:**

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.

**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. 60-200 × 50-100 cm
5. Treating seed before sowing.
6. Balanced use of fertilizers (125: 155: 125 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).
7. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
8. Selection of optimum planting period.
9. Protected cultivation : Sept
10. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
11. Adoption of micro irrigation technologies for efficient use of available water.
12. Adoption of fertigation system for efficient use of fertilizers.

**v. Major insect pests associated with crop:**

Leaf miner , white fly, thrips, leaf eating caterpillar, fruit fly, cut worm, Red pumpkin beetle

**vi. IPM Module for management of insect pests:**

Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

**Red pumpkin beetle**

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Dichlorovos 76% SC | 500 | 627 |

**vii. Major disease associated with crop:** Wilt, Mildew, Mosaic

**viii. IPM Module for management of disease:**

1. Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.
2. Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

**Downy mildew**

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Zineb 75% WP | 1500-2000 | |
| Cymoxanil 8%+ Mancozeb 64% WP | 1500 | 10 |
| Azoxystrobin 23% SC | 500 | 7 |
| Amectoctradin+ Dimethomorph 20.27% SC | 800-1000 | 3 |

**ix. Major weeds associated with crop:** *Trifolium alexenderum , Cyperus rotundus, Cynodon dactylon, Fagopyrum* species

**x. IPM Module for management of weeds:** Manual weeding in hills.

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Polyhouse technology and hybrid cultivars can increase productivity 3-4 times in mid and high

hills.
2. Intervention of improved varieties
3. Advanced plant protection measures
4. Reduce the pesticide loads to innovative interventions
5. Use of organic nutrients and pesticides.

**xii. Production constraints in agro-ecological region:**

1. Lack of plant growing structures.
2. Monkey, baboon, wild pigs are serious threats.
3. Lack of irrigation
4. Lack of marketing in hills
5. Lack of FYM and nutrients.
6. Lack of mechanization.
7. Small and scattered land holdings.
8. Rainfed cultivation.

**8I. Name of the vegetable crop: Pea**

**i. Existing varieties being used:** Traditional field pea , Arkel and Azad pea 3

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12

**iii. Existing package of practices being used:**

1. Sowing in of Autumn month
2. No line sowing,
3. High seed rate,
4. Mature more than 120 days,
5. Stacking is done for tall varieties,
6. Dual purpose varieties
7. 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. Round the year Production depending on irrigation facilities
2. Use of tall varieties sown in line with effective stacking methods.
3. Mangement of powdery mildew, Aschochyta blight and other diseases and Fusarium wilt in autumn season

**v. Major insect pests associated with crop:** Leaf miner , white fly, thrips, leaf eating caterpillar, fruit fly, fruit borer

**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:** Powdery mildew in all agroecological situations
Fusarium wilt in autumn sown crop

**viii. IPM Module for management of disease:**

1. Use of oganic inputs only
2. Use of rust and powdery mldew resistant strains.
3. Use TH colonized compost.
4. Seed biopriming with TH / PsF/ TH + PsF (10g/kg seed) or Seed treatment with Thiram + Carbendazim (2:1) @ 3.0 g/kg seed.
5. Cultivation of powdery mildew resistant varieties
6. 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).

**Powdery mildew**

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Benomil 50% WP | 100 | 200 |
| Carbendazim 50% WP | 150 | 300 |

**ix. Major weeds associated with crop:** *Trifolium alexendrum, 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. 60-200 × 50-100 cm
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.

**8J. Name of the vegetable crop: French Bean**

**i. Existing varieties being used:** Locally available varieties

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Varieties suitable for hills like VL Bean 2, Anupama etc

**iii. Existing package of practices being used:**

Use of locally available varieties, no line spacing.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Use of recommended varieties along with proper crop geometry and nutrient management

**v. Major insect pests associated with crop:** Cut worm and white grub

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:**

viii. **IPM Module for management of disease:**

ix. **Major weeds associated with crop:** Seasonal weeds

x. **IPM Module for management of weeds:** Manual weeding in hills**.**

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Use of recommended varieties along with proper crop geometry proper nutrient and pest management and mulching

xii. **Production constraints in agro-ecological region:**

1. Unawareness about scientific technologies.
2. Availability of agriculture inputs is not easy.
3. Use of unsafe agro chemicals.
4. Difficult labour availability.
5. Different biotic and abiotic stresses.

**9A.Name of the fodder crop: Berseem**

i. **Existing varieties being used:** Mescavi

ii. **High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Vardan

iii. **Existing package of practices being used:** Practice in irrigated(after puddle rice)/ marshy land

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil : loam to clay soil
2. Field preparation: 3-4 Harrowing + Leveling the field.
3. HYVS. – Mescavi, Vardan. BL-10, 22,42, 180, Pusa Gaint & Bundel Berseem 243
4. Seed rate: 25-30 kg/ha
5. Sowing method:

a. Wet method-like rice in puddled field

b.Dry method: Without puddled.

6. Broad casting
7. Sowing time: First an week of October
8. Fertilizer: 30:60:70:: N:P2O5 K2O kg/ha
9. Irrigation: Field should remain at field capacity throughout the crop period after germination.
10. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.
11. Cutting management: First cut -45-50 DAS
12. Other cutting at 25-30 days interval- total 5-6 cutting are taken
13. Yield: 800-1000g/ha. Green forage.

v. **Major insect pests associated with crop:**

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:** Kasni

x. **IPM Module for management of weeds:**

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of HYV
2. Judicious use of fertiliser
3. Timely sowing
4. Sale of green fodder

**xii. Production constraints in agro-ecological region:** Shortages of variety/seed, water

**9B.Name of the fodder crop: Maize**

i. **Existing varieties being used:**

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** African tall

**iii. Existing package of practices being used:** Mixed cropping

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil: Well drained alluvial soil with soil PH 5.5-7.5.
2. Field preparation: 4-5 harrowing + leveling
3. HYVS: African Tall, J-1006. Pratap Makka Chari-b.
4. Seed rate: 50kg/ha
5. Spacing : 30-45 cm (row to row distanced)
   10-15 cm (plant to plant)
6. Sowing time
   Rainfed: Onset of monsoon
   Irrigated : Feb to July
7. Sowing method : Line sowing is proposed over broadcasting
8. Fertilizer : 100-120 : 60:40: 20::: P2O5 : K2O: ZnSo4 kg/ha
9. Irrigation : Fodder maize grown under irrigated condition should be irrigated at 20 days interval. Spring/summer crop requires 5-6 irrigations.
10. Weed control: Pendimethalin @ 0.75 kg ai/ha (PE) application.
11. Harvesting: The crop should be harvested at tasseling /silling stage or 50-55 days after sowing.
12. Yield: Green fodder : 350-450q/ha.

**v. Major insect pests associated with crop:**

**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:** Seasonal weed

**x. IPM Module for management of weeds:**

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Promotion of sweet corn variety
2. INM
3. IPM
4. Use of QPM variety

**xii. Production constraints in agro-ecological region:**

**9C.Name of the fodder crop: Oat**

**i. Existing varieties being used:** Kent

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** UPO212

iii. **Existing package of practices being used:** Traditinal methods

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil : Loam soils
2. Field preparation : 2-3 Harrowing + leveling
3. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
4. Seed rate: 100 kg/ha
5. Spacing : 30cm line to line distance

6. Sowing time: first week of October to last October

**v. Major insect pests associated with crop:**

**vi. IPM Module for management of insect pests:**

**vii. Major disease associated with crop:**

**viii. IPM Module for management of disease:**

ix. **Major weeds associated with crop:** Local weeds

x. **IPM Module for management of weeds:** Hand weeding

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Promotion in rainfed area ,
2. Timely sowing,
3. Timely cutting,
4. Sale of green fodder

**xii. Production constraints in agro-ecological region:** Lack of knowledge

**C1. Livestock: Buffalo**

**1.A Existing breeds available:** Badri, Nd, CB

**1.B Specific breeds to be introduced:** Red sindhi and Sahiwal

**2.A Existing feeds being used:** Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)

**2.B Specific feeds to be introduced / advised:**

**Green fodder:**

1. Agro -based fodder plantation i.e. planting the trees outside the farm and main crop in the center. Increasing the tree density of fodder trees in the forest.
2. Motivating villagers to follow the scientific system of lopping
3. Planting the bunds of fodder grasses in between the fields.
4. By giving proper protection to the herbs, bushes and herbaceous plant.
5. Can be stored in form of silage/ hay. Treating them with the chemicals and maintaining the stores.
6. Generally farmers prefer to grow food crops rather than animal fodder, in this context farmers and livestock owners should be motivated that food grains can be easily procured from the local market according to their requirement but to procure fodder from the market is not possible at all. Hence, they must spare some of the agricultural land or the waste land for seasonal fodder crops production.

**Dry fodder:**

1. Wheat and paddy straws are left over or burnt and ploughed in the field, the leftover crop residues can be reaped, bailed, treated, stored and transported to deficit areas in hills.
2. Dry fodders and other cellulosic wastes may be treated with urea and bailed or they can be converted into compact feed blocks in to convenient size and weight, therefore transported to very remote areas of the hilly terrains and also required lesser place for storage. wheat, Paddy, Madua and Jhingora stalks and maize stovers can be fully utilized after chopping and feeding them in troughs and mangers.
3. Livestock owners should be motivated and educated to feed the stalks, stovers, dry grasses, green fodder and tree leaves after chopping them in small pieces, soaking in water and feeding such fodders in troughs, baskets or mangers. Enrichment of straws/ cellulosic wastes through urea.
4. By changing the change the attitude of farmers to not burn the crop residues and utilize them as livestock feed.
5. Grass production from forest areas can be increased many folds by introducing higher yielding varieties of grasses such as hybrid Napier, Setaria, Guinea, Deenanath, Anjan, Tall fescue, Brome and Rye grass etc.

6. By introducing the measures for higher bio mass production in Van Panchayats. Providing protection to the Fallow, wastelands and orchards.

**Complete feed blocks (qtl)**

1. Involving the NGOs in procuring the waste straws and other agro-industrial byproducts and non conventional feeds from tarai areas.
2. New variety of fodder plants needs to be introduced. Fodder Banks in remote areas and providing the feed and fodder at reasonable price to the farmers.

**Wastage of fodder (qtl)**

Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

**3.A Existing health services:**

Diseases covered under vaccination: FMD, PPR, BQ and HS

Deworming schedule: As such no schedule is followed (lack of awareness)

Other Disease Control Programs/ Health Camps (criteria, target): Infertility Camps

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

3. 3 times scheduled deworming before and after rainy season and during winters.
4. At least 4 health camp per hospital

**4.A Existing management practices:**

Housing, hygiene, drainage: Shed locally called as "GOTH", No proper system of drainage, ventilation and lighting facilities.

Feeding & watering practice: Generally animals are taken to forest for grazing.Whole plant residues are given as feed to the animals.

Welfare aspects: Mainly producing for their hosehold consumption. The marketing approach is still lacking.

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

1. Practiced of Weaning should be adopted.
2. Different shed for the pregnant animal should be there.
3. Use of chaff cutter and manger to minimize the wastage of fodder and labour of the women should be promoted.
4. Use of Urea-Molasses-Mineral Block

**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:**

**C2. Livestock: Cattle**

**1.A Existing breeds available:** ND

**1.B Specific breeds to be introduced:** Murrah

**2.A Existing feeds being used:** Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)

**2.B Specific feeds to be introduced / advised:**

**Green fodder:**

1. Agro -based fodder plantation i.e. planting the trees outside the farm and main crop in the center. Increasing the tree density of fodder trees in the forest.
2. Motivating villagers to follow the scientific system of lopping
3. Planting the bunds of fodder grasses in between the fields.
4. By giving proper protection to the herbs, bushes and herbaceous plant.
5. Can be stored in form of silage/ hay. Treating them with the chemicals and maintaining the stores.
6. Generally farmers prefer to grow food crops rather than animal fodder, in this context farmers and livestock owners should be motivated that the food grains can be easily procured from the local market according to their requirement but to procure fodder from the market is not possible

at all. Hence, they must spare some of the agricultural land or the waste land for seasonal fodder crops production.

**Dry fodder:**

1. Wheat and paddy straws are left over or burnt and ploughed in the field, the leftover crop residues can be reaped, bailed, treated, stored and transported to deficit areas in hills.
2. Dry fodders and other cellulosic wastes may be treated with urea and bailed or they can be converted into compact feed blocks in to convenient size and weight, therefore transported to very remote areas of the hilly terrains and also required lesser place for storage. wheat, Paddy, Madua and Jhingora stalks and maize stovers can be fully utilized after chopping and feeding them in troughs and managers.
3. Livestock owners should be motivated and educated to feed the stalks, stovers, dry grasses, green fodder and tree leaves after chopping them in small pieces, soaking in water and feeding such fodders in troughs, baskets or mangers.
4. Enrichment of straws/ cellulosic wastes through urea.
5. By changing the change the attitude of farmers to not burn the crop residues and utilize them as livestock feed.
6. Grass production from forest areas can be increased many folds by introducing higher yielding varieties of grasses such as hybrid Napier, Setaria, Guinea, Deenanath, Anjan, Tall fescue, Brome and Rye grass etc.
7. By introducing the measures for higher bio mass production in Van Panchayats. Providing protection to the Fallow, wastelands and orchards.

**Complete feed blocks (qtl)**

1. Involving the NGOs in procuring the waste straws and other agro-industrial byproducts and non conventional feeds from tarai areas. New variety of fodder plants needs to be introduced.
2. Fodder Banks in remote areas and providing the feed and fodder at reasonable price to the farmers.

**Wastage of fodder (qtl)**

Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

**3.A Existing health services:**

Diseases covered under vaccination: FMD, PPR, BQ and HS

Deworming schedule: As such no schedule is followed (lack of awareness)

Other Disease Control Programs/ Health Camps (criteria, target): Infertility Camps

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

1. 3 times scheduled deworming before and after rainy season and during winters.
2. At least 4 health camp per hospital

**4.A Existing management practices:**

Housing, hygiene, drainage: Shed locally called as “GOTH”, No proper system of drainage, ventilation and lighting facilities.

Feeding & watering practice: Generally animals are taken to forest for grazing.Whole plant residues are given as feed to the animals.

Welfare aspects: Mainly producing for their hosehold consumption. The marketing approach is still lacking.

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

1. Practiced of Weaning should be adopted.
2. Different shed for the pregnant animal should be there.
3. Use of chaff cutter and manger to minimize the wastage of fodder and labour of the women should be promoted.

4. Use of Urea-Molasses-Mineral Block

**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:**

**C3. Livestock: Sheep**

**1.A Existing breeds available: -**

**1.B Specific breeds to be introduced: -**

**2.A Existing feeds being used:** Green fodder, Dry fodder

**2.B Specific feeds to be introduced / advised: -**

**3.A Existing health services:**

Housing, hygiene, drainage: No seperate barn (house)is their, kept along with large animal.

Feeding & watering practice: Stall-fed and intensive production system. Semi-intensive production system , both the system of rearing are practised

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

1. The sheep house should always be protected from hot and cold wind, humidity, solar radiation and rain.
2. The house should have east-west orientation.
3. Shed should be constructed on elevated land and free from water logging or marshy areas.
4. Adequate floor space (1.2 to 4.0 sq mt/ goat) may be provided to avoid overcrowding.
5. Breed improvement should be adopted.
6. Castration at the right age i.e. 1 to 2 months forbetter meat quality, higher market price and unwanted breeding in the flock.

**4.A Existing management practices:**

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

**5.A Problems of Livestock system- Goatary, Poultry, Fisheries:**

**5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing:**

**C4. Livestock: Goat**

**1.A Existing breeds available:** Chaugarkha, ND

**1.B Specific breeds to be introduced:** Barbari

**2.A Existing feeds being used:** Green fodder, Dry fodder

**2.B Specific feeds to be introduced / advised:** Scientific grazing systems should be adopted on grazing lands and alpine grasslands

**3.A Existing health services:**

Diseases covered under vaccination: PPR

Deworming schedule: -

Other Disease Control Programmes/ Health Camps: PPR , Viral Exanthema

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

1. 3 times scheduled deworming before and after rainy season and during winters.
2. Regular treatment camps to be organized

**4.A Existing management practices:**

Housing, hygiene, drainage: No seperate barn(house)is their, kept along with large animal.

Feeding & watering practice: Stall-fed and intensive production system. Semi-intensive production system , both the system of rearing are practised

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

1. The goat house should always be protected from hot and cold wind, humidity, solar radiation and rain. The house should have east-west orientation.

2. Shed should be constructed on elevated land and free from water logging or marshy areas.
3. Adequate floor space (1.2 to 4.0 sq mt/ goat) may be provided to avoid overcrowding.
4. Breed improvement should be adopted.
5. Castration at the right age i.e. 1 to 2 months forbetter meat quality, higher market price and unwanted breeding in the flock.

**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:**

**C5. Livestock: Poultry**

**1.A Existing breeds available:** Croiler

**1.B Specific breeds to be introduced:** Very few broiler farms are in existence so it needs to be incorporated

**2.A Existing feeds being used:**

**2.B Specific feeds to be introduced / advised:**

**3.A Existing health services:**

Diseases covered under vaccination: Fowl pox and RD

Deworming schedule: -

Other Disease Control Programmes/ Health Camps: The field is Scattered

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:** Routine Schedule as proposed should be followed

**4.A Existing management practices:**

Housing, hygiene, drainage: Backyard rearing

Feeding & watering practice: Household waste, stones

Slaughtering & dressing, etc: Sold as live bird

Welfare aspects: Needs low input and provide high output in terms of good quality protein especially for growing and malnourished children.Poultry Sector, besides providing direct or indirect employment to rural women is also a important tool for subsidiary income generation for many landless and marginal farmers.

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

1. Feeding good quality feed. Early weight gain more profit, better hatching capacity.
2. Maintaining proper floor space and housing of the chicks.

**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:**

**C6. Livestock: Fisheries**

**1.A Existing breeds available:** Common Carp, Silver carp, Grass carp, Mahasheer

**1.B Specific breeds to be introduced:**

**2.A Existing feeds being used:**

**2.B Specific feeds to be introduced / advised:**

**3.A Existing health services:**

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

**4.A Existing management practices:**

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

**5.A Problems of Livestock system- Goatary, Poultry, Fisheries:**

**5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing:**

**Vet. Health services**

| Resouces | Manpower | Infrastructure |
|---|---|---|

| | | No. | V. O. | LEO | Pharmacist | Lab. Tech. | Livestock Assistant | Para vets | Buildings | Equipments | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vety. Hospitals | Existing | 37 | 34 | 48 | 15 | - | 86 | - | 27(Own) and 10(Rent) | Available | - |
| | Proposed | - | 3 | 59 | 24 | - | - | - | - | - | - |
| Mobile Vety. Unit | Existing | 1 | 1 | - | - | - | - | - | No | Not Available | - |
| | Proposed | 1/ block | 11 | - | 12 | 12 | - | - | - | Needs to be procured | |
| Vety. Dispen. | Existing | 107 | - | 48 | - | - | - | - | - | - | - |
| | Proposed | - | - | 59 | - | - | 107 | - | - | - | - |
| AI centres | Existing | 69 | 30 | 39 | - | - | - | | | Available | - |
| | Proposed | - | - | - | - | - | - | - | - | - | - |
| Disease Diag. Labs | Existing | 1(Divisional Level) | 1 | - | - | Vaccant | 1 | - | 1 | Available | - |
| | Proposed | - | - | - | - | 1 | - | | | | |
| Polyclinic | Existing | No | - | - | - | - | - | - | - | - | - |
| | Proposed | 2 | 2 | 4 | 2 | 2 | 4 | - | Required | Required | - |
| Ambu. Clinics | Existing | No | - | - | - | - | - | - | - | - | - |
| | Proposed | - | - | - | - | - | - | - | - | - | - |

**Availability of Medicines/ Vaccines**

**Specific health services to be required/ advised for doubling income in specific agro-ecological zone:**

1. Nutritional gap needs to be filled. Farmers should be provided feed & fodder supplements at subsidised rates.
2. Minimum support prize should be fixed for the farm products.
3. Improved market infrastrusture and market scope.

**Any other suggestions to improve the quality of Vety. Health services:**

1. Need restructuring of the department especially for the hilly areas so as to fulfil the staff requirement.
2. Refresher course should be organised for the doctors.

**Problems of Animal Husbandry**

| | | |
|---|---|---|
| Specific problems due to which income is not increasing | Poor accessibility | yes |
| | Water scarcity | Almost in the whole district |
| | Natural disasters | Frequency is low |
| | Wild life conflicts | Yes frequency is very high due to which farming intensity is decreased to a significant level |
| | Marketing of animals | No availability of structured market |
| | Marketing of products | Low production due to which there is no surplus to be marketed and the transportation cost is also very high thus making is not feasible |
| | Budget | Allocation is low |
| | Manpower shortage | Yes. Monopoly gender role in livestock activity |
| | Capacity building | Para veterinary staff and refreshal courses of vetenarians is required |

| | | |
|---|---|---|
| | Equipment & Implements (old/ shortage, etc.) | Adequate |
| | Mobility | Huge Problem. Dependence on the public vehicle is very high. Difficult terrain. Difficult road connectivity. |
| | Risk cover (Insurance) | Not given but should be given |
| | Relook to policies | - |

**D. Integrating Farming system**

**1.A Existing farming system:** Cattel+Crop/Vegetable

**1.B Specific farming system for doubling income in specific agro-ecological region:**

1. Protected cultivation+ Composting+Goatry/Backyard poultry
2. Fodder production+ Mini dairy+Composting+ Protected cultivation
3. Truthful self seed production(Jethi rice,Lentil, onion,radish,frenchbean,Pea)+ Planting material supply+Mushroom

**E. Reducing post harvest losses and value addition**

**1.A Existing grading facilities:** Manual

**1.B Grading facilities to be advised/ setup for doubling income in the agro-ecological region of district:**

**For grains:**

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

**For horticultural crops:**

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

**2.A Existing processing facilities:** Few units available in fruits

**2.B Processing facilities to be advised/ setup for doubling income in the agro-ecological region of district:**

**For grains:**

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity

**For horticultural crops:**

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

**3.A Existing packing facilities:** Few farmers

**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:** Use of tradicitional bins only

**4.B Storage facilities to be advised/ setup for doubling income in the agro-ecological region of district:**

**For grain**:

1. Multipurpose (small to medium size) warehouse with mechanical drying and fumigation facility
2. Drying cum storage silo
3. Modified atmosphere and Hermetic storage structure
4. Kothar, metal bins for small capacity

**For Horticultural crop:**

1. Air/water pre-cooling chambers on farm level for removal of field heat
2. Evaporative cool chamber for chilling sensitive crops
3. Modified or control atmospheric storage structures
4. Cold storage structures
5. Zero energy cool chamber for hilly areas
6. Solar power cooling chambers

**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:**

1. Development of community pasture.
2. Rejuvenation/repair of faulty/abandoned terraces;
3. Stabilization of eroded land using biological/engineering measures;
4. All agricultural operations should be done on contours i.e. across the existing land slope.
5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
7. Diversion of runoff through ditches from upper slopes to safer places.
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks

for protection.

9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
10. Contour trenching (staggered/continuous).
11. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
12. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
13. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
14. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

**2.A Existing plantation:** Local grasses.

**2.B Plantation suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:** Plantation of suitable trees/brushes in waterlogged and eroded areas

**3.A Existing fodder production:** Berseem, Maize, oat

**3.B Fodder suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:**

**Guinea grass (*Panicum maximum*)**

1. Seed rate( Kg/ha)- 3-4
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management-60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

**Setaria grass (*Setaria anceps*)**

1. Seed rate( Kg/ha)- 1.5 2.0
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 100:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available.
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

**Spear grass (*Hetropogon contortus*)**

1. Seed rate( Kg/ha)- 4-5
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available..
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting

**Rhode grass (*Chloris gayana*)**

1. Seed rate( Kg/ha)- 3-5
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
3. Fertilizer management- 60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
4. Irrigation management- Crop must be irrigated after each cut provided water is available.

5. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

**Marvel grass (*Dicanthium annulatum*)**

1. Seed rate( Kg/ha)- 4-6
2. Spacing (cm)- 50cm x 30cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management-60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available.
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

**Packages of practices to be advised for waste land development**

1. Rejuvenation/repair of faulty/abandoned terraces;
2. Stabilization of eroded land using biological/engineering measures;
3. Plantation of suitable trees/brushes in waterlogged and eroded areas;
4. All agricultural operations should be done on contours i.e. across the existing land slope.
5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
7. Diversion of runoff through ditches from upper slopes to safer places.
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
10. Contour trenching (staggered/continuous).

**Waste water management**

1. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
2. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
3. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
4. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

**4.A Type of waste water:**

1. Effluent from kitchen and bathroom
2. Flowing springs
3. Sewage water from cities from being discharge into surface and ground water resources

**4.B Existing treatment facilities:** NA

**4.CTreatment facilities to be advised/ developed for waste water treatment and utilization in the agro-ecological region of district:**

1. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
2. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
3. 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.

**G. Reduced cultivation cost**

**1.A Existing inputs being given:**

**Rice-wheat/Rice-Potato/Maize-Rajma/Mustard**

1. Annexure–II is enclosed for N,P and K.
2. In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn)/ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop
3. 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. Soil application of 215 kg gypsum/ha
5. Foliar spray of 1% $FeSO_4$ in rice nursery

**Tomato, Cabbage, Capsicum, French bean, Green pea, Radish**

1. In Zn deficient soils, application of 10 kg $ZnSO_4$ (21% Zn)/ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop
2. Foliar spray of 0.2% Borax
5. Soil application of 215 kg gypsum/ha

**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:**

**Paddy**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Conventional nursery raising.
3. Puddling by damala / peg type wooden puddler.
4. Manual transplanting.
5. Manual weed control .
6. Manual fertilizer application.
7. Manual harvesting.
8. Manual threshing.
9. Hand operated paddy thresher –cum-winnower.
10. Cleaning by winnowing fan.

**Wheat**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**Pulses**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting / line sowing / manual thinning.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**Millets**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting / line sowing / manual thinning or by animal drawn danala.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.

6. Manual threshing.
7. Cleaning by Winnowing fan.

**Soybean**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual line sowing.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**Maize**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual line sowing.
3. Manual weed control.
4. Manual earthing-up of plants.
5. Manual fertilizer application.
6. Manual harvesting.
7. Manual shelling.

**Potato**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Furrow making manually or by animal drawn Nasuda.
3. Manual planting and ridge making.
4. Manual weed control.
5. Manual fertilizer application.
6. Manual harvesting / using animal drawn Nasuda.
7. Manual grading.

**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:**

**Paddy**

1. Seedbed preparation by using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Puddling by light weight power tiller / animal drawn improved Pant damala.
3. Weed control by conoweeder.
4. Manual harvesting / harvesting by power cutter / power tiller front mounted vertical conveyor reaper.
5. Threshing by Pant axial flow power hill thresher / hand operated paddy thresher-cum-winnower.

**Wheat**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by single or double row Pant zero-till drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe.
4. Plant protection by manually operated sprayers.

5. Manual harvesting / harvesting by power cutter / power tiller front mounted vertical conveyor reaper.
6. Threshing by Pant wheat thresher for hills.

**Pulses**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by single or double row Pant zero-till drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe.
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.
6. Pant axial flow power hill thresher.

**Millets**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Manual line sowing / improved millet seed drill.
3. Weed control by improved wheel hoe.
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.
6. Threshing by VPKAS millet thresher.

**Soybean**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Sowing by Pant zero-till single / double row seed drill / light weight power tiller operated seed drill.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.
6. Light weight soybean thresher / Pant multi-crop hill thresher.

**Maize**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Manual sowing / power tiller operated maize planter.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Manual earthing-up of plants
5. Plant protection by manually operated sprayers.
6. Manual harvesting using improved sickles.
7. Shelling by hand held maize sheller / power operated maize sheller.

**Potato**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Furrow making manually or by animal drawn Pant hill plough / furrower.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Earthining by power tiller operated or animal drawn ridger.
5. Plant protection by manually operated sprayers.
6. Harvesting by animal / power tiller operated potato digger.
7. Grading by mechanical potato grader.

**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. Fertilizer application should be based on soil test value at right time, right place, right stage with right method.
2. Basal application (50%N+100% P&K) at the time of sowing and 02 foliar application of N, secondary and micronutrients on standing crop.
3. Apply well decomposed organic manures and composts such as vermicompost, biofertilizer to supplement costly fertilizers to reduce cost up to 25-30%.
4. Inclusion of pulses in crop rotation.
5. Need based and recommended concentration of plant protection chemicals using correct method of application.
6. Enhanced use of bio-agents to control disease and pests; avoid use of costly chemicals.
7. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons.
8. Use optimum and recommended seed rate at optimum spacing and depth.
9. Use good quality of water and avoid excess use of water for irrigation.
10. Sprinkler and drip methods for irrigation should be encouraged to improve water use efficiency.
11. Promote reduced tillage operations.

6. **Factors responsible for increasing cost of cultivation in the specific agro-ecological region of district:**

**Irrigated valleys and lower hills**

1. Represent subtropical climate with moderating high temperature (18-30 $^0$C) medium rainfall, low humidity (40-50%) and experiences no snowfall. 80% of total precipitation is received during June to September.
2. Sal in outer Himalayas and pine and oak in middle and inner Himalayas are the predominant vegetation. Soils are alluvial sandy loam to loam.

**Rainfed lower hills**

1. Soils are gravelly and chirty, deep, sandy loam to silty clay loam.
2. Soils are slightly to moderately acidic in nature.

**Factors responsible for increasing cost of cultivation**

1. Heterogeneous soils, soils of each situation differ widely in their physical, physico-chemical characteristics as they are developed from a variety of rocks and minerals under joint influence of vegetation, physiography and climate.
2. Sloping lands with high rate of removal of soil and nutrients from surface through erosion resulting to depletion of soil fertility.
3. Scattered holding and marginal land size.
4. 90 % of areas of mid and high hills are rainfed.
5. High rates of migration from hills to plains of males and young boys in search of jobs.
6. Women based farming system without technical knowledge – how and inputs.
7. Low efficiency of conventional farm tools and implement.
8. Indigenous breed of livestock with low production and working efficiency.
9. Poor quality of FYM. The method of preparation and application of FYM are defective generally heaped in an open area resulting into loss of nutrients.
10. Mostly soils are slightly to strongly acidic in nature depending upon elevation, vegetation and development of soil from rocks and minerals causing nutrient imbalance in soil and impose hidden nutrient toxicity and deficiency symptoms in crops retard growth and yield.
11. Minimum use of fertilizers: farmers are mostly small and marginal economically backward, not able to apply recommended doses of fertilizers. The average consumption is < 10 kg N:P:K ha-1.
12. Non availability of quality seeds of varieties recommended for rainfed upland situations.
13. The inputs are costly and therefore, the small and marginal farmers are not able to adopt the improved technology.

14. Non availability of inputs at right time and right place.
15. Sowing of crops is at the mercy of rains which are erratic. Thus planting is delayed and not done on suitable time. Sowing are done more than once either because of insufficient moisture mostly in rabi crops or due to crust formation in kharif.
16. Farmers follow practice of dry sowing. In such situation the seeds are eaten by birds and grubs resulting in inadequate plant population.
17. Due to limited moisture and nutrient supply the growth of crops is not proper and vegetative phase of growth (flowering and fruiting) are advanced.
18. Improper seed bed preparation: in order to utilize moisture, the farmers do not wait for fine preparation of fields and rush for sowing. This results in improper germination and infestation of weeds.
19. Severe infestation of insect-pest: white grubs and cut worms are the serious polyphagous pests, kill plants and reduce plant population up to 70-80 %. Due to non availability of suitable plant protection chemicals as well as high cost they are beyond the means of farmers. Besides, non availability of water for solution also pose problems.
20. Weeds; common weeds of the upland rainfed areas are Tipatiya (Oxalis latifolia), Pardeshi( Galensojaparviflora), Gajar grass ( Parthenium Sp.)Kuni( Lantena camera) Kala bansa ( Eupatorium sp.).The loss in general in food crops is high from 50-75 %.
21. Improper terrace management: most of terraces developed by farmers are on steep slopes with outward gradient.
22. Lack of proper drainage system for safe disposal of excess rainwater. The heavy runoff of water washes away the top fertile soil lead to steady depletion of nutrients and organic matter.
23. Coarse textured soils (charty/gravely) with low moisture and nutrient retention capacity.
24. Lack of proper storage facilities for crops (cold storage).
25. Lack of awareness for protected cultivation techniques and facilities for commercial high value crops (poly houses, poly tunnels, poly for raising nursery and cash crops.
26. No good marketing facilities.
27. Lack of proper irrigation facilities for minor irrigation and drip irrigation with fertigation.
28. Poor connectivity of road transport system.
29. Lack of farmer's participatory approach models for crop production technologies under hill agricultural system for the state.

**H. off-farm income**

**1.A Existing SHGS operative in specific agro-ecological region of district:**

Shahbhagita(Behgagil), Shanti(Behgagil), Kamdhenu(Shail), Chirag (Shail), Durga(Katarmal), Jai Devi(Katarmal), Jai Surya (Katarmal), Jai golu(Katarmal), Laxmi(Gnayee), Jagriti(Dhon), Gogata first (Gogata), Gogata second(Gogata), Gogata third(Gogata), Laxmi (Bachurari), bhagwati(Dholra), Bargav-2(Bargav), Golu(Bargav), Naveen(Pantkotli), Saral(Pantkotli), Eroli first(Eroli first), Pratiksha(Pilkholi), Deepika(Pilkholi), Pawan(Pilkholi), Prem second(Aliee), Maya(Aliee), Jaidurga (Daso), Swayam deveta (Bhetadangi), Jaigoludeveta(Bhetadangi), Bhagwatimata (Bhetadangi), Jagran(Simalgaon), Navjyoti(Simalgaon), Sakhi (Bhandergaon), Jyoti(Bhandergaon), Saral(Adbora), Siddhi (Adbora), Jalali SHG(Jalali), Ekta(Jalali), Muniyachora first (Muniyachora), Jai bhumiya (Neikana), Shiv shakti(Pali), Nav Jyoti (Pali), Ma jagdamba(Chani), Ma saraswati(Chani), Laxmi (Rampur), Rampur second(Rampur), Priyanka(Erari), Bhagwati (Bajkhet), Lakshmi(Kapkot), Suman(Kapkot), Kali(Goona), Aart (Goona),

**1.B SHGS to be created/ encouraged in the specific agro-ecological region of district for doubling agricultural income:**

Shahbhagita(Behgagil), Shanti(Behgagil), Kamdhenu(Shail), Chirag (Shail), Durga(Katarmal), Jai Devi(Katarmal), Jai Surya (Katarmal), Jai golu(Katarmal), Laxmi(Gnayee), Jagriti(Dhon), Gogata first (Gogata), Gogata second(Gogata), Gogata third(Gogata), Laxmi (Bachurari),

Bhagwati(Dholra), Bargav-2(Bargav), Golu(Bargav), Naveen(Pantkotli), Saral(Pantkotli), Eroli first(Eroli first), Pratiksha(Pilkholi), Deepika(Pilkholi), Pawan(Pilkholi), Maya (Aliee), Jaidurga (Daso), Swayam deveta(Bhetadangi), Jaigoludeveta(Bhetadangi), Bhagwatimata(Bhetadangi), Jagran (Simalgaon), Navjyoti(Simalgaon), Sakhi(Bhandergaon), Jyoti (Bhandergaon), Saral(Adbora), Siddhi(Adbora), Jalali SHG(Jalali), Ekta(Jalali), Muniyachora first(Muniyachora), Jai Bhumiya (Neikana), Shiv Shakti(Pali), Nav Jyoti(Pali), Ma Jagdamba(Chani), Ma Saraswati (Chani), Laxmi(Rampur), Rampur second(Rampur), Bhagwati(Bajkhet), Lakshmi(Kapkot), Suman(Kapkot), Kali (Goona), Aart(Goona),

1. There is need to have regular monitoring and follow up of SHG's by the forming agencies and time to time evaluation of the group.
2. Regular monitoring by the concerned agency must be ensured like ensuring regular meeting of the SHG, checking their register, regular collection of the money, help during conflicts, solving problems occurring during banking etc. and submitting the monitoring report to their concerned officials so that steps can be taken by the high officials to ensure regular continuity of the SHG.
3. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
4. A large number of groups discontinued as they were not having knowledge regarding income generating activities that can be started (what activities can be taken up, how to operate it, where to market the produce etc.) So there is need of encouragement, motivation along with imparting knowledge, skills and linking them to market.
5. Trainings should be provided to the rural women on income generating activities as per the need of rural women, marketing potential and availability of locally available resources.
6. Loan procedure should be made more flexible with less interest rate.
7. As there were problems like non-cooperation among members, confusion regarding money matter, lack of confidence on office bearers with respect to group money etc., there is need of organizing training on good governance, democratic election and how to solve financial and administrative issues.
8. SHG's formed should be grouped into clusters, federations and registered cooperatives so as to converge with govt. schemes, facilitate collective purchase of input and marketing of products.
9. To encourage people to form and sustain SHG's so that new enterprise developed, intensive work needs to be done with them in sustainable manner.
10. Enterprises need to be identified depending upon local resources- human and material.
11. Market linkages need to be developed so that people can sell their produce gainfully.

**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:**

1. Dairying, Copper, wood carving,

2. Buranse fruit juice, woollen articles, carpet weaving, mandua biscuits etc.

**2.B Micro-entrepreneur employment to be generated in the specific agro-ecological region of district for doubling agricultural income:**

1. Farm machinery bank, Lively hood activities
2. Copper, wood carving, buranse fruit, woollen articles, carpet weaving,
3. Aipan designing, nettle fibre craft (bichu grass) are local crafts of the area which can be further promoted for generation of income and employment.

1. **3.A Existing skill development facilities:** Office of Development commissioner (handicrafts)
2. Handicraft marketing,
3. Service and extension centre

**3.B Skill development facilities to be created in the specific agro-ecological region for doubling agricultural income:**

1. Demonstration , Exposure visit, Farmer exhibition, Workshop
2. Training centre, processing and packaging units as per the locally available resources

**4.A Existing women skilling facilities:** Zila udyog Kendra, Educational institute and NGOs

**4.B Women skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:**

1. Demonstration ,Training , Exposure visit, Farmer exhibition, Workshop ,SHG formation
2. Nursery , Mushroom, Beekeeping,
3. Dairy, Fodder production, Preservation/Value addition,Boutique
4. Training centres processing, packaging units and market outlet as per the locally available resources

**5. A Existing youth skilling facilities:** Zila udyog Kendra, Educational institute and NGOs.

**5.B Youth skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:**

1. Nursery, Mechanic, Mushroom, Beekeeping, Dairy, Fodder production, Preservation/Value addition
2. Training centres processing, packaging units and market outlet as per the locally available resources

**Beekeeping**

Beekeeping is an environment friendly and agro-forestry based occupation. It provides enormous potential for income generation, poverty alleviation and sustainable use of forest resources. Beekeeping is one of the oldest traditions in India for collecting the honey. Honey bee farming is becoming popular due its demand in national and international markets as well. *Apis cerana indica* is the indigenous bee, is known to be the ideal pollinator for organically grown mountain crops due to its capacity to significantly enhance agricultural productivity. India has a potential to keep about 120 million bee colonies that can provide self-employment to over 6 million rural and tribal families. In terms of production, these bee colonies can produce over 1.2 million tons of honey and about 15,000 tons of beeswax.

**Less Investment:** Bee Farming is not a manufacturing activity, as such costly machine and tools are not required. There is nothing like production capacity as well. Only small wooden frames with boxes are needed. Their sizes are also standardized. To begin with around 15 such sets/boxes can be purchased or assembled at rate of Rs.1500.00 per box that would cost Rs.22, 500/- for 15 Boxes. Honey extractors would cost to the tune of Rs.5, 000/- each with filtration facilities. For other miscellaneous expenditures including training and consultancy services a sum of Rs.5000.00 can be earmarked. That means total of Rs.32, 000.00 would be required to start Bee Farming with 15 Boxes which is equivalent or less than the cost of cultivation of one acre of paddy field.

**More Returns:** As per the established norms, each box comprises 7-8 hives which is able to harvest around 30-35 kg of honey in a year. The annual harvest of honey starting with 15 bee boxes could be 450-525 kg depending on the flowering season. Even after considering very conservative selling

price of Rs. 150/- per kg; the annual realisation would be to the tune of Rs. 67,500/- to Rs.78,750/-. Therefore, Bee Farming can be considered as an excellent, profitable agro-based green enterprise for landless farmers and entrepreneurs.

Beekeeping in Uttarakhand: Beekeeping has been an integral part of human society since centuries in hill regions of Uttarakhand state. The state of Uttarakhand has a predominantly agrarian economy and large number of small and marginal farmers in the mountainous state call for augmenting agricultural production by organic means. The indigenous bee sub-species *Apis cerana indica* commonly is ideal pollinator for organically grown mountain crops, with the capacity to significantly enhance agricultural productivity with an indirect but vital role in combating soil degradation by pollinating wild plants thereby enabling improved regeneration of bio mass, to be returned to the soil. Beekeeping with *Apis cerana indica F*. is a common practice in hills of Garhwal and Kumoun Himalaya which is carried out mostly by using traditional methods since long past and is stationary in nature. In these regions, beekeeping is also carried out with *Apis mellifera,* but in winter season, due to temperature lower than 20ºC, colonies are being migrated to plains. According to report given by KVK Jeolikot(2017), in Uttarakhand, there are about 4,790 beekeepers with 45,247 number of *A. cerana indica* colonies yielding 546.70 mt of honey production. Whereas, in Almora region of Uttarakhand, there are about 400 beekeepers with 1,165 number of *A. cerana indica* colonies yielding 16.4 mt of honey production. The Uttarakhand state has extremely rich bee forage plants. In most of the remote areas where *Apis cerana indica* beekeeping is common, the use of pesticides and chemicals is negligible, the level of dangerous chemicals in the atmosphere is insignificant and the environmental pollution is at minimal level. Honey produced from such areas is purely natural, free of any residues and can be sold as an organic product. There is vast potential for beekeeping in the country. However, due to lack of knowledge, scientific beekeeping is not being practiced by, most of the beekeepers. It is necessary for beekeepers to participate in the trainings / other capacity building programmes on the subject to gain scientific knowledge on the subject. Selection of good apiary site, good quality bees and proper management are the main keys for success of beekeeping. Following are the important points to start beekeeping and further management practices.

**1. Selection of good apiary site:** Select apiary site by considering the following:

1. Apiary ground should be clean & free from dry leaves etc. to avoid fire during summer
2. Apiary site should be away from power station, brick kilns, highway and train tracks
3. Site should be open & at dry place having shade
4. Site should be easily accessible by road
5. Fresh running water should be easily available near the apiary
6. It should have natural / artificial wind breaks
7. Site should receive early morning and afternoon sunshine
8. There should not be other commercial apiary within 2-3 kilometers from the apiary site
9. There should not be any source of stagnant / dirty water, chemical industry/ sugar mill, etc., nearby the apiary
10. Area should be rich in bee flora

Flora suitable for *Apis cerana indica* in Almora, Uttrakhand region is given below:

| Bee flora (common name) | Scientific name | Source of food |
|---|---|---|
| Simbal | *Bombax ceiba* | Nectar/Pollen |
| Beol | *Grewia* | Nectar/Pollen |
| Ritha | *Sapindus edetergens* | Nectar |
| Onion | *Alium cepa* | Nectar/Pollen |
| Dharak | *Melia azadiracta* | Nectar |
| Sarson | *Brassica compestis* | Nectar |
| Raya | *B. juncea* | Nectar/Pollen |
| Bottle Brush | *Callistemon lanceolatus* | Nectar |

| | | |
|---|---|---|
| Amaltas | *Cassia fistula* | Nectar |
| Dhania | *Coriandrum sativum* | Nectar/Pollen |
| Shishum | *Dalbergia sisoo* | Nectar/Pollen |
| Safeda | *Eucalyptus spp.* | Nectar/Pollen |
| Sunflower | *Helianthus annuus* | Nectar/Pollen |
| Guava | *Psidium guajava* | Nectar/Pollen |
| Behda | *Terminalia bellerica* | Nectar/Pollen |
| Hirda | *Terminalia chebula* | Nectar |
| Toon | *Toona ciliata* | Nectar |
| Ber | *Ziziphus mauritiana* | Nectar/Pollen |
| Bhang | *Cannebis sativa* | Pollen |
| Malta | *Citrus aurantifolia* | Nectar/Pollen |
| Apple | *Malus domestica* | Nectar/Pollen |
| Badam | *Prunus amygdalus* | Nectar/Pollen |
| Til | *Sesamum indicum* | Nectar/Pollen |
| Apricot | *Prunus armeniaca* | Nectar/Pollen |
| Plum | *P. domestica* | Nectar/Pollen |
| Pear | *Pyrus pashia* | Nectar/Pollen |
| Peach | *Pyrus persica* | Nectar/Pollen |
| Tipatia | *Trifolium sp* | Nectar/Pollen |
| Paja | *Prunus puddum* | Nectar/Pollen |
| Buckwheat | *Fagopyrum aurantifolia* | Nectar/Pollen |
| Almora weed | *Rumex spp.* | Nectar |
| Goosberry | *Ribes grossularia* | Nectar/Pollen |
| Rose apple | *Eugenia jambus* | Nectar/Pollen |
| Mango | *Mangifera indica* | Nectar/Pollen |
| Citrus | *Citrus sinensis* | Nectar/Pollen |

**2. Selection of good quality bees:** Beekeeping depends on floral resources, climatic conditions, management and also quality of bees, particularly queen. Therefore, the following should be kept in mind to select the bee colonies:

1. Buy disease free bee colonies from existing reputed beekeepers after getting training on the subject.
2. Select and multiply honey bee colonies only from disease resistant, high honey yielding, young, healthy and high egg laying capacity queen, less swarming tendency etc.
3. Keep colonies with good prolific queens
4. Capture few bee colonies from their natural abodes in forests which may be used for further breeding/ multiplication to prevent inbreeding.

**3. Management of apiary:**

**A. Placement of colonies in apiary**

1. Hives should be as per specification of BIS/ISI and should be of locally available seasoned light weight wood. Unseasoned and heavy wood should be avoided
2. Avoid nailing the bottom board with the brood chamber
3. Restrict number of bee colonies in a apiary from 50-100
4. Keep row to row and box to box distance as10 and 3 feet, respectively

Hives used for traditional beekeeping in hilly areas are

**Wall hives:** Wall hives locally known as 'Khadra', 'Jaala' or 'Jalota' are rectangular structures made in the walls of houses and 'Chhaan' or 'Sunni' (cattle sheds) at the time of construction. Each hive has a small round or rectangular opening on the outer side as an entrance for bees. The size of 'Jalotas' varies in different locations; usually they are 45-60 cm in length, 25-30 cm in width and

20-30 cm in height. Generally one hive is made in each wall, but numbers may vary from 2-4. The interiors of hives are smoothed with cow dung and clay. In winters due to lack of floral resources and extreme cold in the hills, the population of *Apis cerana* colonies decreases to a great extent. Thick wall hives provide considerable insulation in such conditions.

**Log hives:** Two types of log hives are found, Type I: These are made up of cylindrical hollowed pieces of tree trunk 60-100cm long and 20-40 cm in diameter; however size depends upon the circumference of available trunks. This type of log hives is usually made from the trunk of *Quercus leucotrichophora, Q. floribunda, Rhododendron arboreum and Pinus roxburbhii.* The entrance is made at the mid front side. Both sides are plastered with a mixture of cow dung and clay. Type II: Old cooperages locally known as 'Pariya' or 'Dokha' when rendered useless for milk products, are used as hives. These are about 70-90 cm long with the diameter at top from 25-35 cm and thickness of log 3-5cm. An entrance is made towards the outside and the hive is placed horizontally on a raised platform of stones or the wall of a courtyard. It is mainly made up of the wood of *Ougeinia oogeinesis, Rhododendron arboreum, Toona* sp. A stripe of old comb is fixed to the upper part, inside the hive, and is plugged with a wooden or metal cover, then sealed with a mixture of clay and cow dung. The wooden lid is fixed at the top with an entrance on it.

**Miscellaneous Types:** These are rectangular box hives made up of separate wooden boards with movable top cover. Their size varies in different localities. Usually these are 80-110 cm long, 25-30 cm wide and 40-50 cm high. During extraction, the top cover is removed along with attached combs and bees, and taken away from the hive, then each comb is smoked and shaken gently. Bees return to the hive and beekeepers cut combs easily.

All hives are made from locally available materials, thus are economically cheaper and environmentally friendly. These hives have thicker walls as compared to modern hives thus provide protection to bees from extremely low and high temperatures. In higher hills traditional hives are more suitable than modern hives but for the drawback in colony management.

**B. Inspection of colonies**

1. Adopt general colony and personal hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board, top cover, etc. frequently
2. Check the colonies periodically for any abnormalities or changes in behaviour of bees
3. Inspect colonies on clear sunny days preferably at temperatures between 20 and 30°C
4. Do not inspect colonies in cold, windy and cloudy days
5. Use smoker when needed to subdue the bees
6. Use protective dress and veil while inspecting colonies
7. Handle colonies gently, avoid jerks
8. Avoid crushing bees as it could lead to stinging
9. Isolate the diseased colonies from healthy ones.
10. Handle diseased and healthy colonies separately

**C. Provision of fresh water in the apiary**

Ensure availability of fresh water preferably in shallow containers near the apiary to maintain a healthy apiary. Water is needed for the following

1. Maintenance of adequate humidity in a colony to ensure proper incubation of eggs
2. For feeding bee bread by nurse bees, the mixture of honey and pollen of certain consistency is required for which water is needed
3. When temperature in the apiary increases beyond 37°C, water is used by bees to evaporate and cool the colony

**D. Dearth period management**

1. Provide 50% sugar syrup to the colonies during dearth periods when honey stores in the colonies is not adequate and nectar is not available in the area. The syrup should be prepared by boiling clean water in the vessel and sugar added with slow stirring for few minutes. Cover the vessel with lid and let it cool. Feed cooled syrup.

2. Sugar syrup should be kept in such a way that the bees should not drown in it. This should be ensured by using shallow vessels with straw to facilitate easy feeding
3. Do not prepare the feed in open in the apiary and avoid dripping on the ground to prevent robbing by bees and ants
4. Feed the colonies in the evening preferably after sunset
5. Feeding should be given to all colonies in the apiary at one time
6. Pollen substitute comprising of fat free soyabean flour (3 parts) + Brewer's yeast (1 part) + skimmed milk powder (1 part) + sugar (22 parts) +honey (50 parts) made in the form of patties should be provided when pollen stores in the colonies is not adequate and pollen is not available in the area
7. Provide fresh water near the colony in shallow vessels
8. Extra frames should be stored in air tight chambers and fumigated with sulphur powder regularly
9. Old and dark combs should be discarded

**E. Care during honey extraction**

1. Use honey extractor, containers and other bee hive tools /equipments made of stainless steel / food grade plastic. Don't use tins & containers made of other degraded material
2. Wash all the equipments / containers etc. thoroughly with warm water before honey extraction
3. Extract honey from super chambers only
4. Select frames only with 75% sealed cells with ripened honey for extraction
5. Cover the entrance gate of the colony with small branches or twigs to avoid robbing
6. Extract honey in a closed room and not in the open to avoid robbing
7. Do not leave super and brood frames, after extraction of honey open in the apiary;
8. Do not spill honey in the apiary

**F. Care during migration**

1. Migrate colonies during non-availability of flora to areas with abundant flora.
2. Before migration survey the area to assess the availability of the flora to locate the colonies
3. Ensure honey extraction before migration
4. Close the entrance gates of the colonies in the evening after all worker bees are inside the colony
5. Pack the colonies internally and externally before migration to avoid jerking
6. Colonies in the vehicle should be packed in such a way that the entrance side should face the front side of the vehicle
7. Start migration late in the evening and ensure the colonies reach the destination within 10-12 hrs. the next day morning and entrance gates are opened after landing in the new location
8. Avoid jerking in the way while transporting bee colonies

**G. Seasonal management of apiary**

a**) Summer Management**

1. Keep the colonies in thick shade
2. Regulate the microclimate of the apiary by using wet gunny bags over top cover and sprinkling water around the colonies in the apiary during noon hours.
3. Provide fresh water in/near the apiary

**b) Monsoon management**

1. Clean and bury deep the debris lying on the bottom board
2. Keep the surroundings of the colony clean by cutting the unwanted vegetation which may hamper free circulation of the air
3. Provide artificial feeding (sugar syrup and/or pollen substitute) as per requirement of the colony
4. Check the robbing within the apiary
5. Unite weak/laying worker colonies

6. Control predatory wasps, ants, frogs, lizards in the apiary

**c) Post monsoon season management**

1. Provide sufficient space in the colony
2. Strengthen the colonies to stimulate drone brood rearing
3. Control ectoparasitic mites, wax moth and predatory wasps

**(d) Winter management**

6. Examine the colonies and provide winter packings in weak colonies specially in hilly areas
7. Feed sugar/pollen substitute to weak colonies as stimulative feeding to provide energy and initiate brood rearing
8. Shift the colonies to sunny places
9. Protect the colonies from chilly winds by using wind breaks
10. Unite the weak colonies with stronger ones

**e) Spring management**

1. Unpack the colonies, clean the bottom board, replace the worn out hive parts and provide sufficient space
2. Provide stimulative sugar/pollen substitute to increase brood rearing
3. Equalise the colonies
4. Extra frames should be raised by providing comb foundation sheets
5. Replace the old queens with new ones through mass queen rearing or divide the colonies
6. Manage the colonies in such a way to prevent swarming
7. Monitor regularly for ectoparasitic mites and adopt control measures

**H. Protecting colonies from pesticides**

1. Persuade the farmers not to use pesticides or use selective pesticides that are less harmful to bees at recommended concentrations
2. Avoid the use of dust formulations as they are more harmful to bees than spray formulations
3. Prior information about spraying would help in reducing poisoning of bees
4. Avoiding spraying of pesticides during flowering of the crop and peak foraging time of the bees would help in reduction in the mortality of foraging bees
5. Spraying may be done in the evening after sun set when bees do not forage
6. Colonies may be temporarily shifted if heavy spraying schedule is fixed
7. If shifting of the colonies is not possible, feed with 200 ml sugar syrup and close the gate by using wire screen for the day of spraying.

**I.Methods of attracting and catching swarms**

1. Swarming is a natural process for propagation of honey bees. Swarms are the lone source of bees in traditional beekeeping of *Apis cerana* while only a few empty hives are inhabited by absconded or feral colonies.
2. Empty hives are cleaned and smeared with clay, cow dung or both. Honey or jaggery are put inside hive to be used as bait to attract the swarm.
3. Flowering shoots of *Brassica campestris, or Raphanus sativus* can also be used just above the hive entrance, hoping that scout bees will find their home in the empty hive.
4. When swarms is found in the vicinity, water can be sprinkled and soil or ash can be thrown to settle them. 'Tofri' or 'Garori' (special baskets) made up of 'Ringal' (bamboos); 'Jhola' (bag) can be used to catch and carry swarms. 'Kutrine' (burning cotton cloth) is used as a traditional smoker and 'Talikh' (a cloth) to save faces while catching the swarm.
5. To catch a swarm layer of jaggery or honey is applied at the inner base of the basket and hang it inverted near the settled cluster. The cluster is gently displaced from the other side with smoke to direct the bees towards the basket. As the swarm makes a cluster on the basket, it is transferred to the hive. When the bees are settled the basket is removed. Finally the hive is closed with its wooden cover and be smeared with a mixture of cow dung and clay.

**J. Management of Honey Bee Diseases and pest**

Honey bees could be affected by diseases and the real cause of abnormality or any disease present in the honey bee broods need to be ascertained before taking up any control measures. It is best to contact the researchers/scientists/beekeeping experts at the nearest centre or university or Government department working on honey bees. After the exact diagnosis of the causal agent of the particular disease, the guidelines/ recommendations given by the expert should be followed in true letter and spirit. However, general advisory for the management of common diseases of honey bees is given below:

1. Select good site to locate the apiary preferably in an open, dry place with shade.
2. Adopt general colony hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board frequently.
3. Select and multiply honey bee colonies only from disease resistant stocks.
4. Keep colonies with good prolific queens.
5. Create broodlessness in colony for at least 15 days by enclosing the queen in a queen cage.
6. Check the colonies periodically for any abnormalities or changes in behaviour of bees.
7. If you observe any colonies with disease, isolate them from healthy ones. Handle diseased and healthy colonies separately.
8. Keep the colonies strong by adding sealed brood comb or worker population only from healthy colonies and also by providing adequate food during dearth periods.
9. Prevent robbing, drifting, absconding and avoid migration of bee colonies when you notice disease symptoms.
10. Follow 'Shook Swarm' or shaking method to remove contaminated combs completely by transferring entirely new combs in one operation to the colonies with disease symptoms. Destroy the removed combs by burning.
11. Sterilise the combs and equipments by any one of the following methods:

c. Disinfect the empty combs and equipments with 80 per cent acetic acid @ 150 ml per hive body in piles for few days at a protected place. Air the treated materials before use.
d. Dip the contaminated equipments and combs in soap solution containing 7 per cent formalin for 24 hours. Then wash the treated material with water, dry and use.

12. Use of antibiotics to control honey bee diseases is likely to result in contamination of honey causing problems in export of honey.
13. The traditional method to check the entry of ants is spreading ash or turmeric powder in their way.

**K. Honey Extraction**

The main honey seasons in hilly areas are '*Chait*' (April), '*Baisakh*' (May) and '*Ashaad*' (July-August). In some localities, an additional extraction during '*Kartik*' (October) is also done. Colonies yield most honey in '*Chait*'-'*Baisakh*' and the least in '*Kartik*'. Traditional tools used are '*Dathule*'. (sickle) to open the cover or wooden plug and '*Buwan*' (traditional brush) made up of '*Babul*' (*Eriophorum comosum*) to brush off bees. Besides these traditional smokers, large pans for keeping combs, a pot with water and '*Parunla*' or knife for cutting '*Faur*' or '*Fwar*' (bee combs) are required at the time of harvest. Honey is mostly extracted at night but a few beekeepers do it in day time also. Combs are cut down, leaving the innermost comb for feeding and to attract swarms the next year. Honey combs are squeezed after removing the brood area from the cut combs. The harvested honey has many impurities like insect body parts, wax cells, etc. Usually, squeezed combs are thrown away after extraction, which can be fed to cattle especially bulls. Honey is stored in plastic or metal containers and in bottles.

The beekeepers doing beekeeping with modern hives should use honey extractors to harvest honey. The quality of honey extracted using honey extracting machine is much better than squeezing method.

**Mushroom cultivation**

The shrinking land, demand for functional foods, priorities for recycling agricultural residues and

changing trades in view of globalization are going to play an important role in the agricultural scenario, and secondary agriculture is likely to play a pivotal role. Our country can emerge as a major player in mushroom production in wake of availability of plenty of agricultural residues and labour. To remain competitive it will be important to harness science and modern technologies for solving the problems of production and bio-risk management. Mushroom being an indoor crop, utilizing vertical space offers solution to shrinking land and better water utility. Packages and practices of mushroom cultivation in Almora is as follow:

1. **White Button Mushroom (*Agaricus bisporus*)**

Button mushroom scientifically known as *Agaricus bisporus* and has he widest acceptability. Cultivation of this mushroom is a complex process and requires two different temperature i.e. 22-26$^0$C for spawn run and 14-24$^0$C for fruit body formation. Besides specific temperature, it require proper humidity (80-90%) and enough ventilation during fruit body formation.

**Steps of cultivation process**

**Compost preparation:** Compost is an artificially prepared growth medium from which mushroom is able to derive important nutrients required for growth and fructification. Cemented floors and shade over the floor are required for making good quality compost. There are two main methods for compost preparation:

**Long method of composting:** This is an outdoor process and takes around 28 days in its completion with a total of seven turnings. The following materials are required for long method of compost:

| | | | |
|---|---|---|---|
| Wheat straw | 1000 Kg | Urea | 10 kg |
| Wheat bran | 50 kg | Gypsum | 100 kg |
| Ammonium sulphate or calcium ammonium nitrate | 30 kg | Furadan | 500 g |
| Super phosphate | 10 kg | B.H.C. | 500 g |
| Muriate of Potash | 10 kg | | |

Before making compost, wheat straw is spread on cemented floor and is turned many times with water being sprayed at regular intervals.

***Day 0:*** At the stage, there should be around 75% humidity content in the wheat straw, to which wheat bran, calcium ammonium nitrate, urea, murate of potash, and super phosphate are mixed thoroughly and evenly. The material is then piled 1.5m thick x1.25m high with the help of wooden rectangular block. The blocks are removed. Once the entire material has been stacked up or piled up. Water is sprayed twice or thrice to keep the substrate moist. Temperature should be in the range of 70-750C.

***1st turning Day 6:*** On the sixth day first turning is given to the stack. The purpose of turning is that every portion of the pile should get equal amount of aeration and water. If the turnings are not given, then anaerobic condition may prevail which may lead to the formation of non-selective compost. In the stack, the central zone is fermenting at its peak and has maximum temperature rest of the portion is either not at all fermented or ferments improperly. The correct method of turning is as: Removing about 15cm of compost from the top and spread it on one side of the floor, the rest part of compost on the other side of the floor. Now turning is done by shaking the outer (top most) part and the inner part of the compost, first separately and then missing them altogether thoroughly with the help of wooden buckets.

***2nd turning (Day 10):*** On the tenth day, again the top most part and the inner part of the compost is separated, water is sprayed on the top part. Again the two parts are piled up together in such a way that now the top part is inside and the inner part is on the top of the stack.

***3rd turning (day 13)*:** it is also done in the same way as described earlier and required quantity Gypsum mixed at this stage.

***4th turning (day 16)*:** The same process of turning is followed. The required quantity of furadan &

lindane are added during this turning.

***5th turning (day 19)*:** The compost is turned in the same manner.

***6th turning (day 22)*:** The same process of turning is followed. The required quantity of furadan and lindane are added during this turning.

***7th turning (day 25)*:** The compost is turned in the same manner

**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:** Sept. – Nov.& Feb.-April (02 crop)

**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** March.- May & July.-Sept (02 crop)

**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:** May - Aug (01 crop)

**Cultivated species:** Calocybe indica and Macrocybe gigentium

**Spawning and crop management**: About 18-20 days old spawn is used for spawning. Spawning should be done @ 4 per cent of ready substrate. The spawning is usually done by mixing the spawn throughout substrate. The spawned substrate should be filled in polythene bags 4-5kg per bag. The bags should be folded at the top and covered up. The optimum temperature for growth of mycelium, ranges between is 20-37$^{o}$C. Relative humidity in growing room should be range between

80-85% during spawn-run. Spawn run usually takes about 15-20 days.

**Casing:** This mushroom needs casing for fruit body initiation. After complete spawn run casing is done and its thickness should be kept 2-3 cm is being spread uniformly on the surface of the spawn run substrate. Temperature and humidity of the crop room should be maintained at 25-35$^{o}$C and 80-85%, respectively. Proper ventilation and adequate light should be maintained and water being sprayed once or twice a day. After 10-12 day of casing fruit primordia (pin head) are formed and within 5-6 days the mature and ready for harvesting.

**Harvesting:** The fruit bodies should be harvested before spore release by twisting so that stubs are not left on substrate. After harvesting lower portion of stalk with adhering casing soil should be cut with sharp knife. About 70 kg fresh mushroom can be harvested per quintal of dry substrate.

**I. Enabling Policies**

**1.A Existing policies related with agriculture and animal husbandry:**

Promote agriculture & animal husbandry in the state for better income of farmer community

**1.B Policies to be suggested for doubling income in the specific agro-ecological region:**

1. Expand application scientific methods and mechanized cultivation
2. Promotion of secondary agriculture
3. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
4. Checking migration by attracting rural youth in agriculture.

**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:** Establishment of food processing units at distt/tehsil/block level to procure and marketing of surplus

**3.A Existing Incentives:**

**3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district:** Provision of subsidised inputs (seed, chemical fertilizers, etc.) in agri-clinics at cluster level.

**4.A Existing risk coverage facilities:** Crop and Animal Insurance Schemes

**4.B Risk coverage facilities to be suggested for doubling income in the specific agro-ecological region:** raceway insurance facility

**J. Marketing and value addition in specific agro-ecological region**

**1.A Existing marketing facilities:Local market**

**1.B Marketing facilities to be suggested for doubling income in the specific agro-ecological region:** weekely haat

**2.A Existing grading facilities:**

**2.B Grading facilities to be suggested for doubling income in the specific agro-ecological region:**

**For grains:**

**For grains:**

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

**For horticultural crops:**

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

**2.C Processing facilities to be created for better marketing and value addition in the district:**

For grains:

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity
10. Sugarcane crusher, open pan evaporator, moulds for jaggery, packaging unit at village level

**For horticultural crops:**

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

**2.D Packing facilities to be created for better marketing and value addition in the district :**

**For grains:**

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity
3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)
4. IRRI bags for particular commodity

**For horticultural crops:**

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables
3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed
8. Litchi peeling and shredding unit

**3. Existing marketing and value addition problems in the specific agro-ecological region:** No marketing facility, No value addition facility, High transportation cost

**K. Online Management and Evaluation**

**1.A: Existing online management structure available:** Internet etc.

1. **1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district:**

Mobile app. For carp farming

Data base of individual farmer

**2.A: Existing evaluation procedure:** Manual

**2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district:** District level committees of State line departments with KVK experts may be formed for field and as well as online evaluation.

**3.A: Existing monitoring system:** Physical

**3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district:** Mobile apps/ software for online management .

Evaluation may be developed and farmers as we well as concerned experts may be linked with it.

**4.A: Existing feedback system:** Manually

**4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district:** Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.

**5.A: Existing reading system:** Literature, Booklets, Hindi Extension Journals etc

**5.B: Reading system required for online management and evaluation in specific agro-climatic region of district:** Reading manuals may be developed/ published for easy operation of Mobile apps/ software developed for online management and evaluation for farmers as we well as concerned experts linked with it.

**Specific action plan for doubling agricultural income in agro-ecological region**

**Strategy 1 : Productivity Enhancement**

**Introduction, adoption and popularization of high yielding varieties for increasing productivity**

Popularisation of high yielding varieties of major crops viz.

1. Finger millet (, VL Mandua 324, and VL Mandua 352) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat blocks.
2. Barnyard millet (VL Madira 172 and VL Madira 207) in in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat blocks.
3. Soybean (VLS 47, VL Soya 59, VL Soya 63 and VL Soya 65) in in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat blocks.
4. Horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat blocks.
5. Spring rice (VL Dhan 208 and VL Dhan 209 ) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat blocks.
6. Jethi rice ( Vivek Dhan 154 and VL Dhan 157) in Bhikiasen , Dhaula Devi, Hawalbagh, Bhasiachanna, Takula, Dwarahat blocks.
7. Irrigated Rice (VL *Dhan 65,* VL Dhan 86, VL Dhan 68, VL *Dhan 85,* Pusa Basmati 1509 and PRH 10) in irrigated area of *Takula, Chaukhutiya, Bhaisiyachanna, Dwarahat, Syaldey,and Hawalbagh blocks.*
8. Wheat ( VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 and UP 2572) in irrigated/ rainfed area of *Takula, Chaukhutiya, Bhaisiyachanna, Dwarahat, Syaldey,and Hawalbagh blocks.*
9. Barley (VL Jau 118 and VLB 94) in rain fed area of *Takula, Bhaisiyachanna, Dwarahat, Syaldey, Sult, Lamgara and Hawalbagh blocks.*
10. Lentil (VL *Masoor* 125, VL *Masoor* 126, VL *Masoor* 507, VL Masoor 514, PL 5 , PL 7, PL 8) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat blocks.
11. Pili sarson (PPS1) in Dhaula Devi, Hawalbagh, Bhasiachanna, Dwarahat blocks.
12. Vegetable pea (Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat, Tarikhet blocks.
13. French bean (VL Bauni Bean 1 and VL Bean 2) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat, Tarikhet blocks.
14. Tomato (VL Tamatar 4, Manisha, Himsona, Navin 2000) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat, Tarikhet and Syaldey blocks.
15. Capsicum (VL Shimla Mirch 3, California wonder, Bharat, Indra, Tanvi) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat, Tarikhet and Syaldey blocks.
16. Cabbage (Varun, Pragati, Golden acre ) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat and Tarikhet blocks.
17. Potato (Kufri Jyoti, Kufri chandramukhi, Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3) in Dhaula Devi, Lamgara, Takula, Dwarahat, and Tarikhet blocks.

18. Goal Muli (Dunagiri goal) in Dwarahat, Tarikhet and Syaldey blocks,
19. Onion (VL Piaz 3) in Dhaula Devi, Hawalbagh, Lamgara, Bhasiachanna, Takula, Dwarahat, Tarikhet blocks.
20. Garlic (VL Lehsun 1 and VL Lahsun 2) in Dhaula Devi, Hawalbagh, and Lamgara, blocks.

**Recommended package and practices will be followed for the above recommended crop varieties**

**Strengthening of traditional water storage structure**

1. Creation of additional water storage tank for particular vegetable areas of Tarikhet, Hawalbagh, Takula, Lamgara, Bhaisiyachanna, Sult and Syaldey for lean season.
2. Promotion of rain water harvesting and drip-fertigation system in *vegetable* clustersin this regions
3. Creation of trenches for high percolation of water in slope/ terraces in all blocks.
4. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in particular vegetable growing areas viz. Tarikhet, Hawalbagh, Takula, Lamgara, Bhaisiyachanna, Sult and Syaldey.
5. Popularisation of roof water harvesting system in all villages.
6. Rejuvenation and popularisation of traditional water harvesting systems (Naula) in all blocks.

**Adoption of cluster approach for holistic development**

1. Strengthening of old fruit belt of *Lamgara, Hawalbagh, Dunagiri, Dwarahat, Syaldey* and *Chaukhutia belts* by introduction of new cultivars of stone fruits and pickling type mango (Late maturity).
2. Mass cultivation of Cinnamon plants at low hills in *Sult, Syaldey, Dhauladevi* and *Dwarahat* block.
3. Promotion of Ginger /Turmeric cultivation in shady areas in all blocks.
4. Promotion of hybrid/basmati rice particularly in irrigated areas of *Takula, Chaukhutiya, Bhaisiyachanna, Syaldey, Hawalbagh* and pulses, oilseeds in rainfed areas of all blocks.
5. Promotion of off season vegetable/protected cultivation (tomato, capsicum, radish, potato, onion, garlic cucumber, cole crops, leafy vegetable etc.) specially in *Tarikhet, Hawalbagh, Lamgara, Deghat, some part of Takula, Dwarahat, Bhikiyasen, Sult, Bhasiachana* etc).
6. Promotion of off season vegetable such as tomato, capsicum, radish, potato, onion, garlic (protected/openfield) cultivation in all blocks of this region.
7. Organic cultivation of chilli in *Tarikhet, Sult, Bhikiyasen* areas.
8. Irrigated areas of *Syaldey, Chaukhutia, Someswar,Seraghat, Barechina* should be used for seed production of rice and wheat.
9. Fallow land development under agro-forestry in all blocks.
10. Promotion of common minimum programme technology in vegetables to reduce the cost of cultivation and quality produce.

**Management of wild animal problem**

1. Promotion of bio fencing on trench bunds specially in vegetable belts in all blocks.
2. Promotion of lime/lemon in fruits, lady finger in vegetable, ginger or turmeric in spices, dual purpose varieties of barley, wheat and oats or Lemon grass at larger scale in cultivated field in all blocks to minimize the damage from wild boars, monkeys and stray animals.
3. Enacting legislative measures for protection of crop from wild animals in all blocks.
4. Promotion of protected cultivation (low cost polyhouse, polytunnels etc.) in all blocks to ensure some income.

**Adoption of Farm mechanisation (Power tiller, thresher etc)**

1. Adoption of serrated sickle, wheel hoe, handle fork, handle kutla, power tiller, small wheat thresher, winnowing fan, Vivek mandua thresher for reduction of drudgery in practicing farmers and farm women in all blocks.
2. Popularization of manually operated mini crop harvesters,small wheat /paddy thresher in *Takula,*

*Chaukhutiya, Takula, Bhaisiyachanna, Syaldey, Hawalbagh*.

**Adoption of efficient irrigation techniques**

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available,
2. Drip Irrigation in integration with water harvesting structure where irrigation water is not available
3. Green House Cultivation for Vegetables

**Management of soil health**

1. Organic cultivation of traditional crop viz., fingermillet, barnyard millets, black soybean, horsegram, amaranths, traditional rice in all blocks of this region.
2. Promotion of berseem after rice in marshy land of *Takula, Chaukhutiya, Takula, Bhaisiyachanna, Syaldey, Hawalbagh*.
3. Bio-fertiliser/soluble fertiliser based farming in rain fed areas of all blocks specially in *Dhauladevi, Sult, Saldyey, Hawalbagh*.
4. Adoption of pulse based crop rotation and maximum use of value added compost/FYM in all blocks.
5. Making available the required recommended nutrients/ micro-nutrients at right time, place and quantity.
6. Adoption of integrated nutrient management in irrigated areas of rice and wheat for *Takula, Chaukhutiya, Takula, Bhaisiyachanna, Syaldey, Hawalbagh*.
7. Popularization of soil and water conservation measures by pulse based intercropping, contour farming and shoulder bunds in particular rainfed areas of all blocks.
8. Promotion of soil testing kits in all blocks of this region.

**Strategy 2 : Livestock: Goatary, Poultry, Fisheries**

1. Selection of high milk breeds in buffaloes (Murrah) and cattle (Jersy, Sahiwal ,Gir and Red Sindhi) in all blocks.
2. Establishment of Fodder Bank in each block to meet fodder requirement of area.
3. Establishment of milk chilling plant at Tarikhet and *Dhauladevi (Danya*).
4. Establisment of Molases/Multinutrient feed block at Dholadevi and someswar areas
5. Promotion of urea, molasses, multinutrient blocks at *Nyaypanchayt* level.
6. Establishment of three hatcheries for need of broilor or croilor at block level like at *Dholadevi ,Bhikiyasen* and *Dwarahat*.
7. Introduction and promotion of cross Heiffer by Artificial Insemination (AI) for increasing income of marginal farmer in all blocks.
8. Improvement of cattle health through vaccination and proper feeding.
9. Strengthening of traditional water bodies/rivulets with Mahaseer or carps at *Mohan,Kosi* areas and carp at *Gaggas, Vinod* areas.
10. Popularisation of green fodder crops i.e. sorghum, lobia, maize, oat, berseem etc. in all blocks.
11. Community pasture development at village level.

Planning for establishment of *Gaushala* at block level to rear unproductive cattles to avoid the damage crops in cultivated areas.

**Strategy 3 : Integrating Farming system**

**Promotion of different Integrated Farming System modules for 20 nali's or 0.4 ha such as :**

**Vegetable based – 18 nali protected cultivation/Offseason vegetable + 2 nali composting and Goatry/ Poultry**

1. Protected cultivation (100sqm low cost polyhouse- Capsicum, cucumber, Tomato, nursey raising and cole crops)/ off season vegetable; 17 nali + Composting (30sqm) + Goatry (4F+1M) /backyard poultry (50birds)

**Live stock based- 10 nali green fodder + 5 nali Dairy, composting and Goatry/ Poultry+ 5 nali Protected cultivation /Offseason vegetable**

1. Fodder production (10 nali; Sorghum, lobia-Oat in rainfed or berseem in irrigated) + Mini

dairy (Crossbreed05) + Composting (50sqm) + Protected cultivation; 5 nali

**Crop based- 15 nali crop and vegetable+ 5 nali Dairy, composting and Goatry/ Poultry+ 2 nali Nursery raising Protected cultivation 5 nali**

1. Truthfull seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea); 15 nali + Planting material supply 2 nali + Mushroom + Composting

Crop 14 nali (Gahat, madua, soyabean, lentil- 7 nali + vegetable- Cucurbits, French bean, veg pea, tomato, capsicum and leafy vegetables (7 nali)-dairy/backyard poultry; 5 nali +composting (50sqm).

**Strategy 4 : Reducing post harvest losses and value addition**

1. Establishment of mini fruit grading plant in *Lamgara, Dhauladevi, Hawalbagh, Tarikhet*.
2. Establishment of Food and Processing Units at fruit/vegetable patti i.e. *Lamgara, Tarikhet, Sult, Syaldey, Dehghat, Dhauladevi.*
3. Establishment of Value addition centre at *Takula, Hawalbagh, Dwarahat, Chaukhutiya, Bhaisiyachanna.*
4. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all blocks.
5. Establishment of marketing chain for efficient/timely supply of produce/product from nyaypanchayat level.
6. Promotion of common resources on custom hire basis viz. Mini thresher, mini tractor, power tiller etc. in *Syaldey, Chaukhutia, Someshwar, Bhaisiyachanna*.
7. Establishment of small processing units for tertiary and value addition of local mango in *Bhikhiyasein*.
8. Establishment of packaging infrastructure at nyaypanchayat level with packaging, sewing, sealing and labeling facilities.

**Strategy 5 : Waste land development and waste water**

1. Contour making for arable purpose in waste land in all blocks including *Sult, Tarikhet and Dhauladevi*.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in all blocks.
3. Promotion of plantation of mulberry, wild fruit plants and fodder trees (*Bheemal, Alnus, Celtis, Oak etc.*) in all blocks.
4. Regular maintenance of soil bunds to save excessive loss of nutrients and minimize the water loss in wasteland in all blocks.
5. Popularization of V- notch, trenches or silages for percolation of water to avoid surface run off in all blocks.
6. Construction of Loose check dam in gullies/ nalas, check dams in rivers/nalas, and desired artificial structure to maximize water percolation rate in marginal and denudated areas in all blocks.
7. Construction of tank for storage of water for lean season in all blocks.
8. Development of pasture and drinking ponds for animals on waste land at nyaypanchayat level.
9. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

**Strategy 6 : Reduced cultivation cost**

**Promotion of different techniques to reduce cultivation cost in all blocks such as:**

1. Promotion of well decomposed FYM, self prepared vermicompost and biofertilizers to minimize the use of costly chemical fertilizers.
2. Promotion of line sowing and recommended dose of 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. Adoption of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira

threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers.

7. Promotion of mulching (bio or degradable plastic) in vegetables and fruits to maintain moisture and reduce intercultural operation cost.
8. Promotion of pressurized irrigation techniques in horticultural crops.
9. Promotion of tillers and other garden tools (serrated sickle, wheel hoe, handle fork, handle kutla) for reduction of drudgery.

**Strategy 7 : Off-farm income**

1. Promotion of subsidiary occupations like handicraft articles (aipen, jute bags, bichhu grass articles, herbal gulal, natural colours from different flowers, squash, pickles, mushroom production, home made/ valueadded products (bari, papad, namkeen, biscuit), sweets (Bal mithai), copper/ iron utensils.
2. Promotion of apiculture for small and landless farmers.
3. Promotion of sericulture in low hills or valley areas particularly in Takula (Someshwar), Saldye, Dhauladevi blocks.
4. Promotion of cultivation and collection of medicinal plants in all blocks.
5. Promotion of skill development in women and youth in all blocks.

**Strategy 8 : Enabling Policies**

1. Increasing institutional support by providing subsidises and incentives to small and marginal farmers.
2. Labelling of organic inputs and certification mechanism for various crops.
3. Popularization of Udhyan and Krishak Cards for widespread use of government incentives/subsidies to farmers.
4. Establishment of wood bank at *Dunagiri and Shaharphatak areas* to meet the present and future demand of germplasm in horticultural crops.
5. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
6. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
7. Compulsion of Soil Health Card Scheme, Kisan Credit Card and Crop Insurance for all farmers.

**Strategy 9 :Marketing and value addition in specific agro-ecological region**

1. Creation of better transportation facilities with cool chain van at Block level (particularly vegetable/fruit/ floriculture).
2. Establishment of collection center of fruit/ vegetable processing unit (*Tarikhet, Sult, Dhauladevi*) and its direct linkage with food processing industries for better prices.
3. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
4. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
5. Installation of mini grading machines at village level.
6. Establishment of cold room in different clusters i.e *Almora*, *Deghat and Sult* areas.

**Strategy 10 : Online Management and Evaluation**

1. Strengthening of internet connectivity.
2. Development of Mobile apps/ software for online management and evaluation at district level.
3. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
4. Organization of monthly review meeting at district to solve the problems related with farmers.
5. Promotion of use of radio, TV talks and Whatsapp etc. for effective implementation of program.

# Agro-Ecological Region: Region C (1500 m-2400m)

**A.General information about Agroeco-region**

**District:** Almora

**Agro-ecological region:** Region C (1500 m-2400m)

**Main Blocks in Region:** All Blocks

**Main village cluster in blocks:** 3-4 villages in each nyay panchayat

**Irrigated Clusters:** Habalbagh, Takula,chaukhutia,Dwarrahat,Bhaisiyachana, Syalde

**Rainfed Clusters:** Habalbagh, Takula,chaukhutia,Dwarahat,Bhaisiyachana, Salt, Lamgara, Dhauladevi, Syalde, Tarikhet, Bhikiasain

**Existing rain water management facilities:**

1. Diversion of perennial springs and streams through guhls
2. Storage tanks (Hauj)
3. Village pond (Taal and Chaal)
4. Collection from hill slope (Khaal)
5. Hydrum as lift device
6. Roof water harvesting but limited

**B. Productivity Enhancement**

**1. Specific Action / Interventions recommended for harvesting and management of rain water in specific agro-ecological region**

1. Roof water harvesting system
2. Poly tank for water storage for scattered fields
3. Low cost lining material to check seepage
4. Efficient water application systems (sprinkler and drip)
5. Rejuvenation and popularisation of traditional water harvesting systems
6. Cost effective lifting devices
7. Roof top water harvesting system

**2. Existing practices for soil health improvement**

1. Use of undecomposed farmyard mannure/compost
2. Meagre/ no use of biofertilizers
3. Imbalanced/ insufficient nutrient use
4. Use of raw/partially decomposed FYM
5. Meagre/ no compost making/recycling of crop residue
6. Mixed cropping of cereal and legume in few pockets

**3. Specific Action / Interventions recommended to improve soil health in specific agro-ecological region**

**Cereals and oilseeds**

1. Seed/ soil inoculation with Azotobacter and Phosphorus solubilising microbial culture (250-300g each/ acre for seed inoculation;/ and 1-1.5 kg each mixed in well decomposed 25 kg FYM/ acre for soil inoculation)..
2. Soil test based balanced use of fertilizers in irrigated areas as per recommendation; INM shall be preferred
3. Scientific preparation of FYM/ recycling of crop residue, weeds through composting and/or vermicomposting
4. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost

**Pulses and soybean**

1. Seed with specific *Rhizobium* inoculant and Phosphorus solubilising microbial culture.
2. Use of recommended dose of phosphatic fertilizer

3. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha

**Vegetables and spices**

1. Seed/ nursery soil inoculation with *Azotobacter/ Azospirillum* inoculant and Phosphorus solubilising microbial culture (each of 200 g/$m^2$ for nursery soil inoculation; for seed inoculation quantity varies depending on seed size).
2. Seedling inoculation with *Azotobacter/Azospirillum* inoculant and Phosphorus solubilising microbial culture at transplanting.
3. Soil test based balanced use of fertilizers; INM shall be preferred
4. Promotion of common minimum practices in vegetables(soil solarisation,value addition of compost/FYM,etc)
5. Use of FYM @4-5t/ha or application of 2.5-3.0 t/ha vermicompost
6. Establishing soil testing labs at Block level or making mobile soil testing teams.
7. Soil health card campaign so that each farmer has his soil health card.
8. Training and demonstration of compost making as a campaign.
9. Making available the required recommended nutrients/ micro-nutrients at right time, place and quantity.
10. Promoting the use of organic fertilizers/ Bio fertilizers /green manuring in identified organic blocks.

**4.Existing crop cultivation strategy being adopted under changing climatic condition**

1. 1. No contigencies plan is used by farmers
2. Rainfed agriculture with low cropping intensity
3. Merely 6.6 % cultivable area of the district is irrigated, while rest area is rainfed.
4. Growing of vegetables and horticultural crops over very small area

**5.Specific strategy to be adopted for doubling productivity under changing climatic conditions in the agro-ecological region**

1. The climatic projection suggesting increasing air temperature and erratic distribution of rainfall. Therefore following strategy should be followed to increased income under changing climatic scenario.
2. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
3. In event of decreased water availability (Approximately 1000 mm rainfall) in rainy season (June-September) the rain water should be properly stored (In polythene, to make bund) and harvested for Kharif season crops.
4. Share of millets (Finger millet, Barnyard millet) should be increased due to its better capability of tolerating adverse climatic condition.
5. Short duration varieties should be grown so that at least two crops in a year could be taken
6. Growing of Cheti/spring rice variety viz., (VL 206, VL 207, VL 208, VL 209).
7. Organic mulch should be used for reducing frost risk.
8. The area of off season vegetable should be increased at least double by the year 2022.
9. The area having slope 10-30% should be used for growing of horticultural crop viz, Apple, pear, peach, plum, Apricot, walnut should be grown in temperate regions and Mango in Sub-tropical regions.
10. Use fodder crop i.e Sorghum, Lobia as supplementary crop
11. Transplanting of finger millet
12. Late sowing of horse gram
13. Sowing of radish /leafy vegetables as cash crop
14. Plantation of citrus / pome granate
15. sowing late sown varieties of wheat

16. Cultivation of off season vegetable

**6 A. Name of Field Crop: Wheat**

**i. Existing varieties being used:** UP 2572, VL 804, VL 829, VL 738, Dawatkhani 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:** VL *Gehun* 829, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 (from 1500 to 1700m amsl), VL Gehun 832 and HPW 155, HS 365 (from 1700 to 1700m amsl) and UP 2572

**iii. Existing package of practices being used:**

1. **Preparation of land-** 1 - 2 ploughing with local plough followed by planking.
2. **Manure and fertilizer-**
3. Use of un decomposed FYM in rain fed as well as irrigated areas with small doses of chemical fertiliser in irrigated valleys of the district
4. **Sowing time-**Rain fed – last week of October
5. Irrigated- November
6. **Seed rate and seed sowing** -130-150 kg/ha, Broad casting
7. **Irrigation**-Usually maximum area is rain fed, while in irrigated areas, depending upon water availability 1-3 irrigation
8. **Weed Control-** In general, no weed control is done by farmers and they up root the grasses in Feb-March and use as fodder. However, a few farmer use 2,4- D in irrigated areas
9. **Plant Protection Measures-** No any PPM followed

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. **Preparation of land**- 2 ploughing + 1 harrowing with mould bold plough followed by planking.
2. **Sowing time-** Rain fed –First forthnight of October
3. **Seed rate and seed sowing** -100-125kg/ha with a spacing of 18-21 cm.
4. **Manure and fertilizer**- 5-10 tonne FYM (Value added), NPK 100-120:60:40 (Irrigated condition), 50-60:30:20 (Rain fed condition) with micronutrients. Apart from this seed treatment with bio fertiliser i.e. PSB and Azatobacter @ 10 g /kg seed
5. **Irrigation**-As per irrigation facility 1 irrigation at CRI, late jointing stage and 1 at flowering stage.
6. **Weed Control-** Irrigated condition- Clodinafop+Metsulsulfuron methyl @400.00/ha 30-35 DAS (Effective against broad and narrow leaves weeed). Apart from this, Pendimethalin @ 1.00a.i./ha as pre emergence may also be used. Weed may also be controlled by manual weeding at 25-25 and 40-45 DAS.
7. Use of IPM practices

**v. Major insect pests associated with crop:** Cutworm ,Termites, Aphids

**vi. IPM Module for management of insect pests(except organic areas):**

**Aphids (*Macrosiphum (Sitobion) avenae* or *Macrosiphum miscanthi*)**

1. Avoid late sowing of crop to save crop from aphid.
2. Conservation and enhancement of biocontrol agents like coccinellid beetles, Chrysopa, syrphid, Apanteles etc. protects the crop against aphid attack.
3. Spray any of the following insecticides after diluting in 500 litre water/ha when more than 5 aphids are recorded per ear head:

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Thiamethoxam 25% WSG | 50 | 21 |
| Quinalphos 25 %EC | 1000 | |

**Termites: *Microtermes obesi* and *Odontotermes obesus*)**

| Name of the Insecticides | (gm/ml) /ha |
|---|---|
| Thiamethoxam 30% FS (Seed Treatment/Kg) | 3.3 per Kg |

**Cutworm: *Agrotis ipsilon* and *A. segetum*)**

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Methyl parathion 50% EC | 300 | 600 |
| Trichlorfon 50% EC | 500 | 1000 |

**vii. Major disease associated with crop:** Brown spot, Rust, Loose smut, Karnal bunt

**viii. IPM Module for management of disease:**

**Loose smut: *Ustilago nuda* f.sp. *tritici***

Sticker @ 1 ml per liter of water must be applied along with chemical pesticides to improve the effectiveness of chemical. For control of loose smut seed treatment with fungicide.

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Carbendazim 50% WP (Seed Treatment/Kg) | 1.0 | 2.0 |
| Carboxin 75% WP (Seed Treatment/Kg) | 1.5-1.9 | 2-2.5 |
| Tebuconazole 2% DAS | 0.02 | 1.00 |
| Difenoconazole 3% WS | 0.06 | 2.0 |

**Biofungicides**

| Name of the Bio-fungicides | g/Kg | Waiting period (days) |
|---|---|---|
| *Pseudomonas fluorescens* 1.75% WP (In house isolated Strain Accession no. MTCC 5176) | 5 g/Kg seed<br><br>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.<br>**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 |

**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:** *Ranunculus arvensis, Anagallis arvensis, Convolvulus arvensis, Chenopodium album , Asphodelus tenuifolius, Avena fatua,Phalaris minor*

**x. IPM Module for management of weeds(except organic areas):**

**Red chickweed: *Anagalis arvensis* (annual, dicot, broad leaves, leafy)**

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Carfentrazone ethyl 40 %DF | 50 | 80 |
| 2,4-D Sodium salt Technical (80WP) | 625-1000 | 90 |
| Methabenzthiazuron 70 %WP (POE-30DS) | 2000-2500 | 100 |
| Metsulfuron methyl 20%WP | 20 | 80 |
| Metsulfuron methyl 20% WG | 20 | 76 |
| Triasulfuron 20 %WG | 100 | 81 |
| Pendimethalin 30% EC (Light soil) | 3300 | |
| Pendimethalin 30% EC (Medium soil) | 4200 | |
| Clodinafop-propargyl 15%+ Metsulfuron methyl 1 %WP | 400 | 100 |
| Mesoulfuron methyl 3+ Iodosulfuron methyl 0.6 %WG | 400 | 96 |
| Sulfosulfuran 75%+Metsulfuron methyl 5%WG | 40 | 110 |

**Onion weed: *Asphodelus tenuifolius* (annual, monocot, narrow leaves, leafy)**

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| 2,4 D Dimethyl amine salt 58% SL | 860-1290 | |
| 2,4 D ethyl ester 38 %EC | 1320-2200 | |
| MCPA Amine salt 40 %WSC | 2500 | |

**Field bindweed: *Convulvulus arvensis* (perennial, dicot, broad leaves, leafy)**

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| 2,4 D Dimethyl amine salt 58% SL | 860-1290 | |
| Metsulfuron methyl 20%WG | 20 | 76 |
| Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP | 400 | 100 |

**Common wild oat: *Avena fatua* (annual, monocot, narrow leaves, grass)**

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Diclofop methyl 28%EC | 2500-3500 | 90 |
| Isoproturon 50% WP | 2000 | |
| Isoproturon 75% WPs | 1330 | 60 |
| Methabenzthiazuron 70 %WP (PE: 2DAS) | 1500-2000 | 100 |
| Methabenzthiazuron 70% WP (POE: 16-18 DAS) | 1000-1250 | 100 |
| Triallate 50% EC | 2500 | 150 |
| Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP | 400 | 100 |

**Dwarf canary grass: *Phalaris minor* (annual, monocot, narrow leaves, grass)**

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Clodinafop Propargyl 15% WP | 400 | 110 |
| Diclofop methyl 28% EC | 2500-3500 | 90 |
| Fenoxaprop-p-ethyl 10% EC | 1000-1200 | 110 |
| Isoproturon 50% WP | 2000 | |
| Isoproturon 75% WPs | 1330 | 60 |
| Methabenzthiazuron 70 %WP (PE: 2DAS) | 1500-2000 | 100 |
| Methabenzthiazuron 70 %WP (POE: 16-18DAS) | 1000-1250 | 100 |
| Metribuzin 70% WP (Medium soil) | 250 | 120 |
| Metribuzin 70% WP (Heavy soil) | 300 | 120 |
| Pendimethalin 30% EC(Light soil) | 3300 | |
| Pendimethalin 30% EC (Medium soil) | 4200 | |
| Pendimethalin 30% EC (Heavy soil) | 5000 | |
| Pinoxaden 5.1 %EC (POE: 30-35DAS) | 800+900 | 90 |

| | | |
|---|---|---|
| Sulfosulfuran 75%WG | 33.3 | 110 |
| Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP | 400 | 100 |
| Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC | 1250 | 110 |
| Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG | 400 | 96 |
| Sulfosulfuran 75%+Metsulfuron methyl 5%WG | 40 | 110 |

**Bathua/pigweed: *Chenopodium album* (annual, dicot, broad leaves, leafy)**

| **Name of the Herbicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Carfentrazone ethyl 40% DF | 50 | 80 |
| 2,4 D Dimethyl amine salt 58% SL | 860-1290 | |
| 2,4 D ethyl ester 38% EC | 1320-2200 | |
| Methabenzthiazuron 70 %WP (POE: 30DAS) | 2000-2500 | 100 |
| Methabenzthiazuron 70 %WP (POE: 16-18 DAS) | 1000-1250 | 100 |
| Metribuzin 70% WP (Medium soil) | 250 | 120 |
| Metribuzin 70% WP (Heavy soil) | 300 | 120 |
| Metsulfuron methyl 20%WP | 20 | 80 |
| Metsulfuron methyl 20%WG | 20 | 76 |
| Triasulfuron 20 %WG | 100 | 81 |
| Pendimethalin 30% EC (Light soil) | 3300 | |
| Pendimethalin 30% EC (Heavy soil) | 4200 | |
| Sulfosulfuran 75% WG | 33.3 | 110 |
| Clodinafop Propargyl 15%+ Metsulfuron methyl 1% WP | 400 | 100 |
| Fenoxaprop-p-ethyl 7.77%+Metribuzin 13.6%EC | 1250 | 110 |
| Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG | 400 | 96 |
| Sulfosulfuran 75%+Metsulfuron methyl 5%WG | 40 | 110 |

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Organic cultivation
2. Adoption of low-cost based cultivation practices
3. Horse gram/Soybean - Wheat (rainfed)

**Rice –Wheat(irrigated)**

1. Timely Sowing, Seed treatment, Use of HYV
2. Care soil & water conservation measures
3. INM (Maximum use of value added compost/FYM
4. and soluble fertiliser)
5. Integrated weed management
6. IPM
7. Good storages conditions
8. Efficient marketing of value added produce

**xii. Production constraints in agro-ecological region:**

1. Rain ded and scatteres land holdings.
2. Poor availability of agriculture inputs
3. use of imbalance and un decomposed FYM
4. climate change
5. Big issue of Wild animal damages
6. Migration
7. Poor Irrigation facilities
8. SAAR practice(Shifting area practice)

**6B. Name of Field Crop: Rice**

**i. Existing varieties being used:** China-4, Nandhani, Lal dhan ,Saket 4

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**

Direct seeded- VL 85, VL 81, VL 86, VL 62

Rainfed- Chatki Dhan-VL 206, VL 207, VL 208

Jethi dhan –VL 154

**iii. Existing package of practices being used:**

1. **Preparation of land**- 1 - 2 ploughing with local plough followed by Manual puddling
2. **Seed rate and seed sowing** -150 kg/ha in direct seeding , and in transplanting 60-70 kg/ha
3. More than 55 days seeding used
4. **Manure and fertilizer**- use of un decomposed FYM( 1-2.0qt./nali) with small doses of chemical fertiliser by some progressive farmers (in irrigated conditions)as per availability
5. **Irrigation**-usually maximum area is rain fed and in valley –traditionally roaster system is practiced under which, individual farmer get the irrigation too late which affect the crop adversely.
6. **Weed Control** – Butaclor 50 EC @2-3 lt/ha at 0-3 DAT,
7. No IPM practices

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. **Preparation of land**- 1 -2 ploughing followed by puddling
2. **Sowing time-**Second fortnight of April- mid May
3. **Seed rate and seed sowing** -100-125/ha in direct
4. **Manure and fertilizer-** 5-10 tonne FYM, Irrigated- NPKrainfed-50-60:30:20 with micronutrients (Zn, Fe)
5. **Irrigation**-usually maximum area is rain fed
6. **Weed Control**
7. IPM practices

**v. Major insect pests associated with crop:** Stem borer, Rice leaf folder, Rice hopper, Rice bug

**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:
    XIII. Apply insecticide only when necessary, not regularly.
    XIV. Apply insecticide only when the pest population reaches Economic Threshold Level.
    XV. Applying a selective insecticide which is less toxic to natural enemy.
    XVI. Apply the minimum doses of insecticide toxic to pest and least toxic to natural enemy.
    XVII. Use selective formulation and application method.
    XVIII. Application of granular formulation is less harmful to natural enemy
13. Following insecticides may be used to control stem borers of rice when the population or damage of pest is recorded to 1 moth or 1 egg mass/ $m^2$ or 5% dead heart :

**50 Days within transplating (2 inch water in field)**

| **Name of the Insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Chlorantraniliprole 0.4 %GR | 10000 | 53 |
| Fipronil 0.3% GR | 16670-25000 | 32 |
| Cartap 4% Gr | 18750 | |
| Carbofuron 3% CG | 33300 | |
| Carbosulfon 6% G | 16700 | 37 |

**50 Days after tranplanting**

| **Name of the Insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Chlorantraniliprole 18.5 %SC | 150 | 47 |
| Fipronil 5% SC | 1000-1500 | 32 |
| Fipronil 80 %WG | 50-62.5 | 19 |
| Cartap hydrochloride 50 %SP | 1000 | 21 |
| Cartap hydrochloride 75 %SG | 425-500 | 35-89 |
| Flubendamide 39.35% SC | 50 | 40 |
| Flubendamide 20% WG | 125 | 30 |
| Thiacloprid 21.7 %SC | 500 | 30 |
| Acephate 75% SP | 666-1000 | 15 |
| Acephate 95 %SG | 592 | 30 |
| Chromafenozide 80% WP | 94-125 | 32 |
| Monocrotophos 36% SL | 1400 | |
| Chlorpyriphos 20 %EC | 2500 | 30 |
| Quinalphos 25% EC | 2000 | 40 |
| Carbosulfon 25 %EC | 800-1000 | 14 |
| Chlorpyriphos 20% + Acetamiprid 0.4% EC | 2500 | 10 |
| Phosphamidon 40% + Imidachlorpid 2 %SP | 600-700 | 22 |
| Flubendamide 4%+ Buprofezin 20% SC | 175+700 | 30 |
| Flubendamide 3.5%+ Hexaconazole 5 %WG | 1000 | 20 |

**Bio-insecticides**

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Azadirachtin 0.15% EC (Neem seed kernel based) | 2500-5000 | 5 |
| Azadirachtin 0.03% EC (Neem oil based) | 2500-5000 | 5 |
| *Bacillus thuringiensis* var. kurstaki Serotype H-3a,3b, Strain Z-52 | 1500 | |

**Leaf folder:**

Following insecticides may be used to control leaf folders of rice

**50 Days within transplating (2 inch water in field)**

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Chlorantraniliprole 0.4% GR | 10000 | 53 |
| Cartap 4% Gr | 18750 | |
| Carbosulfon 6% G | 16700 | 37 |

**50 Days after transplating**

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Chlorantraniliprole 18.5% SC | 150 | 47 |
| Indoxacarb 15.8 %EC | 200 | 14 |
| Cartap hydrochloride 50 %SP | 1000 | 21 |
| Cartap hydrochloride 75% SG | 425-500 | 35-89 |
| Flubendamide 39.35% SC | 50 | 40 |
| Flubendamide 20 %WG | 125 | 30 |
| Chromafenozide 80% WP | 94-125 | 32 |
| Fipronil 80%WG | 50-62.5 | 30 |
| Acephate 75 %SP | 666-1000 | 15 |
| Acephate 95 %SG | 592 | 30 |
| Monocrotophos 36 %SL | 1400 | |
| Dichlorovos 76% EC | 627 | |
| Chlorpyriphos 20 %EC | 2500 | 30 |
| Quinalphos 25% EC | 2000 | 40 |
| Quinalphos 25 %EC | 1000 | 40 |
| Flubendamide 4%+ Buprofezin 20 %SC | 175+700 | 30 |
| Flubendamide 3.5%+ Hexaconazole 5 %WG | 1000 | 20 |

**Bio-insecticides**

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Azadirachtin 0.15% EC (Neem seed kernel based) | 2500-5000 | 5 |
| Azadirachtin 0.03% EC (Neem oil based) | 2500-5000 | 5 |
| Azadirachtin 5% (Neem extract concentrate containing) | 375 | 5 |
| *Bacillus thuringiensis* var. kurstaki Serotype H-3a,3b, Strain Z-52 | 1500 | |
| *Beauveria bassiana* 1.15%WP Strain BB-ICAR-RJP | 2500 | |
| *Beauveria bassiana* 1.15%WP Strain ICAR | 2500 | |

**Brown plant hopper: *Nilaparvata lugens***

| Name of the Insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|

| | | |
|---|---|---|
| Buprofezin 25% SC | 800 | 20 |
| Clothianidin 50% WDG | 20-24 | 12 |
| Dinotefuran 20% SG | 150-200 | 10 |
| Flonicamid 50% WG | 150 | 36 |
| Pymetrozin 50% WG | 300 | 19 |
| Imidacloprid 17.8% SL | 100-150 | 40 |
| Imidacloprid 30.5 %SC | 60-75 | 37 |
| Imidaclorpid 70% WG | 30-35 | 7 |
| Acetamiprid 20 %SP | 50-100 | 7 |
| Acephate 75% SP | 666-1000 | 15 |
| Acephate 95 % SG | 592 | 30 |
| Thiamethoxam 25 %WSG | 100 | 14 |
| Monocrotophos 36 %SL | 1400 | |
| Fipronil 5 %SC | 1000-1500 | 32 |
| Ethiprole 40%+ Imidacloprid 40% WG | 125 | 15 |
| Chlorpyriphos 20%+ Acetamiprid 0.4%EC | 2500 | 10 |
| Buprofezin 15% + Acephate 35 WP | 1250 | 20 |
| Flubendamide 4%+ Buprofezin 20 SC | 175+700 | 30 |

**Bio- insecticides**

| **Name of the Insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Azadirachtin 0.15% EC (Neem seed kernel based) | 2500-5000 | 5 |
| Azadirachtin 5% (Neem extract concentrate containing) | 375 | 5 |
| *Metarhizium anisopliae* 1.15% WP | 2500 | |

**Rice bug: *Leptocorysa acuta***

| **Name of the Insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Methyl parathion 2% DP | 500 | 25000 |

**Biological control**

**Parasitoids:**

*Gryon flavipes*, attacking: eggs

Predators:

*Micraspis discolor*, attacking: nymphs, adults

*Neoscona theisi*, attacking: nymphs, adults

*Neurothemis fluctuans* and *N. terminata* attacking: nymphs, adults

*Orthetrum sabina*, attacking: nymphs, adults

**Pathogens:** *Beauveria bassiana*, attacking: nymphs, adults

**vii. Major disease associated with crop:** Khaira, rice blast ,Brown spot ,leaf blight, False smut

**viii. IPM Module for management of disease:**

**During Nursery Sowing**

Deep summer ploughing or soil solarisation

Seed bio priming with bio-control agent (PS @10g/kg seed) or fungicide (Carbendazime 1g/kg seed)

**Fertilizers**

Basal: Nitrogen= 30 Kg/ha

P2O5= 60 kg/ha
K2O = 40 kg/ha
Zinc sulphate 25kg/ha
After 30 days crop stage Nitrogen= 50 kg/ha
At Panicle initiation = 40 kg/ha

**Khaira disease: Due to Zinc deficiency)**

| **Name of the Fungicides** | **(gm/ml) /ha** |
|---|---|
| Zinc sulphate (Apply in soil at the time of plot preparation) | 25000 |
| Zinc sulphate spray (2.5 Kg Quick lime & 20 Kg Urea in 1000 lit. water | 5000 |

**Sheath blight: *Rhizoctonia solani***

Drain of water to check spread of sheath blight.

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Carbendazim 50 %WP ( Seed Treatment) | 2 | |
| Carbendazim 50 %WP | 250-500 | |
| Propiconazole 25% EC | 500 | 30 |
| Hexaconazole 5% EC | 1000 | 40 |
| Hexaconazole 5% SC | 1000 | 40 |
| Difenoconazole 25% EC | 0.05% | 25 |
| Flusilazole 40% EC | 300 | 24 |
| Tebuconazole 250% EC (25.9%) | 750 | 10 |
| Validamycin 3% L | 2000 | 14 |
| Iprodione 50% WP | 2250 | 35 |
| Pencycuron 22.9% SC | 150-188 | 600-750 |
| Thifluzamide 24% SC | 375 | 28 |
| Cresoczim-methyl 44.3 %SC | 500 | 30 |
| Tebuconazole 50% +Trifloxystrobin 25% WG | 200 | 21 |
| Carbendazim 12%+Flusilazole 12.5 %SE | 800-960 | 54 |
| Iprodione 25% + Carbendazim 25% WP | 500 | |
| Propiconazole 13.9%+ Difenoconazole 13.9% EC | 0.07-0.1% | 46 |
| Tebuconazole 50% +Trifloxystrobin 25% WGs | 200 | 31 |

**Biofungicides:**

| **Name of the Bio-fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| *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.<br>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 (Nursery Treatment) | 40-100ppm | |
| Streptocyclin (Spray) | 15 | Local recommendation |
| Copper hydroxide 53.8% DF | 1500 | 10 |
| Copper hydroxide 50 %WP | 500 | Local recommendation |

**Biofungicides**

| **Name of the Bio-fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| *Pseudomonas fluorescens* 1.5% WP (BIL-331 Accession No. MTCC 5866) | 5 gm/Kg seed | **Seed Treatment:** Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP with minimum volume of water and coat the seed uniformly, shades dry the seeds just before showing. |

**Brown leaf spot:** ***Cochiobolus miyabianus***

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Propineb 70 %WP | 1500-2000 | |
| Idifenphos 50% EC | 500-600 | 21 |
| Captan 75% WP | 1000 | |

**Biofungicides**

| **Name of the Bio-fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| *Pseudomonas fluorescens* 1.5% WP (BIL-331 Accession No. MTCC 5866) | 2.5 Kg/hectare | **Seed Treatment:** Make a thin paste of required quantity of *Pseudomonas fluorescens* 1.5% WP |

| | | |
|---|---|---|
| | | with minimum volume of water and coat the seed uniformly, shade dry the seeds just before sowing. |

**False smut:** ***Ustilaginoidea virens***

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Copper hydroxide 77% WP | 2000 | |
| Copper hydroxide 53.8 %DF | 1500 | 10 |

**ix. Major weeds associated with crop:** *Oxalis latifolia, Cyperus spp, Echinocloa sp, Commalina benghalensis, Digitaria sanguinales, ,Eclipta* sp

**x. IPM Module for management of weeds:**

**Jungle rice:** ***Echinochloa colonum, E. crusgali*** **(annual, monocot, narrow leaves, grass)**

| **Name of the Herbicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Anilofos 30% EC (Transplanted rice) | 1000-1500 | 30 |
| Anilofos 18% EC (Transplanted rice) | 1660-2500 | |
| Anilofos 2% G (Transplanted rice) | 20000-25000 | 30 |
| Bispyribac Sodium 10% SC (Nursary) | 200 | |
| Butachlor 50% EC (Transplanted rice) | 2500-4000 | 90&120 |
| Butachlor 50% EW (Transplanted rice) | 2500-3000 | |
| Butachlor 5% G | 25000-40000 | 90&120 |
| Chlorimuron ethyl 25% WP (Transplanted rice) | 24 | 60 |
| Clomazone 50% EC (Transplanted rice) | 8000-10000 | 90 |
| Cyhalofop butyl 10% EC | 750-800 | 90 |
| 2,4-D Ethyl Ester 38% EC | 2500 | |
| 2,4-D Ethyl Ester 4.5% GR (Transplanted rice) | 25000 | |
| Fenoxaprop-p-ehtyl 9% EC (Transplanted rice) | 625 | 70 Post |
| Fenoxaprop-p-ehtyl 6.9% EC | 812-875 | 61 |
| Flufenacet 60% DF (Transplanted rice) | 200 | 90-110 |
| Orthosulfamuron 50% WG (Transplanted rice) | 150 | 65 Pre |
| Oxadiargyl 80% WP (Transplanted rice) | 125 | 97 |
| Oxadiargyl 6% EC (Transplanted rice) | 1066 | 97 |
| Oxadiazon 25% EC (Transplanted rice) | 2000 | |
| Oxyflourfen 0.35.5% GR (Transplanted & Direct sown) | 30000-40000 | |
| Oxyflourfen 23.5% EC (Transplanted & Direct sown) | 650-1000 | |
| Pendimethalin 30% EC (Transplanted & Direct sown) | 3300-5000 | |
| Pendimethalin 5% G (Transplanted & Direct sown) | 20000-30000 | |
| Pretilachlor 37% EW (Transplanted rice) | 1500-1875 | 90 |
| Pretilachlor 30.7% EC (Wet Direct Seeding) | 1500-2000 | 110 |
| Pretilachlor 50% EC (Transplanted rice) | 1000-1500 | 75-90 |

| | | |
|---|---|---|
| Anilofos 24%+ 2,4-D ethyl ester 32% EC | 1000&1500 | 90 (Transplanted rice) |
| Bensulfuron methyl 0.6% + Pretilachlor 6 G | 10000 | 88(Transplanted rice) |
| Clomazone 20%+ 2,4- D ethyl ester 30% EC | 1250 | 110 (Transplanted rice) |
| Cinmethylin 10% EC (Transplanted rice) | 750-1000 | 60 |
| Paraquat dichloride 24% SL (Before sowing) | 1250-3500 | |

**Umbrella plant: *Cyperus difformis* (annual, monocot, narrow leaves, sedge)**

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Anilofos 30% EC (Transplanted rice) | 1000-1500 | 30 |
| Azimsulfuron 50% DF (Transplanted & Direct sown) | 70 | 59 |
| Bensulfuron methyl 60%DF (Preemergence) | 100 | 88 |
| Bensulfuron methyl 60%DF (Postemergence) | 100 | 71 |
| Bispyribac Sodium 10% SC (Transplanted rice) | 200 | 78 |
| Butachlor 50% EC (Transplanted rice) | 2500-4000 | 90-120 |
| Butachlor 50% EW (Transplanted rice) | 2500-3000 | |
| Butachlor 5% G | 25000-40000 | 90-120 |
| Clomazone 50% EC (Transplanted rice) | 8000-10000 | 90 |
| Ethoxysulfuron 15 %WDG (Transplanted rice) | 83.3-100 | 110 |
| Orthosulfamuron 50% WG (Transplanted rice) | 150 | 65 Pre |
| Oxadiargyl 80% WP (Transplanted rice) | 125 | 97 |
| Oxadiazon 25% EC (Transplanted rice) | 2000 | |
| Pendimethalin 30% EC (Transplanted & Direct sown) | 3300-5000 | |
| Pendimethalin 5% G (Transplanted & Direct sown) | 20000-30000 | |
| Pretilachlor 37% EW (Transplanted rice) | 1500-1875 | 90 |
| Pretilachlor 30.7% EC (Wet Direct Seeding) | 1500-2000 | 110 |
| Pretilachlor 50% EC (Transplanted rice) | 1000-1500 | 75&90 |
| Bensulfuron methyl 0.6% + Pretilachlor 6% G | 10000 | 88 (Transplanted rice) |
| Clomazone 20%+ 2,4- D ethyl ester 30% EC | 1250 | 110 (Transplanted rice) |
| Metsulfuron methyl 10%+ Chlorimuron ethyl 10% WP | 20 | 90(Transplanted rice) |

**Umbrella plant: *Cyperus rotundus* (annual, monocot, narrow leaves, sedge)**

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Chlorimuron ethyl 25% WP (Transplanted rice) | 24 | 60 |
| 2,4-D Ethyl Ester 4.5% GR (Transplanted rice) | 25000 | |
| MCPA, Amine salt 40% WSC (Transplanted rice) | 2000-5000 | |
| Metsulfuron methyl 20 %WP (Transplanted rice) | 20 | 60 |
| Orthosulfamuron 50% WG (Transplanted rice) | 150 | 65 Pre |
| Bensulfuron methyl 0.6% + Pretilachlor 6% G | 10000 | 88 (Transplanted rice) |

**xi. Specific workable and sustainable intensification capable of doubling agricultural income**

**in specific agro-ecological region:**

1. Organic cultivation
2. Adoption of low-cost based cultivation practices
3. Jethi rice- Wheat/Lentil/Barley/oat (fodder) (rainfed)
4. Rice- Wheat /onion/berseem(irrigated),
5. Timely Sowing/Trans planting, Seed treatment
6. Use of HYV, Hybrid (120-125days), Basmati(120-125days)
7. Care soil & water conservation measures
8. INM (Maximum use of value added compost/FYM and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Marketing of value added produce
13. Avoid early Nursery raising practice and use of 25-35 days old seedling

**xii. Production constraints in agro-ecological region:**

1. Rain ded and scatteres land holdings.
2. Poor availability of agriculture inputs
3. use of imbalance and un decomposed FYM,
4. climate change,
5. Big issue of Wild animal damages
6. Migration
7. Poor Irrigation facilities
8. SAAR practice(Shifting area practice)

**6C. Name of Field Crop: Finger millet**

**i. Existing varieties being used:** Band mutthi(Garhwali mandua), Khuli muthi(Kumaon mandua)

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VL Mandua 324, and VL Mandua 352

**iii. Existing package of practices being used:** Traditional seed variety , undecomposed FYM 1.0-2.0qt./nail, 1-2 weeding

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. **Preparation of land**- 2-3 ploughing followed by planking
2. **Sowing time-** Mid of May
3. **Seed rate and seed sowing** -10-12kg/ha, line to line spacing- 20 cm. take care of gap filling/Thining/Transplanting
4. **Manure and fertilizer-** -Well decomposed FYM @5-10 tonnes/ha , NPK 20:40:0 and seed treatment with bio fertiliser
5. **Irrigation-**usually maximum area is rain fed
6. Weed Control- 2-3 manual weeding ; first at 15-20 and second at 40-45 DAS.
7. Use IPM modules

**v. Major insect pests associated with crop:** Stem borer

**vi. IPM Module for management of insect pests(except organic areas):**

For management of stem borer, cartop hydrochloride 4 G @ 20-25 kg may be applied 10-15 days after planting.

**vii. Major disease associated with crop:** Blast

**viii. IPM Module for management of disease:**

1. Grow resistant variety such as VL 149
2. Seed treatment with carbendazim @ 1g/kg seed followed by 2 sprays of carbendazim @ 0.1% (first when 50 per cent ear heads are formed and second 10 days later)

3. For organic farming seed treatment with Bioagents like T. harzianum @ 10g/kg seed followed by 2 sprays of same @ 10g/litre of water (first when 50 per cent ear heads are formed and second 10 days later).

**ix. Major weeds associated with crop:** *Oxalis latifolia, Phyllanthus niruri, Amaranthus viridis,Euphorbia hirata, Solanum* sp.

**x. IPM Module for management of weeds(except organic areas):** For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting.

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. INM( Maximum use of value added compost/FYM and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

**xii. Production constraints in agro-ecological region:**

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. climate changing,
4. Wild animal damages
5. Migration,
6. Poor Irrigation facilities

**6D. Name of Field Crop: Barnyard millet**

**i. Existing varieties being used:** Non described

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VL Madira 172 and VL Madira 207

**iii. Existing package of practices being used:** Traditional seed variety , un decomposed FYM 1.0 - 2.0qt./nali, 1-2 inter culture

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. **Preparation of land**- 2-3 ploughing followed by planking
2. **Sowing time-** -Ist fortnight of April
3. **Seed rate and seed sowing** -10-12kg/ha, line to line spacing- 20 cm. take care of gap filling/Thining/Transplanting
4. **Manure and fertilizer-** -Well decomposed FYM @5-10 tonnes/ha , NPK 20:40:0 and seed treatment with bio fertiliser
5. **Irrigation-**usually maximum area is rain fed
6. Weed Control- 2-3 manual weeding ; first at 15-20 and second at 40-45 DAS.
7. Use IPM modules

**v. Major insect pests associated with crop:** Stem borer

**vi. IPM Module for management of insect pests(except organic areas):**

**vii. Major disease associated with crop:** Smut

**viii. IPM Module for management of disease:**

**Smuts**

1. Grow resistant variety like PRJ 1.
2. Seed treatment with carbendazim @ 2g/kg seed or carboxin @ 2.5g/kg seed

**ix. Major weeds associated with crop:** *Oxalis latifolia, Phyllanthus niruri, Amaranthus viridis,Euphorbia hirata, Solanum* sp.

**x. IPM Module for management of weeds(except organic areas):** Manual weeding

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Fingermillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Fingermillet+Horsegram/Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. INM( Maximum use of value added compost/FYM
9. and soluble fertiliser)
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

**xii. Production constraints in agro-ecological region:**

1. Less availability of agriculture inputs,
2. use of imbalance and un decomposed FYM,
3. climate changing,
4. Wild animal damages
5. Migration,
6. Poor Irrigation facilities

**7A. Name of the Pulse crop: Horsegram**

**i. Existing varieties being used:** Pahari gahat

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VLG-8, VL Gahat 10, VL Gahat 15 and VL Gahat 19

**iii. Existing package of practices being used:** Traditional seed variety , un decomposed FYM 1.5-2.0qt./nail, broad casting 1-2 inter culture

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. **Preparation of land**- - 2-3 ploughing followed by planking **Seed rate and seed sowing** – 30-40 kg/ha, spacing 30*10cm
2. **Sowing time-** Ist fortnight of June
3. **Manure and fertilizer**- 5 -10 tonne FYM / ha, NPK20:40 :20 along with the use of bio fertiliser
4. **Irrigation**-usually maximum area is rain fed
5. **Weed control** – Two manual weeding at 20-25 and 40-45 DAS is quite effective for weed control. Herbicides i.e. Alachlor 50 Ec 4 lt/ha at 0-3 DAS, Imazethapyr 10SL @100 gm a.i./ha At 15-20DAS.
6. Use of IPM practcices

**v. Major insect pests associated with crop:** -

**vi. IPM Module for management of insect pests(except organic areas): -**

**vii. Major disease associated with crop:** Rot, Syam warn

**viii.IPM Module for management of disease: -**

**ix. Major weeds associated with crop:** *Oxalis latifolia, Phyllanthus niruri, Amaranthus viridis, Euphorbia hirata, Solanum* sp.

**x. IPM Module for management of weeds:** Manual weeding

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Horsegram- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Horsegram +Maize+Finger millet - Wheat/Lentil/Barley/oat (fodder) (rainfed),
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gap filling
7. care soil & water conservation measures
8. INM (Maximum use of value added compost/FYM
9. and soluble fertiliser)
10. Integrated weed management
11. IPM
12. Good storage condition
13. Sale of value added products

**xii. Production constraints in agro-ecological region:**

1. Less availability of agriculture inputs
2. Use of imbalance and un decomposed FYM
3. Climate changing
4. Wild animal damages
5. Migration
6. Poor Irrigation facilities

**7B. Name of the Pulse crop: Lentil**

**i. Existing varieties being used:** Pahari masoor –small seeds

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** PL-4, PL-7, PL-8,VL masoor103,VL masoor-125 VL masoor-126, VL masoor 507

**iii. Existing package of practices being used:** Traditional seed variety , un decomposed FYM 1.0-2.0qt./nail, 1-2 inter culture

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. **Preparation of land-** 2-3 ploughing followed by planking
2. **Seed rate and seed sowing** – 30-40 kg/ha, spacing 25*10cm
3. **Sowing time-** IInd fortnight of October
4. **Manure and fertilizer**-5-10 tonne FYM , NPK 20:40 :20 along with the use of bio fertiliser.
5. **Irrigation-U**sually maximum area is rain fed
6. **Weed control** – Pendimethalin 35 Ec 3.0 lt/ha as pre emergence. 1-2 weeding upto 45 DAS will also control the weeds.
7. Use of IPM practcices

**v. Major insect pests associated with crop:** Pod borer

**vi. IPM Module for management of insect pests:**

**vii. Major disease associated with crop:** Wilt & rust

**viii. IPM Module for management of disease(except organic areas):**

**(Wilt and Rust)**

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:** *Rannunculus arvensis, Anagallis arvensis, Convolvulus arvensis, Chenopodium album , Asphodelus tenuifolius*

**x. IPM Module for management of weeds:** Manual weeding

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Horsegram/Soybean- Lentil (rainfed),
4. Timely Sowing, Seed treatment,
5. Use of HYV, re sowing
6. Care soil & water conservation measures
7. INM (Maximum use of value added compost/FYM
8. and soluble fertiliser)
9. Integrated weed management
10. IPM
11. Good storage condition
12. Sale of value added products

**xii. Production constraints in agro-ecological region:**

1. Water scarcity
2. Wild animals
3. Lack of mechanization
4. Lack of rain water harvesting structures

**7C. Name of Pulse crop: Urd**

**i. Existing varieties being used:** Narendra Urd 1, Pan Urd 19, Uttara, Pant Urd-30

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** PU 31, PU 40

**iii. Existing package of practices being used:**

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years,
2. They also do not follow balance use of chemical fertilizers,
3. It is also observed that due to lack of knowledge,
4. Most of the farmers adopt improper plant protection measures.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Timely sowing of crop in IInd fortnight of June to July.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

**v. Major insect pests associated with crop:** White fly, Fruit borer, Thrips

**vi. IPM Module for management of insect pests :**

1. Crop rotation,
2. Collect and destroy affected plants with egg masses and gregariously feeding larvae of hairy caterpillar and pod borer,

3. Spray NSKE 5% for controlling defoliators, tobacco caterpillar and bugs.

**Fruit Borer**

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Chlorantraniliprole18.5% SC | 100 | 20 |
| Flubendamide 480% SC | 100 | 11 |
| Lufenuron 5.4% EC | 600 | 10 |
| Thiodicarb 75% WP | 625-750 | 17 |
| Monocrotophos 36 %SL | 625 | |

**White fly**

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Phorate 10% CG | 10000 | |

**vii. Major disease associated with crop:** Yellow Mosaic, Blast

**viii. IPM Module for management of disease(except organic areas):**

**1.** For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha.

**2.** For the control of **yellow mosaic control** of white fly or its vector by application of Imidachloropid

**ix. Major weeds associated with crop:** Broad leaf and narrow leaf weeds

**x. IPM Module for management of weeds:**

For Broad leafs 2-4 D sodium salt 80 % 1.0 kg/ha should be applied after 3 weeks of planting

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Sowing of crop in suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management,
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop,
4. Cluster based farming, Inter cropping. Needs to promote local germplasm.

**xii. Production constraints in agro-ecological region:**

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment, poor weed management,
3. Imbalanced use of chemical fertilizer, lack of awareness about pest and disease management among farmers,
4. Difficulties to use heavy modern agriculture implement due to hilly terrain.
5. Proper marketing of agriculture produce is not available,
6. Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

**7D. Name of Pulse Crop: Moong**

**i. Existing varieties being used:** Pant moong 2, Narendra moong-1

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Pant moong-5, IPM-02-03, 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. 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 just after harvesting of wheat if sown in jayad.
2. If sown in kharif season Mid July to Mid August sowing should be done.

3. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
4. Seed treatment with *Rhizobium* and P.S.B. Proper application of compost and farm yard manure.
5. Sowing in line must be promoted for proper intercultural operations.
6. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
7. Arrangement of irrigation facilities in case of drought should be available.
8. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

**v. Major insect pests associated with crop:** White fly, Fruit borer, 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 suitable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management,
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop,
4. Cluster based farming, Inter cropping. Needs to promote local germplasm.

**xii. Production constraints in agro-ecological region:**

1. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment, poor weed management, imbalanced use of chemical fertilizer,
3. Lack of awareness about pest and disease management among farmers, difficulties to use heavy modern agriculture implement due to hilly terrain.
4. Proper marketing of agriculture produce is not available,
5. Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

**7E. Name of Pulse Crop: Arhar(Red gram)**

**i. Existing varieties being used:** UPAS, ICPL-151, AL15

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Pant Arhar-291, VLA-1, Pant Arhar-3

**iii. Existing package of practices being used:**

1. Farmers are not adopting high yielding varieties released for commercial cultivation in the recent years.
2. 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 from mid of May to June.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born diseases.
3. Seed treatment with Rhizobium and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

**v. Major insect pests associated with crop:** White fly, Pod borer, 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

**viii. IPM Module for management of disease(except organic areas):**

**Yellow mosaic**

Control of yellow mosaic control of white fly or its vector by application of Imidacloropid 200 ml/ha, Dimetheoate 1 lit/ha, Seed treatment with Thiram+Carbendazim 2:1@3gm/kg seed.

For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha

**ix. Major weeds associated with crop:** 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. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment, poor weed management,
3. Imbalanced use of chemical fertilizer, lack of awareness about pest and disease management among farmers, difficulties to use heavy modern agriculture implement due to hilly terrain.
4. Proper marketing of agriculture produce is not available, Crop damaged by wild animals,
5. Agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

**7F. Name of Pulse Crop: Chickpea**

**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

**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 I$^{st}$ fortnight of October to II$^{nd}$ fortnight of October.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and P.S.B. Proper application of compost and farm yard manure.
4. Sowing in line must be promoted for proper intercultural operations.
5. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
6. Arrangement of irrigation facilities in case of drought should be available.
7. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

**v. Major insect pests associated with crop:** Gram Pod borer

**vi. IPM Module for management of insect pests :**

**Gram Pod Borer; *H. armigera***

1. Field sanitation and deep ploughing in the summer
2. Adopt proper crop rotation
3. Weeds like *Melilotus*, *Vicia* and *Chenopodium* should be weeded between 30-40 days after sowing of the crop
4. Intercropping/mixed cropping with coriander, linseed, etc.
5. Early planting during mid- October to mid -November
6. Growing of marigold as trap crop to attract adults for egg laying. Later the trap crop should be removed.
7. Use of light trap for destruction of adult insects.
8. Setup pheromone traps @ 5-6 traps/ha for monitoring of adult of *H. armigera*
9. Conservation of natural enemies like *Campoletis chloridae,* Chrysopid, wasp, and spider
10. Chickpea intercropping with coriander and linseed attract more number of *Campoletis*

*chloridae*.

11. Install bird perches @ 15-20/ha for the increasing bird population like black drongo, king crow, myna, Blue jay which preys upon larvae. But these pirches should be removed from the field at maturity of the crop
12. First spray with biorational insecticides like NPV@ 250 LE/ha /NSKE 5% /B.t. @ 1 kg formulation/ha with 0.1% UV retardant such as (Tinopal and 0.5% jaggery) during initial stages of flowering/ and podding stages of the crop to conserve natural enemies followed by need based, judicious and safe application of following any insecticide viz.

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Chlorantraniliprole 18.5% SC | 125 | 11 |
| Emamectin benzoate 5% SG | 220 | 14 |
| Novaluron 10 % EC | 750 | 7 |
| Lambda cyhalothrin 5% EC | 500 | 6 |
| Deltamethrin 2.8% EC | 10-12.5 | 400-5003 |
| Monocrotophos 36% SL | 1000 | |
| Quinalphos 25% EC | 1250 | |
| Ethion 50% EC | 1000-1500 | 21 |

**Bio-insecticides**

| **Name of the 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

**viii. IPM Module for management of disease(except organic areas):**

**Yellow mosaic**

Control of yellow mosaic control of white fly or its vector by application of Imidacloropid 200 ml/ha, Dimetheoate 1 lit/ha, Seed treatment with Thiram+Carbendazim 2:1@3gm/kg seed.

For management of **blast disease**, tricyclozole 400-500 g in 500-600 litre of water may be applied per ha

**ix. Major weeds associated with crop:** 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. Unavailability of proper irrigation facilities.
2. Lack of quality seed, poor awareness of seed treatment, poor weed management,
3. Imbalanced use of chemical fertilizer, lack of awareness about pest and disease management among farmers, difficulties to use heavy modern agriculture implement due to hilly terrain.
4. Proper marketing of agriculture produce is not available, Crop damaged by wild animals,

Agriculture depends on rain, scattered agriculture land, migration and lack of interest in agriculture.

**7G. Name of Pulse Crop: Soyabean**

**i. Existing varieties being used:** Kala bhatt(Oval), Pahari soybean, VLS 47

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** PS 1042, VLS 21, VLS 47, VLS 59, PS 1092

**iii. Existing package of practices being used:**

1. Traditional seed variety , undecomposed FYM 1.0-2.0qt./nail.
2. No use of chemical fertiliser, 1-2 manual weeding.
3. No use plant protection measures

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. **Preparation of land**- 2-3 ploughing followed by planking ,
2. **Sowing time-** Ist fortnight of June
3. **Seed rate and seed sowing** – 75-80 kg/ha, line to line spacing- 45 cm
4. **Manure and fertilizer-** -Well decomposed FYM @5-10 tonnes/ha , NPK 20:60:40 and seed treatment with bio fertiliser
5. **Irrigation**-usually maximum area is rain fed
6. Weed control – Two manual weeding at 20-25 and 40-45 DAS is quite effective for weed control.

**v. Major insect pests associated with crop:** Semi looper, Bihar hairy catter piller,White fly, Girdle beetle, Leaf miner

**vi. IPM Module for management of insect pests(except organic areas):**

**Cultural practices:** The cultural practices make the environment less favorable for the pests and more favorable for its natural enemies. The following are cultural practices recommended for the management of soybean insect pests.

1. Removal and destruction of infected stubbles followed by deep summer ploughing destroys the pupae of stem fly, girdle beetle, pod borer and tobacco caterpillar present in the soil.
2. Optimal fertilizer dose of NPK and S @ 20:60-80: 30-40:20 kg/ ha should be applied.
3. Application of excessive dose of nitrogen fertilizer causes the infestation of all insect pests on soybean.
4. Crop rotation with non-leguminous plants is recommended for the management of leaf miner.
5. Intercropping of soybean with either asafetida (*Ferula assafoetida* L.) or maize or sorghum in the sequence of 4 rows of soybean with 2 rows of intercrop should be practiced. These intercrops help in conservation of biocontrol agents, like coccinellid beetles, Chrysoperla etc. In girdle beetle and semilooper endemic areas, intercropping with maize or sorghum should be avoided.
6. Planting of trap crops like castor for tobacco caterpillar, groundnut for leaf miner, marigold for pod borer and Dhaincha (*Sesbania sesban*) for girdle beetle.
7. Selection of insect resistant or tolerant varieties for cultivation.

**Table1: Resistant or tolerant varieties for insect pests of soybean.**

| Insect pest | Resistant or tolerant variety |
|---|---|
| Stem fly | Dsb 25, Himso 1685, JS 20-89, MACS 1370, MACS 1410, NRC 97, JS 20-53,PS 1543, SL 983, Dsb 23-2 |
| Girdle beetle | MACS 1410, Dsb 23-2, Himso 1685, JS 20-89, KDS 726 |
| Defoliators | Dsb 23-2, KDS 726, PS 1543, PS 1569 |

| | |
|---|---|
| Pod borer | Dsb 25, SL 683, NRC 97, MACS 1370, JS 20-89 |
| Leaf miner | MACS 1370, Himso 1685, MACS 1370, MACS 1410 |
| Pest complex | DS 2708, Dsb 23-2, Dsb 25, Himso 1685, JS 20-53, JS 20-79, JS 20-89, KDS 726, MACS 1370, MACS 1410, NRC 97, SL 983, PS 1543 |

**Mechanical Control:** Reduction of insect pest population by means of manual devices or labour is called mechanical control. The following measures are recommended for mechanical practices for soybean insect pests.

1. Collection and destruction of girdle beetle infested plant parts, egg masses and gregariously feeding larvae of Bihar hairy caterpillar and tobacco caterpillar.
2. Hand picking and mechanical destruction of matured pod borer larvae.
3. Erection of bird perches @ 10-12/ha to attract predatory birds for preying on defoliator larvae.

**Physical control:** Reduction of pest population by using device which affect them physically or alter their physical environment. Manipulation of temperature, humidity, light is used for this purpose. This includes the following:

1. Light traps should be placed at ground level early in the season for collection and destruction of the leafminer moths.
2. Installation of light traps in the field for monitoring and collection of adult moths.

**Biological Control**: The successful management of a pest by means of another living organism (parasitoids, predators and pathogens) is called biological control. The following biological control agents are used in IPM of soybean.

1. Release of *Tricogramma chilonis* @ 50,000/ ha four times at weekly interval against *S. litura*.
2. Spraying of *Bacillus thuringiensis* var. kurstaki @ 0.75 to 1.0 kg/ha for the management of defoliators.
3. Foliar application of HaNPV (*Helicoverpa armigera* Nuclear Polyhedrosis Virus) for *H. armigera* @ 250 LE/ha.
4. The major predators of soybean insect pests are given in the table 2.

**Table 2: Major predators of insect pests of soybean**

| Insect pests attacked | Predator |
|---|---|
| Whiteflies | Lady bird beetles:<br>*Coccinella septumpunctata*<br>*Coccinella transversalis* |
| Lepidopterous caterpillars | Pentatomid bug *Eocanthecona furcellata* |
| Lepidopterous caterpillars and Whiteflies | Spiders: *Lynx* spider and Orb weaver spider |

**Chemical Control:** The control of insects with pesticides/insecticides is known is chemical control. The insecticides are applied only when the population of insect pests crossed the Economic Threshold Level (ETL) (Table 3). The list of insecticides recommended for soybean insect pests are given in table 4.

**Table 3: Economic Threshold Level (ETL) of soybean insect pests**

| Insect Pest | Crop stage | Population/ meter |
|---|---|---|
| Green semilooper | Flowering | 2 larvae |
| Tobacco caterpillar | Flowering | 4 larvae |
| Girdle beetle | Flowering | 10 % infestation |
| Pod borer | Podding | 3 larvae |

**Table 4: List of insecticides recommended for soybean insect pests**

| Insect pests | Insecticides | Dosage |
|---|---|---|
| Sucking pests, stem fly | Thiamethoxam 30 FS (Seed treatment) | 10ml/kg seed |

| | | |
|---|---|---|
| Sucking pests | Acetamiprid 20 SP | 100 ml/ha |
| Sucking pests | Spiromesifen 22.9 SC | 600ml/ha |
| Sucking pests | Imidacloprid 17.8 SL | 500 ml//ha |
| Sucking pests and girdle beetle | Triazophos 40 EC | 800ml/ha |
| Defoliators | Dichlorovos 76EC | 500 ml/ha |
| Defoliators and pod borer | Quinalphos 25 EC | 1500 ml/ha |
| Sucking pests and defoliators | Monocrotophos 36 SL | 800 ml/ha |
| Pod borer | Indoxacarb 15.8EC | 333 ml/ha |
| Defoliators, stem fly and girdle beetle | Chlorantraniliprole 18.5 SC | 150 ml/ha |
| Leaf miner | Carbaryl 50WP | 2.0 kg/ha |
| Leaf miner and sucking pests | Oxydemeton methyl 25EC | 350 ml/ha |
| Girdle beetle | Phorate 10 G | 10 kg/ha |
| Stemfly and girdle beetle | Carbofuran 3 G | 30 kg/ha |

**Bio-insecticides**

**Tobacco caterpillar (*Spodoptera litura*)**

| **Name of the Bio-insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| *Bacillus thuringiensis* var. kurstaki Serotype H-3a,3b, Strain Z-52 | 750 | |

***Hairy caterpillar* (*Spilosoma obliqua*)**

| **Name of the Bio-insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| *Bacillus thuringiensis* var. kurstaki Serotype H-3a,3b, Strain Z-52 | 750 | |

**Semilooper (*Chrysodeixis acuta*)**

| **Name of the Bio-insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| *Bacillus thuringiensis* var. kurstaki Serotype H-3a,3b, Strain Z-52 | 750 | |

**Soyabean leaf miner (*Odontota horni*)**

| **Name of the Bio-insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| *Bacillus thuringiensis* var. kurstaki Serotype H-3a,3b, Strain Z-52 | 750 | |

**vii. Major disease associated with crop:** YMV, leaf spot, blight, Collar rot, rust

**viii. IPM Module for management of disease:**

**Rust: *Phakopsora pachyrhizi***

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Hexaconazole 5% SC | 500 | 30 |
| Propiconazole 25% EC | 500 | 26 |

**Collar rot: *Sclerotium rolfsii***

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Carboxin 37.5%+ Thiram 37.5% DAS | 3.0/Kg | Seed Treatment |

**ix. Major weeds associated with crop :** *Oxalis latifolia, Phyllanthus niruri ,Amaranthus viridis, Euphorbia hirata, Solanum* sp.

**x. Production constraints in agro-ecological region:**

1. Apply Trifluralin 48%EC @ 1.0 kg a.i/ha as pre plant incorporation.
2. Apply Alachlor 50%EC @ 2-2.5 kg a.i/ha or Pendimethalin 30%EC @ 0.75-1.0 kg a.i/ha or

Pendimethalin 30% EC + Imazethapyr 2% EC @ 0.75+0.05 kg a.i/ha or Metribuzin 70%WP @ 0.35-0.525 kg a.i/ha or Diclosulam 84% WDG @ 22-26 g a.i/ha within 3 days after sowing.

3. Apply Quizalofop- ethyl 5%EC @ 0.0375-0.05 kg a.i/ha or Fenoxaprop-p-ethy l 9.3% EC 0.1 kg a.i/ha or Haloxyfop 10.5% EC 108-135 g a.i/ha at 20-25 days after sowing to control grassy weeds.
4. Apply Imazethapyr 10%SL @ 0.1 kg a.i/ha or Imazamox 35%+ Imazethapyr 35% @ 0.07 kg a.i/ha at 20-25 days after sowing to control grassy and non grassy weeds.
5. Apply any pre emergence herbicide followed by one hand weeding at 30-35 days after sowing.

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Soybean- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Timely Sowing, Seed treatment,
5. Use of HYV,
6. Care soil & water conservation measures
7. INM (Maximum use of value added compost/FYM and soluble fertiliser)
8. Integrated weed management
9. IPM
10. Good storage condition
11. Sale of value added products

**xii. Production constraints in agro-ecological region:**

1. Less availability of agriculture inputs,
2. Use of imbalance and un decomposed FYM,
3. Climate changing,
4. Wild animal damages
5. Migration,
6. Poor Irrigation facilities

Lack of ICT tools due to poor awareness and inter net connectivity

**HORTICULTURE**

**Main Blocks in Region:** Fruits: Walnut, Apple, Apricot, Citrus i.e. Malta
Vegetables:
(Tarikhet, Dwarahat, Lamgarah, Dhauladevi)

**Main village cluster in blocks:** Fruits: Walnut, Apple, Apricot, Citrus ( Malta)
Vegetables: Potato, Frenchbean, Vegetable Pea, Cabbage

**Tarikhet**
Fruits: Chaubatia
Vegetables: Chaubatia

**Dwarahat,**
Fruits:Dunagiri, Kukucheena
Vegetables: Dunagiri, Kukucheena

**Lamgarah,**
Fruits:Motiapathar belt, Chaykhan area, Lamgarah belt
Vegetables: Motiapathar

**Dhauladevi**
Fruits:Jageshwar belt,
Vegetables: Jageshwar belt,
Irrigated Clusters: NA
Rainfed Clusters: All Rainfed

**Existing rain water management facilities:** Various World Bank Projects like Watershed Management, MANREGA, and IWMP etc are being run at various blocks of the districts and rain water management facilities like rain water harvesting tanks, Irrigation tank, farm ponds have been given to farmers on subsidy

**8A. Name of Fruit Crop: Apple**

i. **Existing varieties being used:** Royal Delicious, Red Delicious, Rymer, Fanny, Green Sweet 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:** Need to introduce low chill or colour mutants and spur varieties suitable for different agroecological situations viz. Early Red one, Washington spur Pink Lady, Oregeon spur, Super chief and other new stains.

iii. **Existing package of practices being used:**

1. Use of old and traditional varieties
2. Less use of pollinizer cultivars
3. Growing apple without proper lay out
4. Less or no use of mulch for water conservation
5. Poor Orchard management, no proper pruning and training, improper nutrient management
6. High incidence of wooly aphis
7. Use of organic manures
8. High stem and barky cankers
9. No use of IPM
10. No Grading or packing system or facilities
11. No facilities for under sized or cull fruits
12. Wastage due to improper Post Harvest Management

iv. **Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Use of low chill cultivars like Red Velox, Washimgton spur, Pink Lady, Super chief, Red spur, walspur with suitable pollizers arrangement for apple.
2. High density orchard with proper lay out, nutrient management, drip , mulch and IPM Management.

v. **Major insect pests associated with crop:** San jose scale, coddling moth, tent caterpillar

vi. **IPM Module for management of insect pests :**

**San Jose Scale:**

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, Encarsia perniciasi with Aphytis diaspidis may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,Chilocorus bijugus Mulsant,Chilocorus rubidus Hope Pharoscymnus flexibilies Mulsant
5. Spray trees with Thiamethoxam (0.05%) or melathion (0.05%) or oxy demeton methyl (0.07%) and use Imidacloprid (0.007%) or Chlorpyriphos (0.05%) or around tree basin

**Tent Caterpillar:**

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.
5. Spray 0.05% nimbecidine or B.t. based Halt 0.02%.

**Codling Moth/ Fruit borer:**

1. Thorough clean up of orchard.

2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; Parus major and Passer domesticus prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of Trichogramma embryophagum within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

**San jose scale:** ***Diaspidiotus perniciosus= Aspidiotus perniciosus***

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Malathion 50% EC | 0.05% | 1500-2000 |
| Oxydemetonmethyl 25% EC | 0.07% | 4200-5600 |

**vii. Major disease associated with crop:** Canker, collar rot, Powdery mildew, apple scab, leaf fall disease.

**viii. IPM Module for management of disease (except organic areas):**

**Powdery mildew of Apple:** ***Podosphaera leucotricha***

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Dinocap 48% EC (per tree) | 3 | 21 |
| Sulphur 80% WP | 2500-5000 | |
| Lime sulphur 22% SC | 1% | |

**Apple scab:** ***Venturia inaequalis***

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Penconazole 10% EC | 0.05% | 30 |
| Difenoconazole 25% EC | 0.015% | 14 |
| Hexaconazole 5% EC | 0.05% | 30 |
| Fenarimol 12% EC | 0.04% | 30 |
| Dodin 65% WP | 0.075% | 21 |
| Dithianon 75% WP | 1800 | 14-21 |
| Thiophanate methyl 70% WP | 715 | 3 |
| Myclobutanil 10% WP | 0.04% | 21 |
| Propineb 70% WP | 0.30% | 30 |
| Sulphur 80% WG | 1875-2500 | |
| Mancozeb 75% WP (per tree) | 30 | |
| Carbendazim 50% WP (per tree) | 2.50 | |
| Captan 50% WP | 2500 | |
| Ziram 80% WP | 1500-2000 | 21 |

**ix. Major weeds associated with crop:** *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium,* etc.

**x. IPM Module for management of weeds:** Though mechanical, chemical and control

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of high yielding cultivars with and suitable placement of pollinizer in high density planations with sufficent irrigation facility as drip and mulch for establishment of model and commercial orchards.

2. Intercropping of leguminous crops like rajma, bhat and gahat etc.
3. Cultivation of potato as inter crop during the period of beginning of orchard of normal spacing.
4. Cultivation of some vegetable crop as an intercrops i.e. cabbage, cauliflower, French bean etc in normal spacing.

**xii. Production constraints in agro-ecological region:**

1. Excess Rainfall, adverse weather during season hits the spraying schedule of apple.
2. Negligence of drainage causes the root zone decrease.
3. Lesser emphasis on sanitation of orchard which leads the infection of diseases.
4. Lack of adaptation of proper technical knowhow during training and pruning in high /ultra high density orchard
5. No proper facilities of cold chain.
6. Disaster during monsoon hit the specific workable and sustainable intensification yields.
7. No easily access to marketing facilities.

**8B. Name of Fruit Crop: Peach**

**i. Existing varieties being used:** Paradelux, July Elberta, Red June, Alaxender

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Alaxnder, Red globe, crest heaven, glo heaven etc. Nectarine-snow Queen

**iii. Existing package of practices being used:**

1. Use of old and traditional Varieties
2. Poor knowledge of canopy management practices
3. Organic inputs for crop production
4. No knowledge of high density orcharding
5. Irrigation facilities are rarely used
6. Lack of grading and packing facilities
7. No canning or processing unit
8. No availability of waste management of crop residue

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Need to introduce non-clingstone varities with maturity indices on or before June.
2. Use of High denisty plantation with mulch and supplemetation of drip irrigation.

**v. Major insect pests associated with crop:** San jose scale, Tent caterpillar, Codlling moth, Peach leaf curl, Peach fruit fly

**vi. IPM Module for management of insect pests :**

**San Jose Scale:**

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Malathion 50% EC | 0.05% | 1500-2000 |
| Oxydemetonmethyl 25% EC | 0.07% | 4200-5600 |

**Tent Caterpillar:**

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also cause diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.Spray

0.05% nimbecidine or *B.t.* based Halt 0.02%.

**Codling Moth/ Fruit borer:**

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

**Peach Leaf Curl Aphid:**

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

**Peach leaf curl aphid**

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Carbosulfan 3% CG | 1000 | 33300 |
| Oxydemetonmethyl 25% EC | 0.025% | 1500-2000 |

**Peach Fruit Fly:**

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

**vii. Major disease associated with crop:** Gummosis is major problem

**viii. IPM Module for management of disease(except organic areas):**

1. Use of proper cultural or field operation with minimum damage to the crop
2. Use of borax as spray of soil application
3. Use of antibiotic as prophylatic spray.

**ix. Major weeds associated with crop:** *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium,* etc.

**x. IPM Module for management of weeds:** Though mechanical, chemical and control

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

High density plantation with (3x3mts) supplemented with drip irrgation system.

**xii. Production constraints in agro-ecological region:**

1. Availability of Quality planting material
2. Need to delineate the table and canning type varieties.
3. Excess Rainfall, adverse weather during season hits the spraying schedule of apple.

4. Negligence of drainage cause the root zone decrease.
5. Lesser emphasis on sanitation of orchard which leads the infection of diseases.
6. Lack of adaptation of proper technical knowhow during training and pruning in high /ultra high density orchard .
7. No proper facilities of cold chain.
8. Disaster during monsoon hit the specific workable and sustainable intensification yields.
9. No easily access to marketing facilities.

**8C. Name of Fruit Crop: Pear**

**i. Existing varieties being used:** Gola, Victoria, China, Baggugosha, Kashmiri, Thumb pear etc

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Max Bartlette, Red Bartlette, Willium, Starkrimson, Hokoi

**iii. Existing package of practices being used:**

1. Use of old and traditional varieties
2. Less or no use of mulch for water conservation
3. Canopy management is poor
4. Recommended Cultural practices are rarely applied
5. Maturity indices are rarely use
6. Surplus management of fruit are not done
7. Processing industries are not established for Gola nashpati

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Use of new strains or occidental pears are needed for high hills
2. Introduction of new strains with less gritcells in fruits
3. Need to develop Postharvest management system with minimum losses.
4. Processing facilities needs to be strengthened.

**v. Major insect pests associated with crop:** San jose scale, Tent caterpillar, Codlling moth, Peach leaf curl, Peach fruit fly

**vi. IPM Module for management of insect pests :**

**San Jose Scale:**

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Malathion 50% EC | 0.05% | 1500-2000 |
| Oxydemetonmethyl 25% EC | 0.07% | 4200-5600 |

**Tent Caterpillar:**

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.
5. Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

**Codling Moth/ Fruit borer:**

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.

4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

**Peach Leaf Curl Aphid:**

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Carbosulfan 3% CG | 1000 | 33300 |
| Oxydemetonmethyl 25% EC | 0.025% | 1500-2000 |

**Peach Fruit Fly:**

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

**vii. Major disease associated with crop:** Fruit rot

**viii. IPM Module for management of disease(except organic areas):** Applications of contact and systematic fungicides

**ix. Major weeds associated with crop:** *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium* etc.

**x. IPM Module for management of weeds:** Though mechanical, chemical and control

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** Introduction of New Strain *viz*. Anjou, Starkrimson in high hills

**xii. Production constraints in agro-ecological region:**

Availability of quality planting material

**8D. Name of Fruit Crop: Plum**

**i. Existing varieties being used:** Santa rosa, Common Green, New Plum, First Plum, Ram Maneld

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Italian plum, Prunes *viz* Frontier for mid and high hills.

**iii. Existing package of practices being used:**

1. Use of old and traditional varieties
2. Less or no use of pollinizer varieties in plum especially in japnese type varieties
3. Less or no use of mulch for water conservation

4. Canopy management is poor
5. Recommended cultural practices are rarely applied
6. Maturity indices are rarely use

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** High density plantation with drip irrigation system

**v. Major insect pests associated with crop:** San jose scale, Tent caterpillar, Codlling moth, Peach leaf curl, Peach fruit fly

**vi. IPM Module for management of insect pests :**

**San Jose Scale:**

1. Collection and destruction of infected pruned material.
2. Adult emergence monitoring with special sex pheromone
3. TrapsParasite, *Encarsia perniciasi* with *Aphytis diaspidis* may give upto 86.5 per cent parasitism.
4. Conserve Coccinellid predators,*Chilocorus bijugus* Mulsant,*Chilocorus rubidus* Hope *Pharoscymnus flexibilies* Mulsant

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Malathion 50% EC | 0.05% | 1500-2000 |
| Oxydemetonmethyl 25% EC | 0.07% | 4200-5600 |

**Tent Caterpillar:**

1. Pruning and burning of twigs containing egg mass (Dec-Jan).
2. Mopping up the tent with pole and some rags dipped in kerosene tied on its end (at 12.00-3.00 pm).
3. Ues parasitoid Tachnid fly, virus also causes diseases to caterpillar.
4. Spraying with melathion @ 2ml/l or Carbaryl 50 WP @ 2 Kg per 500 lit of water per hac.
5. Spray 0.05% nimbecidine or *B.t.* based Halt 0.02%.

**Codling Moth/ Fruit borer:**

1. Thorough clean up of orchard.
2. Scrapping lose bark from old trees.
3. Collection and destruction of fallen fruits.
4. Mating disruption dispenser, moth pheromone trap can be used
5. Birds; *Parus major* and *Passer domesticus* prey upon overwintering larvae.
6. Predators, such as ground beetles (Carabidae), ants and crickets, and parasitic wasps, attack larvae as they leave fruit and crawl towards tree trunks
7. Spray of Carpovirusine (GV of moth) at fortnightly interval.
8. Release of *Trichogramma embryophagum* within the first appearance of moth and subsequent release at weekly interval.
9. Spraying (before caterpillar enter into fruit), monocrotophos @ 2ml/l or quinolphos @ 2ml/l or 2.0 kg carbaryl 50 WP in 500 l of water/ha.
10. In case of high abundance, tree should be banded with chemically treated bands.

**Peach Leaf Curl Aphid:**

1. Keep plant healthy — avoid excess fertilization.
2. A healthy plant can better withstand the loss of leaves, but excess fertilization can cause succulent tissue that is very susceptible to infection.
3. Monitoring should be done during spring
4. Removal and destruction of alternate host
5. Biological controlling agent like *Coccinella sp.* Green lacewing larvae *(Chrysoperla carnea) Aphelinus matricarinae*.
6. Inspect fruit and foliage for honeydew secretion

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Carbosulfan 3% CG | 1000 | 33300 |

| | | |
|---|---|---|
| Oxydemetonmethyl 25% EC | 0.025% | 1500-2000 |

**Peach Fruit Fly:**

1. Use early maturing varities like 16-33 and Flordasum, Shan-e -Punjab, Pratap.
2. Hoe the orchard (May- June) 4-6 cm deep.
3. Bury the infested fruits at 60 cm deep in the soil.
4. Use Methyl eugenol trap
5. Use Bait spray with yeast hydrolyate-250g, crude sugar, 2.5 kg Malathion 50EC – 250ml in 250 l of water and spraying two weeks before harvesting.

**vii. Major disease associated with crop:** Seasonal weeds

**viii. IPM Module for management of disease (except organic areas):** Spraying of available contact /systematic insecticide if required.

**ix. Major weeds associated with crop:** *Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium* etc.

**x. IPM Module for management of weeds:** Though mechanical, chemical and control

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. High density plantation (3x3 mts) with drip irrigation
2. Intercropping of soybean or gahat or lentil in rabi season
3. Mulch technology
4. Post harvest management of perishable with refrigeration system and development of fruit wines factories in the state.

**xii. Production constraints in agro-ecological region:**

1. Availability of elite planting material
2. Lack of technical knowhow in plum cultivation

**9A. Name of the vegetable crop: Cabbage**

**i. Existing varieties being used:** Golden acre or mix of varieties

**ii. High yielding varieties ( the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** C T-621, Pragati, Indica,, Pusa Mukta , Sri Ganesh Gole

**iii. Existing package of practices being used:**

1. Soil Testing-Farmers do not test their soil
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Cultivars-In cabbage, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be head formation.
8. Transplanting- Farmers practices improper planting distance.
9. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
10. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
11. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
12. Harvesting- The harvesting should not follow as per maturity standards or as per object.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil Testing- Farmers should test their soils before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to go for deep ploughing before sowing the

crop particularly during the hot season or before the snowfall

3. Seed- Farmers should adopt improved varieties/ hybrids
4. Soil solarisation practice should follow in nursery beds
5. Seed Treatment- To combat the different seed borne diseases to treat the seed by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing
6. Seed Rate- It is recommended to use the seed quantity for different as follows-
   (Early)-600-700g/ ha open pollinated
   (Mid and Late)- 500-550g/ha open pollinated
   (Hybrid)-350-400g/ha
5. Optimum sowing time - June, July (Rainfed)
6. Transplanting- Farmers should transplant seedlings properly as for early (40x45cm), medium (40x45cm),
7. Manures and fertilizers- Farmers should incorporate well rotten cow dung (20-25tonnes/ha) and NPK (120:60:60) in irrigated, half dose of NPK in unirrigated condition.
8. Irrigation- As per requirements. At critical stages such as head initiation and head development
9. 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.
10. Harvesting- The farmer must aware about the maturity stage of a particular crop variety so he can harvest the crop as per their object. In general the heads should be harvested when they attempt the size in between 500-750 gms.

**v. Major insect pests associated with crop:** Cut worm, Butterflies , Aphids, *Plutell*a and Painted bugs

**vi. IPM Module for management of insect pests :**

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

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.
2. Hand picking and destruction of cabbage butterfly eggs and larvae in nursery as well as main crop to reduce the pest multiplication.
3. Growing of African bold seeded mustard as trap crop at 22:2 ratio (Cabbage: Mustard) to attract DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

**After Planting**

1. Regular Monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Hook out the head borer and destroy mechanically. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT.

**Dimond back moth: *Plutella Xyllostella***

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Chlorantraniliprole 18.5% SC | 50 | 3 |
| Cyantraniliprole 10.26% OD | 600 | 5 |
| Indoxacarb 14.5% SC | 200-266 | 7 |
| Indoxacarb 15.8% EC | 266 | 5 |
| Spinosad 2.5% SC | 600-700 | 3 |

| | | |
|---|---|---|
| Chhlorfenapyr 10% SC | 750-1000 | 7 |
| Emamectin benzoate 5% SG | 150-200 | 3 |
| Flubendamide 480% SC | 45-60 | 7 |
| Flubendamide 20% WG | 90-120 | 7 |
| Chlofluazuron 5.4% EC | 1500 | 7 |
| Diafenthiuron 50% WP | 600 | 7 |
| Lufenuron 5.4% EC | 600 | 14 |
| Novaluron 10% EC | 750 | 5 |
| Metaflumizone 22% SC | 750-1000 | 3 |
| Tolefenpyrad 15% EC | 1000 | 5 |
| Thiodicarb 75% WP | 1000-1330 | 7 |
| Fipronil 5% SC | 800-1000 | 7 |
| Cypermethrin 10% EC | 650-760 | 7 |

**Bioinsecticides**

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Azadirachtin 0.03% WSP (Neem oil based) | 2500-5000 | 7 |
| *Bacillus thuringiensis* var. galleriae 1593 M sero type H 59 5b, 1.3% FC | 600-1000 | |
| *Bacillus thuringiensis* serovar kurstaki (3a,3b,3c) 5% WP | 500-1000 | |
| *Bacillus thuringiensis* serovar kurstaki serotype 3a,3b, SA II WG | 500 | |

**Cabbage/cauliflower Aphid**

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Cyantraniliprole 10.26% OD | 600 | 5 |
| Tolefenpyrad 15% EC | 1000 | 5 |
| Acetamiprid 20% SP | 75 | 7 |
| Fenvalerate 20% EC | 300-375 | 7 |

**Bioinsecticides**

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period(days)** |
|---|---|---|
| Azadirachtin 0.03% WSP (Neem oil based) | 2500-5000 | 7 |

**Painted bug**

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Dimethoate 30% EC | 200 | 660 |

**vii.Major disease associated with crop:** Damping off in nursery and Black rot

**viii.IPM Module for management of disease(except organic areas):**

1. Change the place for nursery
2. Maintain proper drainage
3. Seed treatment with Streptocycline or hot and cold water treatment (30 min each).

**ix.Major weeds associated with crop:** *Parthenium, Chenopodium album*, Krishnil, Teepatiya

**x. IPM Module for management of weeds:**

1. Use of weedicides, if required.
2. Weeding, hoeing
3. Deep ploughing

**xi.Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of hybrid varieties suitable for year round production system for mid or high hills.
2. Growing crop at right spacing as recommended above.
3. Solarization of nursery before sowing of seed

4. Seed treatment with Streptocycline or hot and cold water
5. Soil testing and application of Boron if needed
6. Use of Chloropyriphose for control of cut worm

**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.

**9B. Name of the vegetable crop: Cauliflower**

**i. Existing varieties being used:** Unknown varieties available in the mandi

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** (Rainfed or partially irrigated) Snow crown

**iii. Existing package of practices being used:**

1. Soil Testing-Farmers do not test their soil.
2. Land Preparation- Farmers do not open the land before sowing for sterilization of the soil.
3. Seed – Most of the farmers are in practices to use the local low yielding seed materials.
4. Nursery- Nursery soil generally not sterilize by the farmers.
5. Seed Treatment- Mostly farmers of the state do not treat the seed materials.
6. Seed Rate- Farmers practices to use uncounter/ un amounted seed quantity.
7. Optimum sowing time : June-July (Rainfed)
8. Cultivars-In cauliflower, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be curd formation.
9. Transplanting- Farmers practices improper planting distance.
10. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
11. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
12. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
13. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
3. Seed- Farmers should use improved varieties/ hybrids
4. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
5. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma Viride 4g/kg before sowing.
6. Seed Rate- It is recommended to use the seed quantity for different as follows-
   Cauliflower (Early)-500-750g/ ha open pollinated.
   Cauliflower (Mid and Late)- 300-350g/ha open pollinated.

Cauliflower (Hybrid)-250-300g/ha.

7. Varieties- Farmers should select proper variety for suitable sowing time as per maturity group.
8. For early crop- Early Kunwari, Pusa Kartiki, Pusa Early Synthetic; Mid- Pusa Synthetic, Pusa Shubhra, Pant Shubhra, Hisar No.1 and Late- Pusa Snowball-16, Pusa Snowball Kt-1, Pusa Hybrid-2.
9. Transplanting- Farmers should transplant seedlings properly as for early (30x30cm), medium (45x30cm), and late (60 x 45 cm).
10. Manures and fertilizers- Farmers should incorporate well rotten cow dung (15-20tonnes/ha) and NPK (150:80:60) in irrigated, half dose of NPK in un irrigated condition.
11. Irrigation- Farmers should apply water in the field at proper stage of the crop. As critical growing stage such as proper growing stage, curd formation and maturity stages.
12. Weed control- Farmers must know about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically.
13. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

**v. Major insect pests associated with crop:** DBM, Aphids

**vi. IPM Module for management of insect pests :**

**Before Planting**

1. Deep ploughing in the month of summer to expose immature stages of insect pest.
2. Growing of African bold seeded mustard as trap crop at 22:2 ratio to attract DBM for oviposition at least 10 days ahead of planting of main crop may reduce the infestation.

**After Planting**

1. Regular monitoring of the plants randomly for the presence of pests on both the leaf surface as well as between the leaves.
2. Hand picking and destruction of leaf webber and egg masses and early instar larvae to reduce further multiplication of pests in the field.
3. Spray Neem seed powder extract 4% @ every 10 days interval starting from 30 days after planting (DAT) and alternate spray with Neem cake (5%) to keep the pest in check.
4. Spray Neem soap 1% to manage the sucking pests at 10 days interval from 30 to 90 DAT.
5. Spray Dipel 8 SP (Bt var. kurstaki) @ 0.2% at 15 days interval after 22-25 DAT to manage DBM.

**Dimond back moth: *Plutella Xyllostella***

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Chlorantraniliprole 18.5% SC | 50 | 3 |
| Cyantraniliprole 10.26% OD | 600 | 5 |
| Indoxacarb 14.5% SC | 200-266 | 7 |
| Indoxacarb 15.8% EC | 266 | 5 |
| Spinosad 2.5% SC | 600-700 | 3 |
| Chhlorfenapyr 10% SC | 750-1000 | 7 |
| Emamectin benzoate 5% SG | 150-200 | 3 |
| Flubendamide 480% SC | 45-60 | 7 |
| Flubendamide 20% WG | 90-120 | 7 |
| Chlofluazuron 5.4% EC | 1500 | 7 |
| Diafenthiuron 50% WP | 600 | 7 |
| Lufenuron 5.4% EC | 600 | 14 |
| Novaluron 10% EC | 750 | 5 |
| Metaflumizone 22% SC | 750-1000 | 3 |
| Tolefenpyrad 15% EC | 1000 | 5 |
| Thiodicarb 75% WP | 1000-1330 | 7 |

| | | |
|---|---|---|
| Fipronil 5% SC | 800-1000 | 7 |
| Cypermethrin 10% EC | 650-760 | 7 |

**Bioinsecticides**

| **Name of the insecticides** | **(gm/ml) /ha** |
|---|---|
| *Bacillus thuringiensis* var. galleriae 1593 M sero type H 59 5b, 1.3% FC | 600-1000 |
| *Bacillus thuringiensis* serovar kurstaki serotype 3a,3b, SA II WG | 500 |

**Cabbage/cauliflower Aphid**

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Cyantraniliprole 10.26% OD | 600 | 5 |
| Tolefenpyrad 15% EC | 1000 | 5 |
| Acetamiprid 20% SP | 75 | 7 |
| Fenvalerate 20% EC | 300-375 | 7 |

**Bioinsecticides**

| **Name of the Bio-insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Azadirachtin 0.03% WSP (Neem oil based) | 2500-5000 | 7 |

**vii. Major disease associated with crop:** Black rot and stalk rot Damping off , black rot, Alternaria are serious problem

**viii. IPM Module for management of disease(except organic areas):**

Recommended pesticides in their recommended doses are being used.

***Xanthomonas* Black rot:**

Seed treatment with Streptocyclin @ 100 mg/kg seed and two spray of Streptocyclin 1.0 gm / 10 litre of water after 10-12 days interval.

**ix.Major weeds associated with crop:** *Parthenium, Chenopodium album*, Krishnil, Teepatiya

**x. IPM Module for management of weeds:**

1. Use of weedicide if required.
2. Weeding, hoeing
3. Deep ploughing.

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Advanced technical package and practises regarding crop.
2. Use of trap crop like radish to attract the white butterfly.
3. Inter Cropping with coriander and rye in hills.

**xii.Production constraints in agro-ecological region:**

1. 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.

**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:** (rainfed) Japanese White, Pusa Himani, Mino early, Ankur Naveen, Century -11

**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: June-Aug
4. Planting distance- Farmers practices improper planting distance and sown through broadcast.
5. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
6. Fertilizers: Farmer use imbalance fertilizer
7. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method..
8. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
9. Harvesting- The root harvesting should not follow as per maturity standards or as per object.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
3. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or Trichoderma viride 4g/kg before sowing
4. Seed Rate- The recommended seed rate of Asiatic type radish 10 Kg/ha and European type 12-14 Kg/ha
5. Planting distance- Farmers should be sown the seed Asiatic type line to line 45 cm and plant to plant 8cm and European type line to line 30 cm and plant to plant 8 cm
6. Manures and fertilizers- should be used as per soil testing , General recommendation are FYM-250q/ha Nitrogen: 60 kg/ Phosphorus: 100 kg/ha and Potassium: 50kg/ha Micronutrient: should be used as per soil testing,
7. Irrigation- Farmers should apply water in the field at proper stage of the crop. Irrigate the crop in winter at 7-8 days interval and in summer 3-4 days interval
8. Harvesting- Depending upon the cultivars, the roots become ready for harvesting in about 25-35 days after sowing. 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 are problem

**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.
3. Imidacloprid 17.8 SL @ 0.25ml/l or Acetamiprid 20%SP @100g/ha or Thiamethoxam 25%WG@ 100g/ha if needed.

**vii. Major disease associated with crop:** Damping off, black rot, etc

**viii. IPM Module for management of disease(except organic areas):**

Use of recommended pesticides in recommended dose

**ix. Major weeds associated with crop: -**

**x. IPM Module for management of weeds: -**

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Cauliflower early- Radish- Bottlegourd

Brinjal-Radish –Chilli

Bottle bourd-radish-French bean

**xii. Production constraints in agro-ecological region:**

1. Less availability of high quality seeds
2. High prices of hybrid seeds
3. Post-harvest losses are more due to non availability of storage facility
4. High prices of fertilizers
5. Low prices of farm produce
6. Lack of knowledge about the cultivation practices
7. Lack of processing facilities
8. So far no minimum support price is fixed for the crop

**9D. Name of the vegetable crop: Tomato**

**i. Existing varieties being used:** Private company varieties like Himsona, Rakshhak etc.

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** VL Tamatar 4 upto 1800m amsl

**iii. Existing package of practices being used:**

1. Poorly managed nurseries, S
2. ubterreaen staking,
3. Non- judicious use of fertilizers,
4. Generally crop grown in open field condition
5. Sowing time- Oct-Nov. and Jan-Feb
6. Sowing space-75x60 cm and 75x45 cm

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Use of indeterminate, round, optimal fruits weight (+_120) g weight hybrids, use of organic manures, sepcial training and pruning techniques, Upright stacking and earthing up operation, with standard harevsting techniques and stages.
2. Use Inderminate tomato varieties like Naveen 2000+ under protected cultivation to promote vertical cultivation of tomato in marginal holdings under polyhouse condition. Use Zn in deficient soil.
3. Use micronutrient including Ca, B and Mo
4. Crop rotation Tomato-cowpea-Early cauliflower.

**v. Major insect pests associated with crop:** Fruit borer and white flies

**vi. IPM Module for management of insect pests:**

**Fruit borer**

1. Growing trap crop of African tall marigold as border row before 15 days of transplanting is beneficial in reducing egg laying in main crop.
2. Field sanitation and clean cultivation is effective tool to suppress the pest population.
3. Setting of sex pheromone traps @ 5 trap/acre for monitoring is effective.
4. Spray of Ha NPV @ 500 LE/ha mixed with 0.1 per cent UV retardant (Tinopol) and 0.5 per cent jiggery is effective.
5. Use of Bt @ 0.50kg/acre and NSKE 5 per cent to kill early stage larvae. Release of the egg parasitoid, *Trichogramma chilonis* or *T. brasiliensis* @ 1Lakh/ha coinciding with flower initiation at 15 days interval may reduce the pest population.
6. Development of pyridalyl nanocapsule suspension for efficient management of tomato fruit and

shoot borer (*Helicoverpa armigera*) is an efficient approach for frequent delivery and effective management.

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Indoxacarb 14.5% SC | 400-500 | 5 |
| Chlorantraniliprole 18.5% SC | 150 | 3 |
| Cyantraniliprole 10.26% OD | 900 | 3 |
| Flubendamide 480% SC | 120 | 5 |
| Flubendamide 20% WG | 240 | 5 |
| Novaluron 10% EC | 750 | 1-3 |
| Novaluron 5.25%+ Indoxacarb 4.5% SC | 1700 | 5 |
| Methomil 40% SP | 750-1125 | 5-6 |
| Lambda cyhalothrin 5% CS | 300 | 5 |

**Management strategies( white fly and other sucking pests)**

**A. Crop Hygiene**

Field hygiene should be a high priority and should be included as an integral part of the overall strategy for managing whitefly populations, Tomato yellow leaf curl virus (TYLCV) incidence, and insecticide resistance. These practices will help reduce the onset of the initial infestation of whitefly, regardless of biotype, and lower the initial infestation level during the cropping period.

**B. Other Cultural Control Practices**

1. Use proper pre-planting practices.
2. Vegetative propagated ornamental plants (i.e. *Hibiscus, Poinsettia*, etc.) should not be grown at the same location, especially if bringing in plant materials from other areas.
3. Avoid yellow clothing or utensils as these attract whitefly adults.
4. Delay planting new fall crops as long as possible.
5. Do not plant new crops near or adjacent to old, infested crops.
6. Use proper post-planting practices.
7. Apply an effective insecticide to kill whitefly adults prior to cultural manipulations such as pruning, tying, etc. Rogue tomato plants with symptoms of TYLCV.
8. Plants should be treated for whitefly adults prior to rouging and, if nymphs are present, should be removed from the field, preferably in plastic bags, and disposed of as far from production fields as possible.
9. Manage weeds within crops to minimize interference with spraying and to eliminate alternative whitefly and virus host plants.
10. Destroy old crops within 5 days after harvest, destroy whitefly infested abandoned crops.

**C. Insecticidal Control Practices**.

1. Restricted the use of neonicotinoids (imidacloprid or acetamiprid) in the field only during the first six weeks of the crop thus leaving a neonicotinoid-free period at the end of the crops.
2. Use selective rather than broad-spectrum control products where possible to conserve natural enemies and enhance biological control.
3. Do not apply insecticides on weeds on field perameters. These could kill whitefly natural enemies and, thus, interfere with biological control.
4. Crop rotation is effective tool to prevent pest population.
5. Avoiding of same group of crop in same field for a long time is beneficial.
6. Sticky trap is effective to control whitefly population.

**White fly**

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Cyantraniliprole 10.26% OD | 900 | 3 |
| Spiromesifen 240% SC | 625 | 3 |
| Thiamethoxam 25% WSG | 200 | 5 |

| | | |
|---|---|---|
| Imidacloprid 17.8% SL | 150-175 | 3 |

**vii. Major disease associated with crop:** Buckeye fruit rot is a major serious disease.

**viii. IPM Module for management of disease(except organic areas):**

**Buck eye rot:**

1. Burn the infected fruit, leaves etc. and staking of plants,
2. Remove the leaves upto 9 inches from ground.

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Mancozeb 75% WP | 1500-2000 | |
| Propeneb 70% WP | 1500 | 10 |

**ix. Major weeds associated with crop:** *Trifolium alaxenderum, 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. Use of high yielding varieties grown under ventillated polyhouse using standardized technology with fertigation technogy in tomato can enhance the productivity of tomato manifold.
2. Polyhouse technogy is a boon for small and marginal farmers with fragmented holdings.
3. Reduce number of spray of pesticides.
4. Raise nursery on treated soil.
5. Treat seed with fungicide before sowing.
6. Manage fog during fruiting period.

**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
5. Imbalance use of fertilizes.
6. More numbers of pesticides' spray
7. Increase incidences of Bacterial wilt.

**9E. Name of the vegetable crop: Potato**

**i. Existing varieties being used:** Tumari Local and Kufri Jyoti

**ii.High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Kufri Jyoti, Kufri chandramukhi, Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3

**iii.Existing package of practices being used:**

1. Use of big sized tuber or divion of tuber (50-60 g)
2. No Tuber treatment
3. Use of organic maures, sowing in flat bed.
4. Sowing time is March-April.
5. Limited or no IPM practices
6. Region C (1500-2400): March-April
7. Spacing: 50-60 x 15-20 cm
8. Seed rate: 25-30 qtl/ha
9. 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. Use of Kufri Giriraj variety with proper seed size (with 3 sprouted eyes, sown in line with

aplication of organic manures.

2. Late blight resistant variety such as K Girdhari, K.Himalini and K. Shailja should be selected for planting. Fertilizer should be used on soil test basis. Dehaulming practise should be adopted for long duration storage of tubers.
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, Epilachna beetle, aphids, white grub

**vi. IPM Module for management of insect pests:**

**Potato tuber moth: *Phthorimaea operculella***

1. Heaps of green grasses may be kept at suitable interval in infested field during evening and next day early in the morning along with caterpillars to destroy.
2. Clean cultivation and mechanical destruction of caterpillars also help in reducing pest infestation.
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.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.

**vii. Major disease associated with crop:** Late blight and common scab disease in the crop and tuber.

**viii. IPM Module for management of disease:**

1. Cultural practices are used.
2. Use Certified seed / disease free seed.
3. Plant imroved/ resistant cultivars like Kufri giriraj, K. Himalini, K. Girdhari, K. Himgiri and K. Himsona.
4. Regularly monitor the field and rouge the virus affected plants. Need based spraying of systemic insecticides shuld be done to check the vector population.
5. Destroy the crop residues and left over tubers after harvest.

**Late blight of potato: *Phytophthora infestans***

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Cyazafamid 34.5% SC | 200 | 27 |
| Chlorothaonil 75% WP (per lit. water) | 0.875-1.250 | 14 |
| Azoxystrobin 23% SC | 500 | 12 |
| Mandipropamid 23.4% SC (per lit. water) | 0.8 | 40 |
| Propineb 70% WP | 0.30% | 15 |
| Captan 50% WG | 1500 | 21 |
| Captan 75% WP | 1667 | 8 |
| Copperoxychloride 50% WP | 1250 | |
| Copperhydroxide 53.8% DF | 1500 | 22 |

| | | |
|---|---|---|
| Dimethomorph 50% WP | 1000 | 16 |
| Hexaconazole 2% SC | 3000 | 21 |
| Mancozeb 75% WP | 1500-2000 | |
| Zineb 75% WP | 1500-2000 | |
| Metalaxyl 8%+ Mancozeb 64%WP | 2500 | 49 |
| Metalaxyl 4%+ Mancozeb 64%WP | 2500 | 24 |
| Capatan70%+ Hexaconazole 5% WP | 500-1000 | 21 |
| Carbendazim 25%+ Mancozeb 50%WS | 0.6-0.7/Kg | Seed Treatment |
| Cymoxanil 8%8% +Mancozeb 64%WP | 1500 | 10 |
| Famoxadone 16.6%+Cymoxamil 22.1% SC | 500 | 40 |
| Fenamidone 10%+ Mancozeb 50% WG | 1250-1500 | 30 |
| Metiram 55%+ Pyraclostrobin 5% WG | 1500-1750 | 15 |
| Metalaxyl 3.3%+ Chlorothanil 33.1% SC | 0.02% | 34 |

**Potato scab: *Streptomyces scabiei***

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Thiram 75% WS (Seed Treatment/ Kg) | 2.5-3.0 | 7-10 |

**ix. Major weeds associated with crop:** *Chenopodium* and local weeds

**x. IPM Module for management of weeds:**

1. Mechanical and cultuiral method.
2. Proper crop rotation
3. Timely hand weeding
4. Winter/ summer ploughing

**Bathua, Pigweed*: Chenopodium album* (annual, dicot, broad leaves, leafy)**

| Name of the Herbicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| 2,4 D Dimethyl amine salt 58% SL | 2000 | 3440 |
| Oxyflourfen 23.5% EC | 100-200 | 425-850 |

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Selection of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja.
2. Seed treatment should be followed.
3. Planting of pre-sprouted tubers should be done.
4. Proper crop rotation to should be followed.
5. Winter/ summer ploughing of fields.
6. Use of organic mulching material in appropriate thickness especially under rain fed mid hills agro climatic conditions.
7. Dehaulming practise should be adopted by the farmers for long duration storage of tubers.
8. Medium size whole tuber should be used as planting material.

**xii. Production constraints in agro-ecological region:**

1. The seed of early maturing disease resistant varieties like K Girdhari, K Himalini and K. Shailja is not available in sufficient quantity.
2. Use of infected planting material by the farmers.
3. Use of un sprouted seed (newly dug tubers)
4. Proper crop rotation is not followed.
5. Cultivation on sloppy land.
6. In situ moisture conservation techniques such as mulching technology are not followed.
7. Dehaulming technique is not followed.
8. Imbalance use of fertilizers.

9. Use of unrecompensed FYM.
10. Lack of storage facilities.
11. Seed production is not done by the farmers.

**9F. Name of the vegetable crop: Brinjal**

**i. Existing varieties being used:** Locally available varieties

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** 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: Feb- March
5. Transplanting- Farmers practices improper planting distance.
6. Manures- Farmers incorporated cow dung in undecomposed stages in the field.
7. Fertilizers: Farmer use imbalance fertilizer
8. Irrigation- Farmers do not apply water in the field at proper stage of the crop and by proper irrigation method..
9. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field and chemical method of weed control
10. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil Testing- Farmers should practice for soil test before sowing the crop for proper recommendation of fertilizers.
2. Land Preparation- The farmers are recommended to open the land before sowing the crop for sterilization.
3. Soil solarisation practice in nursery must be followed by the farmers because it is easy method of sterilization at low cast.
4. Seed Treatment- For minimal attack of the different diseases farmers must treat the seed materials by Captan @ 2g/kg of seed orCarbandazim @2g/kg of seed 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
9. Weed control- Farmers must know the about the losses in the production of the crop by weeds, they should adopt proper weed control management practices either manually or chemically. Farmer can control the weeds by hand weeding along with pre-planting surface application @ of 1.0-1.5 kg/ha Alachlor.
10. Growth substances: Use 2,4-D @ 2ppm at flowering stage

11. Harvesting- The farmer must aware about the maturity stage of a particular crop so he can harvest the crop as per their object.

**v. Major insect pests associated with crop:** Shoot and fruit borers

**vi. IPM Module for management of insect pests:**

**Brinjal fruit & shoot borer: *Leucinodes orbonalis***

Only cultural practices can be used.

**Brinjal fruit & shoot borer: *Leucinodes orbonalis***

1. The damaged portions of the plants and fruits should be removed and destroyed.
2. Early removal of drooping shoots will reduce the fruit infestation.
3. Proper collection of all the infested flower buds, fruits during harvest.
4. Continuous cultivation of brinjal also favors the pest infestation.
5. Varieties like Punjab Barsati, (moderate resistant cultivar) Pusa purple round, Punjab Neelam found to be resistant to brinjal fruit borer.
6. Biological method recommended by IIHR, Bengaluru involving release of *Trichogramma chilonis* @10 to 15 lakh parasites/ha/season along with 2 sprays of *Bt* formulation found to be economically effective.
7. Installation of BSFB (brinjal shoot and fruit borer) pheromone traps Lucinure @3/ha to monitor and mass trap the male moths is effective.
8. Neem Seed Kernal Extract( NSKE)5 % per cent at the time of flowering is effective.
9. Prevent continuous growing of same group of crop at same field.
10. Rotate brinjal with cabbage or other crops

| **Name of the insecticides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Chlorantraniliprole 18.5% SC - | 200 | 22 |
| Emamectin Benzoate 5% SG | 200 | 3 |
| Thiacloprid 21.7% SC | 750 | 5 |
| Thiodicarb 75% WP | 625-1000 | 6 |
| Lambda cyhalothrin 5% CS | 300 | 5 |
| Cypermethrin 25% EC | 150-200 | 1 |
| Betacyfluthrin 8.49%+ Imidacloprid 19.81% OD | 200 | 7 |
| Triazophos 35% + Deltamethrin 1% EC | 1250 | 3 |
| Pyriproxyfen 5%+ Fenpropathrin15% EC | 750 | 7 |

**vii. Major disease associated with crop:** Phomopsis blight and rot (*Phomopsis vexan*) is a serious problem in the hills.

**viii. IPM Module for management of disease:**

1. Use healthy seed materials for sowing.
2. Seed should be extracted only from disease free fruits.
3. After extraction of seeds it should be dried for a week and then stored.
4. Avoid continuous cultivation of brinjal. A rotation of brinjal - paddy - gingelly will helps to check the disease development.
5. In the fields the affected plants and debris should be collected and burnt
6. During summer deep ploughing should be given.
7. Spray following insecticides

**Blight**

| **Name of the Fungicides** | **(gm/ml) /ha** | **Waiting period (days)** |
|---|---|---|
| Zineb 75% WP | 1125-1500 | 1500-2000 |

**ix. Major weeds associated with crop:** *Cyperus rotundus, Panicum repens, Cynodon dactylon, Amaranthus virdis, Parthenium hysterophorus*

**x. IPM Module for management of weeds:**

1. Hand weeding.
2. The field should be kept weed-free, especially in the initial stage of plant growth, as weeds compete with the crop and reduce the yield drastically.
3. Frequent shallow cultivation should be done at regular interval so as to keep the field free from weeds and to facilitate soil aeration and proper root development.
4. Deep cultivation is injurious because of the damage of roots and exposure of moist soil to the surface.
5. Two-three hoeing and the earthing up are required to keep the crop free of weeds.
6. Preemergence application of Fluchloralin (1.5 kg a.i./ha) coupled with one hand weeding 30 days after transplanting is effective for control of weeds

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of hybrids can increase productivity 2to 3 times higher.
2. Use of mulch in rainy season.
3. Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year such as Brinjal- Radish-Bottle gourd, Brinjal- spinach-cowpea, Brinjal- Turnip-Amaranthus, Brinjal- Spinach-Bitter gourd etc.

**xii. Production constraints in agro-ecological region:**

1. Less availability of high quality seeds
2. High prices of hybrid seeds
3. Post-harvest losses are more due to non availability of storage facility
4. High prices of fertilizers
5. Low prices of farm produce
6. Lack of knowledge about the cultivation practices
7. Lack of processing facilities
8. So far no minimum support price is fixed for the crop.

**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. Traditional seeds, No seed treatment, Poor nursery management, Tranplanting on or before rainy or monsoon season, Crop geometry knowledge is poor, Poor dry fruit storage.
2. Growing local varieties.
3. No line transplanting.
4. Generally they plant two over aged seedling at one place.
5. 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. Use of seed tretment like Pant bioagent 3 for managing seed and soilborne diseases.
2. Earthening up of plants within 45 days after transplantation to get rid off waterlogging
3. Use of tall and cluster bearing type like local strain Lakhaur mirch.
4. Use of high dose of organic manure i.e. 200 q/Ha increases productivity and incidence of dieback and Anthracnose.
5. Grow high yielding varieties.
6. Treat the seed with copper containing fungicides before sowing.
7. Adopt soil testing.
8. Transplant one seedling at one place.

9. Transplant the seedlings when they attain 5-6 leaf stage.
10. Transplant the seedlings at proper spacing-
11. Dwarf varieties like Kashi Anmol at 45 x 30 cm
12. Tall varieties like Pusa Sadabahar, Pant C-1 at 50 x 50 cm.
13. 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 problem is major problem

**vi. IPM Module for management of insect pests:**

**Chilli thrips, *Scirtothrips dorsalis* Hood**

1. Thrips *Franklinothrips vespiformis* (Crawford) and *Erythrothrips asiaticus* R. &. M. are predaceous in nature and their population may be encouraged by avoiding chemical sprays.
2. Yellow or blue sticky trap is effective for controlling this pest.
3. If still the population persist spraying of imidacloprid 70% WG @ 0.25ml/l or acetamiprid 20%SP @ 0.2g/l or thiomethoxam 25%WG @ 0.2g/l or metasystox@1.5ml/l is effective.

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Thiamethoxam 30% FS (Seed Treatment) | 7/Kg | |
| Imidacloprid 70% WS (Seed Treatment) | 10-15/Kg | |
| Cyantraniliprole 10.26% OD | 600 | 3 |
| Emamectin benzoate 5% SG | 200 | 3 |
| Spinosad 480% SC | 160 | 3 |
| Acetamiprid 20% SP | 50-100 | 3 |
| Thiacloprid 21.7% SC | 225-300 | 5 |
| Indoxacarb 14.5%+ Acetamiprid 7.7% SC | 400-500 | 5 |
| Flubendamide 19.92%+ Thiacloprid 19.92% | 200-250 | 5 |
| Methomil 40% SP | 750-1125 | 5&6 |
| Lambda cyhalothrin 5% EC | 300 | 5 |
| Ethion 50% EC | 1500-2000 | 5 |
| Fipronil 5% SC | 800-1000 | 7 |
| Imidacloprid 17.8% SL | 125-250 | 40 |

**vii. Major disease associated with crop:** Dieback and anthracnose is major disease of block.

**viii. IPM Module for management of disease:**

**Dieback**

1. Use of disease-free seeds is important in preventing the disease. Seed treatment with Thiram or Captan 4g/kg is found to be -effective in eliminating the seed-borne inoculum.
2. Good control of the disease has been reported by three sprayings with Ziram O. 25% Captan 0.2% or miltox 0.2%. Chemicals like wettable Zineb 0.15% not only reduced the disease incidence but also increased the yield of fruits.

**Anthracnose**

1. Seeds should be obtained from spotless fruits.
2. Debris of diseased crop should be collected and burnt. Seed treatment with thiram or captan at the rate of 2.5g/kg of seed.

**ix. Major weeds associated with crop:** *Euphobia hirta, Cynadon dactylon ,Cyperus and Oxalis*

**x. IPM Module for management of weeds:** Manual weeding

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Use of tall hybrids supplentation of organic packages of practices to be followed
2. Grow high yielding varieties.
3. Treat the seed with copper containing fungicides before sowing.
4. Adopt soil testing.

5. Transplant one seedling at one place.
6. Transplant the seedlings when they attain 5-6 leaf stage.
7. Transplant the seedlings at proper spacing.

**xii. Production constraints in agro-ecological region:**

1. High incidence of flower and fruit drop in chillies
2. Fruit losses due to high incidence of dieback and anthracnose.
3. Non availability of quality seed.
4. Less irrigation facilities.
5. High cost of hybrid seeds.
6. Unaware about the insect-pest management.

**9H. Name of the vegetable crop: Cucumber**

i. **Existing varieties being used:** Kalyanpur Green, Japanese Long Green, Poona Khira, Pant Khira-1, Poinsette, Japanese Long Green, Straight Eight, Swarna Sheetal, Swarna Poorna, Swarna Ageti etc.

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:**

**For open field condition:** Pusa Udhay, Pusa Barkha,Shubhangi, Himangi, Punjab Naveen, Tasty, Ruchi, Mandakini, Kumud, Noori, Alamgir, Rani, Don etc,

**For protected condition:** Pant Parthenocarpic Cucumber-2 & 3, Hilton, Kian, Isatis, Malini etc.

**iii. Existing package of practices being used:**

1. Use of traditional seeds,
2. Planting in rainy season,
3. Traditional stacking method,
4. Long harvest duration season,
5. Sale at local market
6. Absence of crop rotation.
7. Random selection of variety (May or may not be suited to Agroeco-region).
8. Untimely sowing / planting of crop.
9. Use of untreated seed.
10. Unbalanced use of fertilizers.
11. Use of plant protection chemicals having long wetting period.
12. Use of traditional irrigation system.
13. No soil solarisation/ treatment during lean period.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Glasshouse or polyhouse technology
2. Use of Hybrids or/and Pathenocarpic varieties
3. Management of crop geometry.
4. Use of organic manure or fertigation inside polyhouse.
5. Management of Dacus and other flies.
6. Use of protected cultivation.
7. Adoption of crop/ soil health related crop rotations.
8. Recommended/suitable variety for Agroeco-region.
9. Use recommended spacing eg. 60-200 × 50-100 cm
10. Treating seed before sowing.
11. Balanced use of fertilizers (125: 155: 125 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).
12. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
13. Selection of optimum planting period.

14. Sowing time: Feb- March
15. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
16. Adoption of micro irrigation technologies for efficient use of available water.
17. Adoption of fertigation system for efficient use of fertilizers

**v. Major insect pests associated with crop:**

Leaf miner , white fly, thrips, leaf eating caterpillar, fruit fly, cut worm, Red pumpkin beetle

**vi. IPM Module for management of insect pests:**

Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

**Red pumpkin beetle**

| Name of the insecticides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Dichlorovos 76% SC | 500 | 627 |

**vii. Major disease associated with crop:** Wilt, Mildew, Mosaic

**viii. IPM Module for management of disease:**

1. Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.
2. Use of recommended insecticides as per recommended doses during pre-sowing and post-sowing.

**Downy mildew**

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Zineb 75% WP | 1500-2000 | |
| Cymoxanil 8%+ Mancozeb 64% WP | 1500 | 10 |
| Azoxystrobin 23% SC | 500 | 7 |
| Amectoctradin+ Dimethomorph 20.27% SC | 800-1000 | 3 |

**ix. Major weeds associated with crop:** *Trifolium alexenderum , Cyperus rotundus, Cynodon dactylon, Fagopyrum* species

**x. IPM Module for management of weeds:** Manual weeding in hills.

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Polyhouse technology and hybrid cultivars can increase productivity 3-4 times in mid and high hills.
2. Use of protected cultivation.
3. Adoption of crop/ soil health related crop rotations.
4. Recommended/suitable variety for Agroeco-region.
5. Use recommended spacing eg. 60-200 × 50-100 cm
6. Treating seed before sowing.
7. Balanced use of fertilizers (125: 155: 125 Kg N: P: K/ha, respectively) with water soluble fertilizers (fertigation).
8. Selection of eco-friendly plant protection chemicals having short wetting period, recommended for protected cultivation.
9. Selection of optimum planting period.
   (Protected cultivation): Feb- March
10. Use of different protected systems/materials eg. Mulch, agro shed net house, insect proof net house, water harvesting tank etc.
11. Adoption of micro irrigation technologies for efficient use of available water.
12. Adoption of fertigation system for efficient use of fertilizers

**xii. Production constraints in agro-ecological region:**

1. Lack of plant growing structures.
2. Monkey, baboon, wild pigs are serious threats.
3. Good quality seed is inaccessible.

4. High cost of seed & poor purchasing power of farmers.
5. Water scarcity.
6. Protected cultivation is cost involving technologies.
7. Repair of the poly houses/ micro irrigation structures is a tedious task.
8. Damage of crop / poly houses /micro irrigation structure by wild animals.
9. Unawareness about scientific technologies.
10. Involvement of middle men in marketing.
11. Availability of agriculture inputs is not easy.
12. Use of unsafe agro chemicals.
13. Difficult labour availability.
14. Different biotic and abiotic stresses.

**9I. Name of the vegetable crop: Pea**

i. **Existing varieties being used:** Traditional field pea , Arkel and Azad pea 3

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Vivek Matar 10, Vivek Matar 11 and Vivek Matar 12

**iii. Existing package of practices being used:**

1. Sowing in of Autumn month
2. Broadcasting method,
3. No line sowing,
4. High seed rate,
5. Mature more than 120 days,
6. Stacking is done for tall varieties,
7. Dual purpose varieties
8. 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. Round the year Production depending on irrigation facilities
2. Use of tall varieties sown in line with effective stacking methods.
3. Management of powdery mildew, Aschochyta blight and other diseases and Fusarium wilt in autumn season
4. 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).
5. Sowing time: Mid Aug
6. Seed rate: 100 Kg/ ha
7. Treating the seed with 2 g Thiram /kg of seed and rhizobium culture if being sown in field for first time.
8. 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.
9. 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, fruit borer

**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:** Powdery mildew in all agroecological situations
Fusarium wilt in autumn sown crop, Aschochya blight in rainy season in high hills.

**viii. IPM Module for management of disease:**

1. Use of oganic inputs only

2. Use of rust and powdery mldew resistant strains.
3. Use TH colonized compost.
4. Seed biopriming with TH / PsF/ TH + PsF (10g/kg seed) or Seed treatment with Thiram + Carbendazim (2:1) @ 3.0 g/kg seed.
5. Cultivation of powdery mildew resistant varieties
6. 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).

**Powdery mildew**

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Benomil 50% WP | 100 | 200 |
| Carbendazim 50% WP | 150 | 300 |

**ix. Major weeds associated with crop:** *Trifolium alexendrum, 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. Increasing crop intensity, Line spacing
2. Use of tall cultivars in cropping system
3. Standardization of time for seed sowing in pea viz. Septemeber sowing in high hills, Mid Nov sowing time for Mid hills can enhance productivity. Use recommended spacing eg. 60-200 × 50-100 cm

**xii. Production constraints in agro-ecological region:**

1. Monkey Menace
2. Need to increase seed production program in distt.
3. Lack of irrigation
4. Lack of marketing in hills
5. Lack of FYM and nutrients.
6. Lack of mechanization.
7. Small and scattered land holdings.
8. Rainfed cultivation.

**9J. Name of the vegetable crop: French Bean**

i. **Existing varieties being used:** Locally available varieties

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Varieties suitable for hills like VL Bean 2, Anupama etc

**iii. Existing package of practices being used:**

Use of locally available varieties, no line spacing.

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:** Use of recommended varieties along with proper crop geometry and nutrient management

**v. Major insect pests associated with crop:** Cut worm and white grub

**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:**

**viii. IPM Module for management of disease:**

**ix. Major weeds associated with crop:** Seasonal weeds

**x. IPM Module for management of weeds:** Manual weeding in hills**.**

**xi. Specific workable and sustainable intensification capable of doubling agricultural income**

**in specific agro-ecological region:** Use of recommended varieties along with proper crop geometry proper nutrient and pest management and mulching

**xii. Production constraints in agro-ecological region:**
Use of recommended varieties along with proper crop geometry proper nutrient and pest management and mulching

**10A.Name of the fodder crop: Berseem**

**i. Existing varieties being used:** Mescavi

**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** Vardan

**iii. Existing package of practices being used:** Practice in irrigated(after puddle rice)/ marshy land

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil : loam to clay soil
2. Field preparation: 3-4 Harrowing + Leveling the field.
3. HYVS. – Mescavi, Vardan. BL-10, 22,42, 180, Pusa Gaint & Bundel Berseem 243
4. Seed rate: 25-30 kg/ha
5. Sowing method:

b. Wet method-like rice in puddled field

b.Dry method: Without puddled.

6. Broad casting
7. Sowing time: First an week of October
8. Fertilizer: 30:60:70:: N:P2O5 K2O kg/ha
9. Irrigation: Field should remain at field capacity throughout the crop period after germination.
10. Weed control: Apply Pendimethalin @ 3.3 L/ha after crop sowing.
11. Cutting management: First cut -45-50 DAS
12. Other cutting at 25-30 days interval- total 5-6 cutting are taken
13. Yield: 800-1000g/ha. Green forage.

**v. Major insect pests associated with crop:**

**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:** Kasni

**x. IPM Module for management of weeds:**

**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

**xii. Production constraints in agro-ecological region:** Shortages of variety/seed, water

**10B.Name of the fodder crop: Maize**

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:** African tall

**iii. Existing package of practices being used:** Mixed cropping

**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil: Well drained alluvial soil with soil PH 5.5-7.5.
2. Field preparation: 4-5 harrowing + leveling
3. HYVS: African Tall, J-1006. Pratap Makka Chari-b.
4. Seed rate: 50kg/ha
5. Spacing : 30-45 cm (row to row distanced)
   10-15 cm (plant to plant)

6. Sowing time
   Rainfed: Onset of monsoon
   Irrigated : Feb to July
7. Sowing method : Line sowing is proposed over broadcasting
8. Fertilizer : 100-120 : 60:40: 20::: P2O5 : K2O: ZnSo4 kg/ha
9. Irrigation : Fodder maize grown under irrigated condition should be irrigated at 20 days interval. Spring/summer crop requires 5-6 irrigations.
10. Weed control: Pendimethalin @ 0.75 kg ai/ha (PE) application.
11. Harvesting: The crop should be harvested at tasseling /silling stage or 50-55 days after sowing.
12. Yield: Green fodder : 350-450q/ha.

**v. Major insect pests associated with crop:**
**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:** Seasonal weed
x. **IPM Module for management of weeds:** Hand weeding
**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Promotion of sweet corn variety
2. INM
3. IPM
4. Use of QPM variety

**xii. Production constraints in agro-ecological region:** Shortages of variety/seed, water

**10C.Name of the fodder crop: Oat**

**i. Existing varieties being used:** Kent
**ii. High yielding varieties (the seed of which is available in the state) to be used for increasing yield in specific agro-ecological region:** UPO212
iii. **Existing package of practices being used:** Traditional methods
**iv. Specific package of practices to be suggested for increasing yield in specific agro-ecological region:**

1. Soil : Loam soils
2. Field preparation : 2-3 Harrowing + leveling
3. HYVS: UPO-94, 212, Pant Oat-3, 06, Kent, Bundel Jai-822, 851, 992 Phule Harita,05-6
4. Seed rate: 100 kg/ha
5. Spacing : 30cm line to line distance
6. Sowing time: first week of October to last October

**v. Major insect pests associated with crop:**
**vi. IPM Module for management of insect pests:**
**vii. Major disease associated with crop:**
**viii. IPM Module for management of disease:**
**ix. Major weeds associated with crop:** Local weeds
**x. IPM Module for management of weeds:** Hand weeding
**xi. Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:**

1. Promotion in rainfed area ,
2. Timely sowing,
3. Timely cutting,
4. Sale of green fodder

**xii. Production constraints in agro-ecological region:** Shortages of variety/seed, water

**C1. Livestock: Buffalo**

**1.A Existing breeds available:** Badri, Nd, CB

**1.B Specific breeds to be introduced:** Red sindhi and Sahiwal

**2.A Existing feeds being used:** Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)

**2.B Specific feeds to be introduced / advised:**

**Green fodder:**

1. Agro -based fodder plantation i.e. planting the trees outside the farm and main crop in the center. Increasing the tree density of fodder trees in the forest.
2. Motivating villagers to follow the scientific system of lopping
3. Planting the bunds of fodder grasses in between the fields.
4. By giving proper protection to the herbs, bushes and herbaceous plant.
5. Can be stored in form of silage/ hay. Treating them with the chemicals and maintaining the stores.
6. Generally farmers prefer to grow food crops rather than animal fodder, in this context farmers and livestock owners should be motivated that food grains can be easily procured from the local market according to their requirement but to procure fodder from the market is not possible at all. Hence, they must spare some of the agricultural land or the waste land for seasonal fodder crops production.

**Dry fodder:**

1. Wheat and paddy straws are left over or burnt and ploughed in the field, the leftover crop residues can be reaped, bailed, treated, stored and transported to deficit areas in hills.
2. Dry fodders and other cellulosic wastes may be treated with urea and bailed or they can be converted into compact feed blocks in to convenient size and weight, therefore transported to very remote areas of the hilly terrains and also required lesser place for storage. wheat, Paddy, Madua and Jhingora stalks and maize stovers can be fully utilized after chopping and feeding them in troughs and mangers.
3. Livestock owners should be motivated and educated to feed the stalks, stovers, dry grasses, green fodder and tree leaves after chopping them in small pieces, soaking in water and feeding such fodders in troughs, baskets or mangers. Enrichment of straws/ cellulosic wastes through urea.
4. By changing the change the attitude of farmers to not burn the crop residues and utilize them as livestock feed.
5. Grass production from forest areas can be increased many folds by introducing higher yielding varieties of grasses such as hybrid Napier, Setaria, Guinea, Deenanath, Anjan, Tall fescue, Brome and Rye grass etc.
6. By introducing the measures for higher bio mass production in Van Panchayats. Providing protection to the Fallow, wastelands and orchards.

**Complete feed blocks (qtl)**

1. Involving the NGOs in procuring the waste straws and other agro-industrial byproducts and non conventional feeds from tarai areas.
2. New variety of fodder plants needs to be introduced. Fodder Banks in remote areas and providing the feed and fodder at reasonable price to the farmers.

**Wastage of fodder (qtl)**

Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

**3.A Existing health services:**

Diseases covered under vaccination: FMD, PPR, BQ and HS

Deworming schedule: As such no schedule is followed (lack of awareness)

Other Disease Control Programs/ Health Camps (criteria, target): Infertility Camps

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

1. 3 times scheduled deworming before and after rainy season and during winters.
2. At least 4 health camp per hospital

**4.A Existing management practices:**

Housing, hygiene, drainage: Shed locally called as "GOTH", No proper system of drainage, ventilation and lighting facilities.

Feeding & watering practice: Generally animals are taken to forest for grazing.Whole plant residues are given as feed to the animals.

Welfare aspects: Mainly producing for their hosehold consumption. The marketing approach is still lacking.

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

1. Practiced of Weaning should be adopted.
2. Different shed for the pregnant animal should be there.
3. Use of chaff cutter and manger to minimize the wastage of fodder and labour of the women should be promoted.
4. Use of Urea-Molasses-Mineral Block

**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:**

**C2. Livestock: Cattle**

**1.A Existing breeds available:** ND

**1.B Specific breeds to be introduced:** Murrah

**2.A Existing feeds being used:** Green fodder, Dry fodder, Concentrate feed (qtl), Complete feed blocks (qtl), UMMB (qtl), Wastage of fodder (qtl)

**2.B Specific feeds to be introduced / advised:**

**Green fodder:**

1. Agro -based fodder plantation i.e. planting the trees outside the farm and main crop in the center. Increasing the tree density of fodder trees in the forest.
2. Motivating villagers to follow the scientific system of lopping
3. Planting the bunds of fodder grasses in between the fields.
4. By giving proper protection to the herbs, bushes and herbaceous plant.
5. Can be stored in form of silage/ hay. Treating them with the chemicals and maintaining the stores.
6. Generally farmers prefer to grow food crops rather than animal fodder, in this context farmers and livestock owners should be motivated that the food grains can be easily procured from the local market according to their requirement but to procure fodder from the market is not possible at all. Hence, they must spare some of the agricultural land or the waste land for seasonal fodder crops production.

**Dry fodder:**

1. Wheat and paddy straws are left over or burnt and ploughed in the field, the leftover crop residues can be reaped, bailed, treated, stored and transported to deficit areas in hills.
2. Dry fodders and other cellulosic wastes may be treated with urea and bailed or they can be converted into compact feed blocks in to convenient size and weight, therefore transported to very remote areas of the hilly terrains and also required lesser place for storage. wheat, Paddy, Madua and Jhingora stalks and maize stovers can be fully utilized after chopping and feeding them in troughs and managers.
3. Livestock owners should be motivated and educated to feed the stalks, stovers, dry grasses, green fodder and tree leaves after chopping them in small pieces, soaking in water and feeding such fodders in troughs, baskets or mangers.

4. Enrichment of straws/ cellulosic wastes through urea.
5. By changing the change the attitude of farmers to not burn the crop residues and utilize them as livestock feed.
6. Grass production from forest areas can be increased many folds by introducing higher yielding varieties of grasses such as hybrid Napier, Setaria, Guinea, Deenanath, Anjan, Tall fescue, Brome and Rye grass etc.
7. By introducing the measures for higher bio mass production in Van Panchayats. Providing protection to the Fallow, wastelands and orchards.

**Complete feed blocks (qtl)**

1. Involving the NGOs in procuring the waste straws and other agro-industrial byproducts and non conventional feeds from tarai areas. New variety of fodder plants needs to be introduced.
2. Fodder Banks in remote areas and providing the feed and fodder at reasonable price to the farmers.

**Wastage of fodder (qtl)**

Scientific grazing system in the pastures & grasslands. Use of chaff cutter/ manger

**3.A Existing health services:**

Diseases covered under vaccination: FMD, PPR, BQ and HS

Deworming schedule: As such no schedule is followed (lack of awareness)

Other Disease Control Programs/ Health Camps (criteria, target): Infertility Camps

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

3. 3 times scheduled deworming before and after rainy season and during winters.
4. At least 4 health camp per hospital

**4.A Existing management practices:**

Housing, hygiene, drainage: Shed locally called as "GOTH", No proper system of drainage, ventilation and lighting facilities.

Feeding & watering practice: Generally animals are taken to forest for grazing.Whole plant residues are given as feed to the animals.

Welfare aspects: Mainly producing for their hosehold consumption. The marketing approach is still lacking.

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

1. Practiced of Weaning should be adopted.
2. Different shed for the pregnant animal should be there.
3. Use of chaff cutter and manger to minimize the wastage of fodder and labour of the women should be promoted.
4. Use of Urea-Molasses-Mineral Block

**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:**

**C3. Livestock: Sheep**

**1.A Existing breeds available: -**

**1.B Specific breeds to be introduced: -**

**2.A Existing feeds being used:** Green fodder, Dry fodder

**2.B Specific feeds to be introduced / advised: -**

**3.A Existing health services:**

Housing, hygiene, drainage: No seperate barn (house)is their, kept along with large animal.

Feeding & watering practice: Stall-fed and intensive production system. Semi-intensive production system , both the system of rearing are practised

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

1. The sheep house should always be protected from hot and cold wind, humidity, solar radiation and rain.
2. The house should have east-west orientation.
3. Shed should be constructed on elevated land and free from water logging or marshy areas.
4. Adequate floor space (1.2 to 4.0 sq mt/ goat) may be provided to avoid overcrowding.
5. Breed improvement should be adopted.
6. Castration at the right age i.e. 1 to 2 months forbetter meat quality, higher market price and unwanted breeding in the flock.

**4.A Existing management practices:**

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

**5.A Problems of Livestock system- Goatary, Poultry, Fisheries:**

**5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing:**

**C4. Livestock: Goat**

**1.A Existing breeds available:** Chaugarkha, ND

**1.B Specific breeds to be introduced:** Barbari

**2.A Existing feeds being used:** Green fodder, Dry fodder

**2.B Specific feeds to be introduced / advised:** Scientific grazing systems should be adopted on grazing lands and alpine grasslands

**3.A Existing health services:**

Diseases covered under vaccination: PPR

Deworming schedule: -

Other Disease Control Programmes/ Health Camps: PPR , Viral Exanthema

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

1. 3 times scheduled deworming before and after rainy season and during winters.
2. Regular treatment camps to be organized

**4.A Existing management practices:**

Housing, hygiene, drainage: No seperate barn(house)is their, kept along with large animal.

Feeding & watering practice: Stall-fed and intensive production system. Semi-intensive production system , both the system of rearing are practised

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

1. The goat house should always be protected from hot and cold wind, humidity, solar radiation and rain. The house should have east-west orientation.
2. Shed should be constructed on elevated land and free from water logging or marshy areas.
3. Adequate floor space (1.2 to 4.0 sq mt/ goat) may be provided to avoid overcrowding.
4. Breed improvement should be adopted.
5. Castration at the right age i.e. 1 to 2 months forbetter meat quality, higher market price and unwanted breeding in the flock.

**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:**

**C5. Livestock: Poultry**

**1.A Existing breeds available:** Croiler

**1.B Specific breeds to be introduced:** Very few broiler farms are in existence so it needs to be incorporated

**2.A Existing feeds being used:**

**2.B Specific feeds to be introduced / advised:**

**3.A Existing health services:**

Diseases covered under vaccination: Fowl pox and RD
Deworming schedule: -
Other Disease Control Programmes/ Health Camps: The field is Scattered

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:** Routine Schedule as proposed should be followed

**4.A Existing management practices:**

Housing, hygiene, drainage: Backyard rearing
Feeding & watering practice: Household waste, stones
Slaughtering & dressing, etc: Sold as live bird
Welfare aspects: Needs low input and provide high output in terms of good quality protein especially for growing and malnourished children.Poultry Sector, besides providing direct or indirect employment to rural women is also a important tool for subsidiary income generation for many landless and marginal farmers.

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

1. Feeding good quality feed. Early weight gain more profit, better hatching capacity.
2. Maintaining proper floor space and housing of the chicks.

**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:**

**C6. Livestock: Fisheries**

**1.A Existing breeds available:** Common Carp, Silver carp, Grass carp, Mahasheer

**1.B Specific breeds to be introduced:**

**2.A Existing feeds being used:**

**2.B Specific feeds to be introduced / advised:**

**3.A Existing health services:**

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:**

**4.A Existing management practices:**

**4.B Specific management practices to be advised for doubling income in specific agro-ecological region of district:**

**5.A Problems of Livestock system- Goatary, Poultry, Fisheries:**

**5.B Specific problems related with AH/ LS/Goatary/Poultry/Fisheries due to which income is not increasing:**

**Vet. Health services**

| **Resouces** | | **Manpower** | | | | | | | **Infrastructure** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | V. O. | LEO | Pharmacist | Lab. Tech. | Livestock Assistant | Para vets | Buildings | Equipments | Others |
| Vety. Hospitals | Existing | 37 | 34 | 48 | 15 | - | 86 | - | 27(Own) and 0(Rent) | Available | - |
| | Proposed | - | 3 | 59 | 24 | - | - | - | - | - | - |
| Mobile Vety. Unit | Existing | 1 | 1 | - | - | - | - | - | No | Not Available | - |
| | Proposed | 1/ block | 11 | - | 12 | 12 | - | - | - | Needs to be procured | |
| Vety. Dispen. | Existing | 107 | - | 48 | - | - | - | - | - | - | - |
| | Proposed | - | - | 59 | - | - | 107 | - | - | - | - |
| AI centres | Existing | 69 | 30 | 39 | - | - | - | | | Available | - |
| | Proposed | - | - | - | - | - | - | - | - | - | - |
| Disease Diag. Labs | Existing | 1(Divisional Level) | 1 | - | - | Vaccant | 1 | - | 1 | Available | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Proposed | - | - | - | - | 1 | - | | | | |
| Polyclinic | Existing | No | - | - | - | - | - | - | - | - | - |
| | Proposed | 2 | 2 | 4 | 2 | 2 | 4 | - | Required | Required | - |
| Ambu. Clinics | Existing | No | - | - | - | - | - | - | - | - | - |
| | Proposed | - | - | - | - | - | - | - | - | - | - |

**Availability of Medicines/ Vaccines**

**Specific health services to be required/ advised for doubling income in specific agro-ecological zone:**

1. Nutritional gap needs to be filled. Farmers should be provided feed & fodder supplements at subsidised rates.
2. Minimum support prize should be fixed for the farm products.
3. Improved market infrastrusture and market scope.

**Any other suggestions to improve the quality of Vety. Health services:**

1. Need restructuring of the department especially for the hilly areas so as to fulfil the staff requirement.
2. Refresher course should be organised for the doctors.

**Problems of Animal Husbandry**

| | | |
|---|---|---|
| Specific problems due to which income is not increasing | Poor accessibility | yes |
| | Water scarcity | Almost in the whole district |
| | Natural disasters | Frequency is low |
| | Wild life conflicts | Yes frequency is very high due to which farming intensity is decreased to a significant level |
| | Marketing of animals | No availability of structured market |
| | Marketing of products | Low production due to which there is no surplus to be marketed and the transportation cost is also very high thus making is not feasible |
| | Budget | Allocation is low |
| | Manpower shortage | Yes. Monopoly gender role in livestock activity |
| | Capacity building | Para veterinary staff and refreshal courses of vetenarians is required |
| | Equipment & Implements (old/ shortage, etc.) | Adequate |
| | Mobility | Huge Problem. Dependence on the public vehicle is very high. Difficult terrain. Difficult road connectivity. |
| | Risk cover (Insurance) | Not given but should be given |
| | Relook to policies | - |

**D. Integrating Farming system**

**1.A Existing farming system:** Cattel+Crop/Vegetable

**1.B Specific farming system for doubling income in specific agro-ecological region:**

1. Protected cultivation+ Composting+Goatry/Backyard poultry
2. Fodder production+ Mini dairy+Composting+ Protected cultivation
3. Truthful self seed production(Jethi rice,Lentil, onion,radish,frenchbean,Pea)+ Planting material

supply+Mushroom

**E. Reducing post harvest losses and value addition**

**1.A Existing grading facilities:** Manual

**1.B Grading facilities to be advised/ setup for doubling income in the agro-ecological region of district:**

**For grains:**

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

**For horticultural crops:**

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

**2.A Existing processing facilities:** Few units available in fruits

**2.B Processing facilities to be advised/ setup for doubling income in the agro-ecological region of district:**

**For grains:**

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity
7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity

**For horticultural crops:**

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

**3.A Existing packing facilities:** Few farmers

**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:** Use of tradicitional bins only

**4.B Storage facilities to be advised/ setup for doubling income in the agro-ecological region of district:**

**For grain**:

1. Multipurpose (small to medium size) warehouse with mechanical drying and fumigation facility
2. Drying cum storage silo
3. Modified atmosphere and Hermetic storage structure
4. Kothar, metal bins for small capacity

**For Horticultural crop:**

1. Air/water pre-cooling chambers on farm level for removal of field heat
2. Evaporative cool chamber for chilling sensitive crops
3. Modified or control atmospheric storage structures
4. Cold storage structures
5. Zero energy cool chamber for hilly areas
6. Solar power cooling chambers

**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:**

1. Development of community pasture.
2. Rejuvenation/repair of faulty/abandoned terraces;
3. Stabilization of eroded land using biological/engineering measures;
4. All agricultural operations should be done on contours i.e. across the existing land slope.
5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
7. Diversion of runoff through ditches from upper slopes to safer places.
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
10. Contour trenching (staggered/continuous).
11. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
12. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
13. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
14. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.

**2.A Existing plantation:** Local grasses.

**2.B Plantation suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:** Plantation of suitable trees/brushes in waterlogged and eroded areas

**3.A Existing fodder production:** Berseem, Maize, oat

**3.B Fodder suggested and Package of practices to be advised/ developed for waste land development and waste water management in the agro-ecological region of district:**

**Guinea grass (*Panicum maximum*)**

1. Seed rate( Kg/ha)- 3-4
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management-60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

**Setaria grass (*Setaria anceps*)**

1. Seed rate( Kg/ha)- 1.5 2.0
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 100:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available.
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

**Spear grass (*Hetropogon contortus*)**

1. Seed rate( Kg/ha)- 4-5
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available..
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting

**Rhode grass (*Chloris gayana*)**

1. Seed rate( Kg/ha)- 3-5
2. Spacing (cm)- 50cm x 50cm or 40000 rooted slips/ha Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
3. Fertilizer management- 60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
4. Irrigation management- Crop must be irrigated after each cut provided water is available.
5. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

**Marvel grass (*Dicanthium annulatum*)**

1. Seed rate( Kg/ha)- 4-6
2. Spacing (cm)- 50cm x 30cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management-60:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available.
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval (Irrigated). In rainfed, first cut may be taken after 3-4 months after planting.

**Packages of practices to be advised for waste land development**

1. Rejuvenation/repair of faulty/abandoned terraces;
2. Stabilization of eroded land using biological/engineering measures;

3. Plantation of suitable trees/brushes in waterlogged and eroded areas;
4. All agricultural operations should be done on contours i.e. across the existing land slope.
5. Temporary gully control structures (brush-wood dam, loose-rock dam, plank/slab dam, log dam, gabion check dam etc.) should be constructed to stabilize gullies using locally available materials.
6. Permanent gully control structures (drop spillway, drop inlet spillway and chute spillway) should be constructed in badly eroded large gullies where temporary structures are inadequate or uneconomical.
7. Diversion of runoff through ditches from upper slopes to safer places.
8. Gabion structures can be made along the hill roads as retaining wall, and along the stream banks for protection.
9. Contour bunding up to 6% slope in areas with less than 800 mm mean annual rainfall and permeable soils; and graded bunding in areas with > 6% slope and > 800 mm mean annual rainfall.
10. Contour trenching (staggered/continuous).

**Waste water management**

1. Domestic wastewater may be reclaimed at house hold level for use in kitchen gardens.
2. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
3. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
4. Efforts must be made to rejuvenate the dying springs or enhance the discharge of flowing springs by way of plantation and trenching in their recharge zone.
5. Effluent from kitchen and bathroom

**4.A Type of waste water:**

**1.** Flowing springs

**2.** Sewage water from cities from being discharge into surface and ground water resources

**4.B Existing treatment facilities:** NA

**4.CTreatment facilities to be advised/ developed for waste water treatment and utilization in the agro-ecological region of district:**

1. Industrial wastewater must be purified by the concerned industries at their factory level, and should not be thrown into the streams/rivers.
2. The discharge from perennial/seasonal natural water springs must be stored in tanks to ensure continuous water supply for drinking and domestic uses.
3. 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.

**G. Reduced cultivation cost**

**1.A Existing inputs being given:**

**Rice-wheat/Rice-Potato/Maize-Rajma/Mustard**

1. Annexure–II is enclosed for N,P and K.
2. In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn)/ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop
3. 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. Soil application of 215 kg gypsum/ha
5. Foliar spray of 1% $FeSO_4$ in rice nursery

**Tomato, Cabbage, Capsicum, French bean, Green pea, Radish**

1. In Zn deficient soils, application of 10 kg $ZnSO_4$ (21% Zn)/ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop
2. Foliar spray of 0.2% Borax

7. Soil application of 215 kg gypsum/ha

**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:**

**Amaranth**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual broadcasting / line sowing / manual thinning
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**Millets**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker
2. Manual broadcasting / line sowing / manual thinning or by animal drawn Danala.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual harvesting.
6. Manual threshing.
7. Cleaning by Winnowing fan.

**French Bean**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Manual line sowing.
3. Manual weed control.
4. Manual fertilizer application.
5. Manual picking for vegetable beans and harvesting.
6. Manual threshing for seed.
7. Cleaning by Winnowing fan.

**Potato**

1. Seedbed preparation by animal drawn Nasuda followed by wooden planker.
2. Furrow making manually or by animal drawn

**Nasuda**

1. Manual planting and ridge making.
2. Manual weed control.
3. Manual fertilizer application.
4. Manual harvesting / using animal drawn Nasuda.
5. Manual grading

**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:**

**Amaranth**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.

2. Broadcasting by centrifugal manual broadcaster.
3. Manual thinning by three prong wheel hoe.
4. Weed control by improved wheel hoe.
5. Plant protection by manually operated sprayers.
6. Manual harvesting using improved sickles.
7. Manual threshing.

**Millets**

1. Seedbed preparation using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Manual line sowing / improved millet seed drill.
3. Weed control by improved wheel hoe .
4. Plant protection by manually operated sprayers.
5. Manual harvesting using improved sickles.
6. Threshing by VPKAS millet thresher .

**French Bean**

1. Seedbed preparation by using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Light weight power tiller operated inclined plate planter.
3. Weed control by improved wheel hoe / power weeder.
4. Plant protection by manually operated sprayers.
5. Manual picking and harvesting.
6. Threshing by multi-crop thresher.

**Potato**

1. Seedbed preparation by using light weight power tillers/ animal drawn improved Pant hill plough followed by light weight planker made of composite material.
2. Furrow making manually or by animal drawn Pant hill plough / furrower.
3. Weed control by improved wheel hoe / light weight power weeder.
4. Earthing by power tiller operated or animal drawn ridger.
5. Plant protection by manually operated sprayers.
6. Harvesting by animal / power tiller operated potato digger.
7. Grading by mechanical potato grader.

**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:**

**Mid Hills**

1. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
2. Avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
3. Encourage use of organic manures and biofertilizers; reduce the dose of chemical fertilizers.
4. Need based application of insecticides and pesticides, preferably enhanced the use of bioagents.
5. Farmer should use high yielding variety seed and multiply at his own site for next 02-03 seasons.

6. Use optimum and recommended seed rate at optimum spacing and depth.
7. Encourage water harvest technology for irrigation.
8. Use sprinkler and drip method for irrigation should be encouraged.
9. Use of mulches and available composts/organic manures
10. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
11. Promote reduced tillage operations.

**Factors responsible for increasing cost of cultivation in the specific agro-ecological region of district:**

**High hills**

1. The irrigated area is only 4-5% by gulls.
2. Region represents temperate climate with mean annual temperature ranging from 11-150C, about 90% of rainfall is received during rainy season, 8% in winter and 2% in summers.
3. The soils are highly acidic, high in un-humified organic matter.

**Very high hills**

1. Area is confined to inner Himalayas.
2. Climate is humid temperate with low to very low annual mean temperature ranging from (5-110 C).
3. The rainfall is low and snowfall is high and land covered under heavy snow for more than six months.
4. The weather remains foggy with high humidity. Kharsu oak and Himalayan fir are the dominant vegetation. The soils are highly acidic.

**Factors responsible for increasing cost of cultivation**

1. Heterogeneous soils, soils of each situation differ widely in their physical, physico-chemical characteristics as they are developed from a variety of rocks and minerals under joint influence of vegetation, physiography and climate.
2. Sloping lands with high rate of removal of soil and nutrients from surface through erosion resulting to depletion of soil fertility.
3. Scattered holding and marginal land size.
4. 90 % of areas of mid and high hills are rainfed.
5. High rates of migration from hills to plains of males and young boys in search of jobs.
6. Women based farming system without technical knowledge – how and inputs.
7. Low efficiency of conventional farm tools and implement.
8. Indigenous breed of livestock with low production and working efficiency.
9. Poor quality of FYM. The method of preparation and application of FYM are defective generally heaped in an open area resulting into loss of nutrients.
10. Mostly soils are slightly to strongly acidic in nature depending upon elevation, vegetation and development of soil from rocks and minerals causing nutrient imbalance in soil and impose hidden nutrient toxicity and deficiency symptoms in crops retard growth and yield.
11. Minimum use of fertilizers: farmers are mostly small and marginal economically backward, not able to apply recommended doses of fertilizers. The average consumption is < 10 kg N:P:K ha-1.
12. Non availability of quality seeds of varieties recommended for rainfed upland situations.
13. The inputs are costly and therefore, the small and marginal farmers are not able to adopt the improved technology.
14. Non availability of inputs at right time and right place.
15. Sowing of crops is at the mercy of rains which are erratic. Thus planting is delayed and not done on suitable time. Sowing are done more than once either because of insufficient moisture mostly in rabi crops or due to crust formation in kharif.
16. Farmers follow practice of dry sowing. In such situation the seeds are eaten by birds and grubs resulting in inadequate plant population.

17. Due to limited moisture and nutrient supply the growth of crops is not proper and vegetative phase of growth (flowering and fruiting) are advanced.
18. Improper seed bed preparation: in order to utilize moisture, the farmers do not wait for fine preparation of fields and rush for sowing. This results in improper germination and infestation of weeds.
19. Severe infestation of insect-pest: white grubs and cut worms are the serious polyphagous pests, kill plants and reduce plant population up to 70-80 %. Due to non availability of suitable plant protection chemicals as well as high cost they are beyond the means of farmers. Besides, non availability of water for solution also pose problems.
20. Weeds; common weeds of the upland rainfed areas are Tipatiya (Oxalis latifolia), Pardeshi( Galensojaparviflora), Gajar grass ( Parthenium Sp.)Kuni( Lantena camera) Kala bansa ( Eupatorium sp.).The loss in general in food crops is high from 50-75 %.
21. Improper terrace management: most of terraces developed by farmers are on steep slopes with outward gradient.
22. Lack of proper drainage system for safe disposal of excess rainwater. The heavy runoff of water washes away the top fertile soil lead to steady depletion of nutrients and organic matter.
23. Coarse textured soils (charty/gravely) with low moisture and nutrient retention capacity.
24. Lack of proper storage facilities for crops (cold storage).
25. Lack of awareness for protected cultivation techniques and facilities for commercial high value crops (poly houses, poly tunnels, poly for raising nursery and cash crops.
26. No good marketing facilities.
27. Lack of proper irrigation facilities for minor irrigation and drip irrigation with fertigation.
28. Poor connectivity of road transport system.
30. Lack of farmer's participatory approach models for crop production technologies under hill agricultural system for the state.

**H. off-farm income**

**1.A Existing SHGS operative in specific agro-ecological region of district:**

Shahbhagita(Behgagil), Shanti(Behgagil), Kamdhenu(Shail), Chirag (Shail), Durga(Katarmal), Jai Devi(Katarmal), Jai Surya (Katarmal), Jai golu(Katarmal), Laxmi(Gnayee), Jagriti(Dhon), Gogata first (Gogata), Gogata second(Gogata), Gogata third(Gogata), Laxmi (Bachurari), bhagwati(Dholra), Bargav-2(Bargav), Golu(Bargav), Naveen(Pantkotli), Saral(Pantkotli), Eroli first(Eroli first), Pratiksha(Pilkholi), Deepika(Pilkholi), Pawan(Pilkholi), Prem second(Aliee), Maya(Aliee), Jaidurga (Daso), Swayam deveta (Bhetadangi), Jaigoludeveta(Bhetadangi), Bhagwatimata (Bhetadangi), Jagran(Simalgaon), Navjyoti(Simalgaon), Sakhi (Bhandergaon), Jyoti(Bhandergaon), Saral(Adbora), Siddhi (Adbora), Jalali SHG(Jalali), Ekta(Jalali), Muniyachora first (Muniyachora), Jai bhumiya (Neikana), Shiv shakti(Pali), Nav Jyoti (Pali), Ma jagdamba(Chani), Ma saraswati(Chani), Laxmi (Rampur), Rampur second(Rampur), Priyanka(Erari), Bhagwati (Bajkhet), Lakshmi(Kapkot), Suman(Kapkot), Kali(Goona), Aart (Goona),

**1.B SHGS to be created/ encouraged in the specific agro-ecological region of district for doubling agricultural income:**

1. The encouragement to existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation & packing, etc. may be provided for better performance.
2. New SHGs may also be created other villages of the district.
3. **SHG already formed and need to be encouraged:** Shahbhagita(Behgagil), Shanti(Behgagil), Kamdhenu(Shail), Chirag (Shail), Durga(Katarmal), Jai Devi(Katarmal), Jai Surya (Katarmal), Jai golu(Katarmal), Laxmi(Gnayee), Jagriti(Dhon), Gogata first (Gogata), Gogata second(Gogata), Gogata third(Gogata), Laxmi (Bachurari), Bhagwati(Dholra), Bargav-2(Bargav), Golu(Bargav), Naveen(Pantkotli), Saral(Pantkotli), Eroli first(Eroli first),

Pratiksha(Pilkholi), Deepika(Pilkholi), Pawan(Pilkholi), Maya (Aliee), Jaidurga (Daso), Swayam deveta(Bhetadangi), Jaigoludeveta(Bhetadangi), Bhagwatimata(Bhetadangi), Jagran (Simalgaon), Navjyoti(Simalgaon), Sakhi(Bhandergaon), Jyoti (Bhandergaon), Saral(Adbora), Siddhi(Adbora), Jalali SHG(Jalali), Ekta(Jalali), Muniyachora first(Muniyachora), Jai Bhumiya (Neikana), Shiv Shakti(Pali), Nav Jyoti(Pali), Ma Jagdamba(Chani), Ma Saraswati (Chani), Laxmi(Rampur), Rampur second(Rampur), Bhagwati(Bajkhet), Lakshmi(Kapkot), Suman(Kapkot), Kali (Goona), Aart(Goona),

4. 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.
5. 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.
6. Imparting the information to the groups about various govt. schemes regarding loan, trainings and marketing of the product.
7. 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.
8. 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.
9. Loan procedure should be made more flexible with less interest rate.
10. 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.
11. 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.
12. 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.
13. Enterprises need to be identified depending upon local resources- human and material.
14. Market linkages need to be developed so that people can sell their produce gainfully.

**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:**

Dairying, Copper, wood carving,

Buranse fruit juice, woollen articles, carpet weaving etc.

**2.B Micro-entrepreneur employment to be generated in the specific agro-ecological region of district for doubling agricultural income:**

1. Mushroom production
2. Honey Bee production
3. Sericulture
4. Processing of fruits, vegetables & spices
5. Vermin composting units
6. Woollen knitting & Handicraft
7. Bio fertilizer units
8. Copper, wood carving, buranse fruit, woollen articles, carpet weaving, aipan designing, nettle fibre craft (bichu grass) are local crafts of the area which can be further promoted for generation of income and employment.

**3.A Existing skill development facilities:** -

**3.B Skill development facilities to be created in the specific agro-ecological region for doubling agricultural income:**

Training centre, processing and packaging units as per the locally available resources

**4.A Existing women skilling facilities:** Zila udyog Kendra, Educational institute and NGOs

**4.B Women skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:**

1. Processing of fruits, vegetables & spices
2. Woollen knitting & Handicraft
3. Mushroom production
4. Honey Bee production
5. Sericulture
6. Training centre, processing and packaging units as per the locally available resources

**5.A Existing youth skilling facilities: -**

**5.B Youth skilling facilities to be created in the specific agro-ecological region for doubling agricultural income:**

1. Mushroom production
2. Honey Bee production
3. Sericulture
4. Processing of fruits, vegetables & spices
5. Training centre, processing and packaging units as per the locally available resources

**Beekeeping**

Beekeeping is an environment friendly and agro-forestry based occupation. It provides enormous potential for income generation, poverty alleviation and sustainable use of forest resources. Beekeeping is one of the oldest traditions in India for collecting the honey. Honey bee farming is becoming popular due its demand in national and international markets as well. *Apis cerana indica* is the indigenous bee, is known to be the ideal pollinator for organically grown mountain crops due to its capacity to significantly enhance agricultural productivity. India has a potential to keep about 120 million bee colonies that can provide self-employment to over 6 million rural and tribal families. In terms of production, these bee colonies can produce over 1.2 million tons of honey and about 15,000 tons of beeswax.

**Less Investment:** Bee Farming is not a manufacturing activity, as such costly machine and tools are not required. There is nothing like production capacity as well. Only small wooden frames with boxes are needed. Their sizes are also standardized. To begin with around 15 such sets/boxes can be purchased or assembled at rate of Rs.1500.00 per box that would cost Rs.22, 500/- for 15 Boxes. Honey extractors would cost to the tune of Rs.5, 000/- each with filtration facilities. For other miscellaneous expenditures including training and consultancy services a sum of Rs.5000.00 can be

earmarked. That means total of Rs.32, 000.00 would be required to start Bee Farming with 15 Boxes which is equivalent or less than the cost of cultivation of one acre of paddy field.

**More Returns:** As per the established norms, each box comprises 7-8 hives which is able to harvest around 30-35 kg of honey in a year. The annual harvest of honey starting with 15 bee boxes could be 450-525 kg depending on the flowering season. Even after considering very conservative selling price of Rs. 150/- per kg; the annual realisation would be to the tune of Rs. 67,500/- to Rs.78,750/-. Therefore, Bee Farming can be considered as an excellent, profitable agro-based green enterprise for landless farmers and entrepreneurs.

Beekeeping in Uttarakhand: Beekeeping has been an integral part of human society since centuries in hill regions of Uttarakhand state. The state of Uttarakhand has a predominantly agrarian economy and large number of small and marginal farmers in the mountainous state call for augmenting agricultural production by organic means. The indigenous bee sub-species *Apis cerana indica* commonly is ideal pollinator for organically grown mountain crops, with the capacity to significantly enhance agricultural productivity with an indirect but vital role in combating soil degradation by pollinating wild plants thereby enabling improved regeneration of bio mass, to be returned to the soil. Beekeeping with *Apis cerana indica F*. is a common practice in hills of Garhwal and Kumoun Himalaya which is carried out mostly by using traditional methods since long past and is stationary in nature. In these regions, beekeeping is also carried out with *Apis mellifera,* but in winter season, due to temperature lower than 20ºC, colonies are being migrated to plains. According to report given by KVK Jeolikot(2017), in Uttarakhand, there are about 4,790 beekeepers with 45,247 number of *A. cerana indica* colonies yielding 546.70 mt of honey production. Whereas, in Almora region of Uttarakhand, there are about 400 beekeepers with 1,165 number of *A. cerana indica* colonies yielding 16.4 mt of honey production. The Uttarakhand state has extremely rich bee forage plants. In most of the remote areas where *Apis cerana indica* beekeeping is common, the use of pesticides and chemicals is negligible, the level of dangerous chemicals in the atmosphere is insignificant and the environmental pollution is at minimal level. Honey produced from such areas is purely natural, free of any residues and can be sold as an organic product. There is vast potential for beekeeping in the country. However, due to lack of knowledge, scientific beekeeping is not being practiced by, most of the beekeepers. It is necessary for beekeepers to participate in the trainings / other capacity building programmes on the subject to gain scientific knowledge on the subject. Selection of good apiary site, good quality bees and proper management are the main keys for success of beekeeping. Following are the important points to start beekeeping and further management practices.

**1. Selection of good apiary site:** Select apiary site by considering the following:

1. Apiary ground should be clean & free from dry leaves etc. to avoid fire during summer
2. Apiary site should be away from power station, brick kilns, highway and train tracks
3. Site should be open & at dry place having shade
4. Site should be easily accessible by road
5. Fresh running water should be easily available near the apiary
6. It should have natural / artificial wind breaks
7. Site should receive early morning and afternoon sunshine
8. There should not be other commercial apiary within 2-3 kilometers from the apiary site
9. There should not be any source of stagnant / dirty water, chemical industry/ sugar mill, etc., nearby the apiary
10. Area should be rich in bee flora

Flora suitable for *Apis cerana indica* in Almora, Uttrakhand region is given below:

| Bee flora (common name) | Scientific name | Source of food |
|---|---|---|
| Simbal | *Bombax ceiba* | Nectar/Pollen |
| Beol | *Grewia* | Nectar/Pollen |
| Ritha | *Sapindus edetergens* | Nectar |

| | | |
|---|---|---|
| Onion | *Alium cepa* | Nectar/Pollen |
| Dharak | *Melia azadiracta* | Nectar |
| Sarson | *Brassica compestis* | Nectar |
| Raya | *B. juncea* | Nectar/Pollen |
| Bottle Brush | *Callistemon lanceolatus* | Nectar |
| Amaltas | *Cassia fistula* | Nectar |
| Dhania | *Coriandrum sativum* | Nectar/Pollen |
| Shishum | *Dalbergia sisoo* | Nectar/Pollen |
| Safeda | *Eucalyptus spp.* | Nectar/Pollen |
| Sunflower | *Helianthus annuus* | Nectar/Pollen |
| Guava | *Psidium guajava* | Nectar/Pollen |
| Behda | *Terminalia bellerica* | Nectar/Pollen |
| Hirda | *Terminalia chebula* | Nectar |
| Toon | *Toona ciliata* | Nectar |
| Ber | *Ziziphus mauritiana* | Nectar/Pollen |
| Bhang | *Cannebis sativa* | Pollen |
| Malta | *Citrus aurantifolia* | Nectar/Pollen |
| Apple | *Malus domestica* | Nectar/Pollen |
| Badam | *Prunus amygdalus* | Nectar/Pollen |
| Til | *Sesamum indicum* | Nectar/Pollen |
| Apricot | *Prunus armeniaca* | Nectar/Pollen |
| Plum | *P. domestica* | Nectar/Pollen |
| Pear | *Pyrus pashia* | Nectar/Pollen |
| Peach | *Pyrus persica* | Nectar/Pollen |
| Tipatia | *Trifolium sp* | Nectar/Pollen |
| Paja | *Prunus puddum* | Nectar/Pollen |
| Buckwheat | *Fagopyrum aurantifolia* | Nectar/Pollen |
| Almora weed | *Rumex spp.* | Nectar |
| Goosberry | *Ribes grossularia* | Nectar/Pollen |
| Rose apple | *Eugenia jambus* | Nectar/Pollen |
| Mango | *Mangifera indica* | Nectar/Pollen |
| Citrus | *Citrus sinensis* | Nectar/Pollen |

**2. Selection of good quality bees:** Beekeeping depends on floral resources, climatic conditions, management and also quality of bees, particularly queen. Therefore, the following should be kept in mind to select the bee colonies:

1. Buy disease free bee colonies from existing reputed beekeepers after getting training on the subject.
2. Select and multiply honey bee colonies only from disease resistant, high honey yielding, young, healthy and high egg laying capacity queen, less swarming tendency etc.
3. Keep colonies with good prolific queens
4. Capture few bee colonies from their natural abodes in forests which may be used for further breeding/ multiplication to prevent inbreeding.

**3. Management of apiary:**

**A. Placement of colonies in apiary**

1. Hives should be as per specification of BIS/ISI and should be of locally available seasoned light weight wood. Unseasoned and heavy wood should be avoided
2. Avoid nailing the bottom board with the brood chamber
3. Restrict number of bee colonies in a apiary from 50-100
4. Keep row to row and box to box distance as10 and 3 feet, respectively

Hives used for traditional beekeeping in hilly areas are

**Wall hives:** Wall hives locally known as 'Khadra', 'Jaala' or 'Jalota' are rectangular structures made in the walls of houses and 'Chhaan' or 'Sunni' (cattle sheds) at the time of construction. Each hive has a small round or rectangular opening on the outer side as an entrance for bees. The size of 'Jalotas' varies in different locations; usually they are 45-60 cm in length, 25-30 cm in width and 20-30 cm in height. Generally one hive is made in each wall, but numbers may vary from 2-4. The interiors of hives are smoothed with cow dung and clay. In winters due to lack of floral resources and extreme cold in the hills, the population of *Apis cerana* colonies decreases to a great extent. Thick wall hives provide considerable insulation in such conditions.

**Log hives:** Two types of log hives are found, Type I: These are made up of cylindrical hollowed pieces of tree trunk 60-100cm long and 20-40 cm in diameter; however size depends upon the circumference of available trunks. This type of log hives is usually made from the trunk of *Quercus leucotrichophora, Q. floribunda, Rhododendron arboreum and Pinus roxburbhii.* The entrance is made at the mid front side. Both sides are plastered with a mixture of cow dung and clay. Type II: Old cooperages locally known as 'Pariya' or 'Dokha' when rendered useless for milk products, are used as hives. These are about 70-90 cm long with the diameter at top from 25-35 cm and thickness of log 3-5cm. An entrance is made towards the outside and the hive is placed horizontally on a raised platform of stones or the wall of a courtyard. It is mainly made up of the wood of *Ougeinia oogeinesis, Rhododendron arboreum, Toona* sp. A stripe of old comb is fixed to the upper part, inside the hive, and is plugged with a wooden or metal cover, then sealed with a mixture of clay and cow dung. The wooden lid is fixed at the top with an entrance on it.

**Miscellaneous Types:** These are rectangular box hives made up of separate wooden boards with movable top cover. Their size varies in different localities. Usually these are 80-110 cm long, 25-30 cm wide and 40-50 cm high. During extraction, the top cover is removed along with attached combs and bees, and taken away from the hive, then each comb is smoked and shaken gently. Bees return to the hive and beekeepers cut combs easily.

All hives are made from locally available materials, thus are economically cheaper and environmentally friendly. These hives have thicker walls as compared to modern hives thus provide protection to bees from extremely low and high temperatures. In higher hills traditional hives are more suitable than modern hives but for the drawback in colony management.

**B. Inspection of colonies**

1. Adopt general colony and personal hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board, top cover, etc. frequently
2. Check the colonies periodically for any abnormalities or changes in behaviour of bees
3. Inspect colonies on clear sunny days preferably at temperatures between 20 and 30°C
4. Do not inspect colonies in cold, windy and cloudy days
5. Use smoker when needed to subdue the bees
6. Use protective dress and veil while inspecting colonies
7. Handle colonies gently, avoid jerks
8. Avoid crushing bees as it could lead to stinging
9. Isolate the diseased colonies from healthy ones.
10. Handle diseased and healthy colonies separately

**C. Provision of fresh water in the apiary**

Ensure availability of fresh water preferably in shallow containers near the apiary to maintain a healthy apiary. Water is needed for the following

1. Maintenance of adequate humidity in a colony to ensure proper incubation of eggs
2. For feeding bee bread by nurse bees, the mixture of honey and pollen of certain consistency is required for which water is needed
3. When temperature in the apiary increases beyond 37°C, water is used by bees to evaporate and cool the colony

**D. Dearth period management**

1. Provide 50% sugar syrup to the colonies during dearth periods when honey stores in the colonies is not adequate and nectar is not available in the area. The syrup should be prepared by boiling clean water in the vessel and sugar added with slow stirring for few minutes. Cover the vessel with lid and let it cool. Feed cooled syrup.
2. Sugar syrup should be kept in such a way that the bees should not drown in it. This should be ensured by using shallow vessels with straw to facilitate easy feeding
3. Do not prepare the feed in open in the apiary and avoid dripping on the ground to prevent robbing by bees and ants
4. Feed the colonies in the evening preferably after sunset
5. Feeding should be given to all colonies in the apiary at one time
6. Pollen substitute comprising of fat free soyabean flour (3 parts) + Brewer's yeast (1 part) + skimmed milk powder (1 part) + sugar (22 parts) +honey (50 parts) made in the form of patties should be provided when pollen stores in the colonies is not adequate and pollen is not available in the area
7. Provide fresh water near the colony in shallow vessels
8. Extra frames should be stored in air tight chambers and fumigated with sulphur powder regularly
9. Old and dark combs should be discarded

**E. Care during honey extraction**

1. Use honey extractor, containers and other bee hive tools /equipments made of stainless steel / food grade plastic. Don't use tins & containers made of other degraded material
2. Wash all the equipments / containers etc. thoroughly with warm water before honey extraction
3. Extract honey from super chambers only
4. Select frames only with 75% sealed cells with ripened honey for extraction
5. Cover the entrance gate of the colony with small branches or twigs to avoid robbing
6. Extract honey in a closed room and not in the open to avoid robbing
7. Do not leave super and brood frames, after extraction of honey open in the apiary;
8. Do not spill honey in the apiary

**F. Care during migration**

1. Migrate colonies during non-availability of flora to areas with abundant flora.
2. Before migration survey the area to assess the availability of the flora to locate the colonies
3. Ensure honey extraction before migration
4. Close the entrance gates of the colonies in the evening after all worker bees are inside the colony
5. Pack the colonies internally and externally before migration to avoid jerking
6. Colonies in the vehicle should be packed in such a way that the entrance side should face the front side of the vehicle
7. Start migration late in the evening and ensure the colonies reach the destination within 10-12 hrs. the next day morning and entrance gates are opened after landing in the new location
8. Avoid jerking in the way while transporting bee colonies

**G. Seasonal management of apiary**

a**) Summer Management**

1. Keep the colonies in thick shade
2. Regulate the microclimate of the apiary by using wet gunny bags over top cover and sprinkling water around the colonies in the apiary during noon hours.
3. Provide fresh water in/near the apiary

**b) Monsoon management**

1. Clean and bury deep the debris lying on the bottom board
2. Keep the surroundings of the colony clean by cutting the unwanted vegetation which may

hamper free circulation of the air
3. Provide artificial feeding (sugar syrup and/or pollen substitute) as per requirement of the colony
4. Check the robbing within the apiary
5. Unite weak/laying worker colonies
6. Control predatory wasps, ants, frogs, lizards in the apiary

**c) Post monsoon season management**

1. Provide sufficient space in the colony
2. Strengthen the colonies to stimulate drone brood rearing
3. Control ectoparasitic mites, wax moth and predatory wasps

**(d) Winter management**

1. Examine the colonies and provide winter packings in weak colonies specially in hilly areas
2. Feed sugar/pollen substitute to weak colonies as stimulative feeding to provide energy and initiate brood rearing
3. Shift the colonies to sunny places
4. Protect the colonies from chilly winds by using wind breaks
5. Unite the weak colonies with stronger ones

**e) Spring management**

1. Unpack the colonies, clean the bottom board, replace the worn out hive parts and provide sufficient space
2. Provide stimulative sugar/pollen substitute to increase brood rearing
3. Equalise the colonies
4. Extra frames should be raised by providing comb foundation sheets
5. Replace the old queens with new ones through mass queen rearing or divide the colonies
6. Manage the colonies in such a way to prevent swarming
7. Monitor regularly for ectoparasitic mites and adopt control measures

**H. Protecting colonies from pesticides**

1. Persuade the farmers not to use pesticides or use selective pesticides that are less harmful to bees at recommended concentrations
2. Avoid the use of dust formulations as they are more harmful to bees than spray formulations
3. Prior information about spraying would help in reducing poisoning of bees
4. Avoiding spraying of pesticides during flowering of the crop and peak foraging time of the bees would help in reduction in the mortality of foraging bees
5. Spraying may be done in the evening after sun set when bees do not forage
6. Colonies may be temporarily shifted if heavy spraying schedule is fixed
7. If shifting of the colonies is not possible, feed with 200 ml sugar syrup and close the gate by using wire screen for the day of spraying.

**I.Methods of attracting and catching swarms**

1. Swarming is a natural process for propagation of honey bees. Swarms are the lone source of bees in traditional beekeeping of *Apis cerana* while only a few empty hives are inhabited by absconded or feral colonies.
2. Empty hives are cleaned and smeared with clay, cow dung or both. Honey or jaggery are put inside hive to be used as bait to attract the swarm.
3. Flowering shoots of *Brassica campestris, or Raphanus sativus* can also be used just above the hive entrance, hoping that scout bees will find their home in the empty hive.
4. When swarms is found in the vicinity, water can be sprinkled and soil or ash can be thrown to settle them. 'Tofri' or 'Garori' (special baskets) made up of 'Ringal' (bamboos); 'Jhola' (bag) can be used to catch and carry swarms. 'Kutrine' (burning cotton cloth) is used as a traditional smoker and 'Talikh' (a cloth) to save faces while catching the swarm.
5. To catch a swarm layer of jaggery or honey is applied at the inner base of the basket and hang it

inverted near the settled cluster. The cluster is gently displaced from the other side with smoke to direct the bees towards the basket. As the swarm makes a cluster on the basket, it is transferred to the hive. When the bees are settled the basket is removed. Finally the hive is closed with its wooden cover and be smeared with a mixture of cow dung and clay.

**J. Management of Honey Bee Diseases and pest**

Honey bees could be affected by diseases and the real cause of abnormality or any disease present in the honey bee broods need to be ascertained before taking up any control measures. It is best to contact the researchers/scientists/beekeeping experts at the nearest centre or university or Government department working on honey bees. After the exact diagnosis of the causal agent of the particular disease, the guidelines/ recommendations given by the expert should be followed in true letter and spirit. However, general advisory for the management of common diseases of honey bees is given below:

1. Select good site to locate the apiary preferably in an open, dry place with shade.
2. Adopt general colony hygiene in the apiary like cleanliness in the beehives including cleaning the bottom board frequently.
3. Select and multiply honey bee colonies only from disease resistant stocks.
4. Keep colonies with good prolific queens.
5. Create broodlessness in colony for at least 15 days by enclosing the queen in a queen cage.
6. Check the colonies periodically for any abnormalities or changes in behaviour of bees.
7. If you observe any colonies with disease, isolate them from healthy ones. Handle diseased and healthy colonies separately.
8. Keep the colonies strong by adding sealed brood comb or worker population only from healthy colonies and also by providing adequate food during dearth periods.
9. Prevent robbing, drifting, absconding and avoid migration of bee colonies when you notice disease symptoms.
10. Follow 'Shook Swarm' or shaking method to remove contaminated combs completely by transferring entirely new combs in one operation to the colonies with disease symptoms. Destroy the removed combs by burning.
11. Sterilise the combs and equipments by any one of the following methods:

e. Disinfect the empty combs and equipments with 80 per cent acetic acid @ 150 ml per hive body in piles for few days at a protected place. Air the treated materials before use.

f. Dip the contaminated equipments and combs in soap solution containing 7 per cent formalin for 24 hours. Then wash the treated material with water, dry and use.

12. Use of antibiotics to control honey bee diseases is likely to result in contamination of honey causing problems in export of honey.
13. The traditional method to check the entry of ants is spreading ash or turmeric powder in their way.

**K. Honey Extraction**

The main honey seasons in hilly areas are '*Chait*' (April), '*Baisakh*' (May) and '*Ashaad*' (July-August). In some localities, an additional extraction during '*Kartik*' (October) is also done. Colonies yield most honey in '*Chait*'-'*Baisakh*' and the least in '*Kartik*'. Traditional tools used are '*Dathule*'. (sickle) to open the cover or wooden plug and '*Buwan*' (traditional brush) made up of '*Babul*' (*Eriophorum comosum*) to brush off bees. Besides these traditional smokers, large pans for keeping combs, a pot with water and '*Parunla*' or knife for cutting '*Faur*' or '*Fwar*' (bee combs) are required at the time of harvest. Honey is mostly extracted at night but a few beekeepers do it in day time also. Combs are cut down, leaving the innermost comb for feeding and to attract swarms the next year. Honey combs are squeezed after removing the brood area from the cut combs. The harvested honey has many impurities like insect body parts, wax cells, etc. Usually, squeezed combs are thrown away after extraction, which can be fed to cattle especially bulls. Honey is stored in plastic or metal containers and in bottles.

The beekeepers doing beekeeping with modern hives should use honey extractors to harvest honey. The quality of honey extracted using honey extracting machine is much better than squeezing method.

**I. Enabling Policies**

**1.A Existing policies related with agriculture and animal husbandry:**

Promote agriculture & animal husbandry in the state for better income of farmer community

**1.B Policies to be suggested for doubling income in the specific agro-ecological region:**

1. Expand application scientific methods and mechanized cultivation
2. Promotion of secondary agriculture
3. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
4. Checking migration by attracting rural youth in agriculture.

**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:** Establishment of food processing units at distt/tehsil/block level to procure and marketing of surplus

**3.A Existing Incentives: -**

**3.B Incentives to be suggested for doubling income in the specific agro-ecological region of district:** Provision of subsidised inputs (seed, chemical fertilizers, etc.) in agri-clinics at cluster level.

**4.A Existing risk coverage facilities:** Crop and Animal Insurance Schemes

**4.B Risk coverage facilities to be suggested for doubling income in the specific agro-ecological region:** Trout crop raceway insurance facility

**J. Marketing and value addition in specific agro-ecological region**

**1.A Existing marketing facilities:Local market**

**1.B Marketing facilities to be suggested for doubling income in the specific agro-ecological region:** Fish market at Almora, Trout fish market facility &
Marketing of trout through farmers' co-operatives

**2.A Existing grading facilities:**

**2.B Grading facilities to be suggested for doubling income in the specific agro-ecological region:**

**For grains:**

1. Indented cylinder for rice/paddy grading
2. Sieve gyrator for particular commodity
3. Dockage tester for particular commodity

**For horticultural crops:**

1. Sorter for particular commodity
2. Size grader for particular commodity
3. Weight grader for particular commodity
4. Colour grader for particular commodity

**2.C Processing facilities to be created for better marketing and value addition in the district:**

For grains:

1. Processing unit with facilities of mechanical drying, farm level shed drying, cleaning and milling
2. Mobile seed processing unit at village level for particular commodity
3. Mobile paddy miller at village level for particular commodity
4. Rice mill with parboiling, drying, dehulling, grading and polishing at district level
5. Small capacity flour mill with packaging facility at village level for particular commodity
6. Large capacity multigrain flour mill with washing, drying, milling and packaging unit at district level for particular commodity

7. Cleaner, splitter, grader and packaging at village level for pulse milling
8. Pearler, grader, miller and packaging unit for millets
9. Cleaner, mechanical oil expeller, hydro-distillation unit (clevanger), bottling and canning unit at district level for particular commodity
10. Sugarcane crusher, open pan evaporator, moulds for jaggery, packaging unit at village level

**For horticultural crops:**

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity
3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

**2.D Packing facilities to be created for better marketing and value addition in the district :**

**For grains:**

1. Packaging infrastructure at village level with packaging, sewing, sealing and labeling facilities
2. Jute bags and raffia bags with LDPE coated for particular commodity
3. 3-ply laminated packaging bags for particular commodity (polyethylene, polypropylene, or a co-polymer)
4. IRRI bags for particular commodity

**For horticultural crops:**

1. Packaging platform at farm level with packaging, sticking, sealing and labeling facilities
2. Wooden boxes or lined or unlined corrugated fibreboard boxes for fruits and vegetables
3. Small LDPE and HDPE polybags for particular commodity
4. Fresh fruits packaging with active packaging (ethylene, oxygen, moisture scavangers)
5. Paperboard boxes for particular commodity
6. Perforated paperboard boxes and LDPE/HDPE polybags for highly perishable crops
7. Shrink and wrapping packaging for fresh and minimal processed
8. Litchi peeling and shredding unit

**3. Existing marketing and value addition problems in the specific agro-ecological region:**

1. Transportation problem during rainy season.
2. No Mandi is available in the district.
3. No value addition plants of crops are available

**K. Online Management and Evaluation**

**1.A: Existing online management structure available:** Internet etc.

2. **1.B: Restructuring required for online management and evaluation in specific agro-climatic region of district:**

Mobile app. For carp farming

Data base of individual farmer

**2.A: Existing evaluation procedure:** Manual

**2.B: Evaluation procedures required for online management and evaluation in specific agro-climatic region of district:** District level committees of State line departments with KVK experts may be formed for field and as well as online evaluation.

**3.A: Existing monitoring system:** Physical

**3.B: Monitoring procedures / system required for online management and evaluation in specific agro-climatic region of district:** Mobile apps/ software for online management . Evaluation may be developed and farmers as we well as concerned experts may be linked with it.

**4.A: Existing feedback system:** Manually

**4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district:** Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.

**5.A: Existing reading system:** Literature, Booklets, Hindi Extension Journals etc

**5.B: Reading system required for online management and evaluation in specific agro-climatic region of district:** Reading manuals may be developed/ published for easy operation of Mobile apps/ software developed for online management and evaluation for farmers as we well as concerned experts linked with it.

**Specific action plan for doubling agricultural income in agro-ecological region**

**Strategy 1 : Productivity Enhancement**

**Introduction, adoption and popularization of high yielding varieties for increasing productivity**

Popularisation of high yielding varieties of major crops viz.

1. Finger millet (VL Mandua 352 upto 2000 m amsl) in Dhaula Devi and Lamgara blocks.
2. Barnyard millet (VL Madira 172 and VL Madira 207 upto 2000 m amsl) in Dhaula Devi and Lamgara blocks
3. Wheat ( VL *Gehun* 829, VL *Gehun* 907, VL *Gehun* 953, HS 507, HPW 349 (from 1500 to 1700m amsl), VL Gehun 832 and HPW 155, HS 365 (from 1700 to 1700m amsl) and UP 2572) in Dhaula Devi, tarikhet and Lamgara blocks.
4. Barley (VL Jau 118 and VLB 94 upto 1700m amsl) in Dhaula Devi, tarikhet and Lamgara blocks.
5. Lentil (PL 5, PL 7, PL 8) in Dhaula Devi, tarikhet and Lamgara blocks.
6. Vegetable pea (Vivek Matar 11 for main season & VL Ageti Matar 7 for August sown) in Dhaula Devi, Hawalbagh, Lamgara, Dwarahat, Tarikhet blocks.
7. French bean (VL Bean 2 upto 1800m amsl) in Dhaula Devi, Hawalbagh, Lamgara, Dwarahat, Tarikhet blocks.
8. Tomato (VL Tamatar 4 upto 1800m amsl, Manisha, Himsona, Navin 2000) in Dhaula Devi, Lamgara, Takula, Dwarahat and Tarikhet blocks.
9. Capsicum (VL Shimla Mirch 3 utp 1800m amsl, California wonder, Bharat, Indra, Tanvi) in Dhaula Devi, Lamgara, Takula, Dwarahat and Tarikhet blocks.
10. Cabbage (Varun, Pragati, Golden acre) in Dhaula Devi, Lamgara, Takula, Dwarahat and Tarikhet blocks.
11. Potato (Kufri Jyoti, Kufri chandramukhi, Kufri Girriraj, Kufri Chipsona 1, Kufri chipsona 3) in Dhaula Devi, Lamgara, Takula, Dwarahat, and Tarikhet blocks.
12. Gol Muli (Dunagiri Gol) in Dwarahat and Tarikhet blocks,
13. Onion (VL Piaz 3 upto 2000m amsl) in Dhaula Devi, Lamgara, Takula, Dwarahat, Tarikhet blocks.
14. Garlic (VL Lahsun 2) in Dhaula Devi and Lamgara, blocks.

**Recommended package and practices will be followed for the above recommended crop varieties**

**Strengthening of traditional water storage structure**

1. Creation of additional water storage tank/ polytank for particular vegetable areas of *Tarikhet (Chaubatia), Hawalbagh (Shitlakhet, Kasardevi), Lamgara (Shaharphatak, Motiapathar) and Dhauladevi ( Jageshwar*) for lean season.
2. Promotion of rain water harvesting and drip-fertigation system in *vegetable* clustersin this regions
   in all blocks.
3. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in particular vegetable growing areas viz. *Tarikhet (Chaubatia), Hawalbagh (Shitlakhet ,Kasardevi), Lamgara (Shaharphatak, Motiapathar) and Dhauladevi ( Jageshwar*)
4. Popularisation of roof water harvesting system in all villages.
5. Rejuvenation and popularisation of traditional water harvesting systems (Naula) in all blocks.

**Adoption of cluster approach for holistic development**

1. Strengthening of old fruit belt of *Tarikhet*, Dwarahat (*Dunagiri*), *Lamgara* and *Hawalbagh* by introduction of new cultivars of stone fruits.
2. Promotion of Ginger /Turmeric cultivation in shady areas in all blocks.
3. Promotion of off season vegetable/protected cultivation ((tomato, capsicum, radish, potato, onion, garlic cucumber, cole crops,leafy vegetable etc.) specially in *Tarikhet, Hawalbagh, Lamgara, Dunagiri,Jageshwar.*
4. Fallow land development under agro-forestry in all blocks.
5. Promotion of recommended high yielding varieties and organic cultivation in all blocks.
6. Promotion of common minimum programme technology in vegetables to reduce the cost of cultivation and quality produce.

**Management of wild animal problem**

1. Promotion of bio fencing on trench bunds specially in vegetable belts in all blocks.
2. Promotion of Citrus/ nut fruits, lady finger in vegetable, ginger or turmeric in spices, dual purpose varieties of barley, wheat and oats or Lemon grass at larger scale in cultivated field in all blocks to minimize the damage from wild pigs, monkeys and cows.
3. Enacting legislative measures for protection of crop from wild animals in all blocks.
4. Promotion of protected cultivation (low cost polyhouse, polytunnels etc.) in all blocks to ensure some income.

**Adoption of Farm mechanisation (Power tiller, thresher etc)**

1. Adoption of serrated sickle, wheel hoe, handle fork, handle kutla, power tiller, small wheat thresher, winnowing fan, Vivek Millet thresher cum pearler Vivek small tool kit for reduction in drudgery of hill farmers.
2. Popularization of manually operated mini crop harvesters, small wheat /paddy thresher in *Takula, Bhaisiyachanna* and *Hawalbagh*.

**Adoption of efficient irrigation techniques**

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available,
2. Drip Irrigation in integration with water harvesting structure where irrigation water is not available
3. Green House Cultivation for Vegetables

**Management of soil health**

1. Organic cultivation of traditional crop viz., fingermillet, ugal, rice bean, barnyard millets, black soybean, horsegram, traditional rice in all blocks of this region.
2. Bio-fertiliser/soluble fertiliser based farming in rain fed areas of all blocks.
3. Adoption of pulse based crop rotation and maximum use of value added compost/FYM in all blocks.
4. Making available the required recommended nutrients/ micro-nutrients at right time, place and quantity.
5. Popularization of soil and water conservation measures by pulse based intercropping, contour farming and shoulder bunds in particular rainfed areas of all blocks.
6. Promotion of soil testing kits in all blocks of this region.

**Strategy 2 : Livestock: Goatary, Poultry, Fisheries**

1. Selection of high milk breeds in buffaloes (Murrah) and cattle (Jersy, Sahiwal, Gir and Red Sindhi) in all blocks.
2. Establishment of Fodder Bank in each block to meet fodder requirement of area.
3. Establishment of milk chilling plant at *Lamgara block*
4. Establisment of Molases/Multinutrient feed block at Lamgara.
5. Promotion of urea, molasses, multinutrient blocks at *Nyaypanchayt* level.
6. Establishment of hatcheries for need of broilor or croilor at block level like at *Saharfatak* area.
7. Introduction and promotion of cross Heiffer by Artificial Insemination (AI) for increasing income of marginal farmer in all blocks.

8. Improvement of cattle health through vaccination and proper feeding.
9. Strengthening of traditional water bodies/rivulets with Mahaseer or carps at Garurabajh and *Vishvnathn river* areas.
10. Popularisation of green fodder crops i.e. sorghum, lobia, maize, oat, berseem (Irrigated only) etc. in all blocks.
11. Community pasture development at village level.
12. Planning for establishment of *Gaushala* at block level to rear unproductive cattles to avoid the damage crops in cultivated areas in all blocks.

**Strategy 3 : Integrating Farming system**

**Promotion of different Integrated Farming System modules for 20 nali's or 0.4 ha such as :**

**Vegetable based – 18 nali protected cultivation + 2 nali composting and Goatry/ Poultry**

Protected cultivation (100sqm low cost polyhouse- Capsicum, cucumber, Tomato, nursey raising and cole crops)/ off season vegetable; 18 nali + Composting (50sqm) + Goatry (4F+1M) /backyard poultry (50birds)

**Live stock based- 10 nali green fodder + 5 nali Dairy, composting and Goatry/ Poultry+ 5 nali Protected cultivation**

Fodder production (10 nali; Sorghum, lobia-Oat in rainfed or berseem in irrigated) + Mini dairy (Crossbreed05) + Composting (50sqm) + Protected cultivation; 5 nali

**Crop based- 15 nali crop and vegetable+ 5 nali Dairy, composting and Goatry/ Poultry+ 2 nali Nursery raising Protected cultivation 5 nali**

1. Truthfull seed production (Jethi rice, Lentil, onion, radish, frenchbean, Pea); 15 nali + Planting material supply 2 nali + Mushroom + Composting

Crop 14 nali (Gahat, madua, soyabean, lentil- 7 nali + vegetable- Cucurbits, French bean, veg pea, tomato, capsicum and leafy vegetables (7 nali)-dairy/backyard poultry; 5 nali +composting (50sqm).

**Strategy 4 : Reducing post harvest losses and value addition**

1. Establishment of mini fruit grading plant in *Saharfatak, Hawalbagh and Chaubatiya*.
2. Establishment of Food and Processing Units at fruit/vegetable belt in *Lamgara*, *Tarikhet, Jageshwar, Seharphatak and Bhikiasain.*
3. Establishment of Value addition centre at *Takula, Jainti, Jageshwar, Hawalbagh (kasardevi) and Bhaisiyachanna.*
4. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all blocks.
5. Establishment of marketing chain for efficient/timely supply of produce/product from nyaypanchayat level.
6. Promotion of common resources on custom hire basis viz. Mini thresher, power tiller etc. in all blocks.
7. Establishment of packaging infrastructure at nyaypanchayat level with packaging, sewing, sealing and labeling facilities.

**Strategy 5 : Waste land development and waste water**

1. Contour making for arable purpose in waste land in all blocks.
2. Afforestation of plants and perennial grasses in steep slope of more than 35% slope in all blocks.
3. Promotion of plantation of mulberry, wild fruit plants and fodder trees (*Griwia, Alnus, Celtis, Oak, Buransh,Kaafal etc.*) in all blocks.
4. Regular maintenance of soil bunds to save excessive loss of nutrients and minimize the water loss in wasteland in all blocks.
5. Popularization of V- notch, trenches or silages for percolation of water to avoid surface run off in all blocks .
6. Construction of Loose check dam in gullies/ nalas, check dams in rivers/nalas, and desired

artificial structure to maximize water percolation rate in marginal and denudated areas in all blocks.
7. Construction of tank for storage of water for lean season in all blocks.
8. Development of pasture and drinking ponds for animals on waste land at nyaypanchayat level.
9. Establishment of waste water treatment plants based on phycoremediation technique at sewer drainage points.

**Strategy 6 : Reduced cultivation cost**

**Promotion of different techniques to reduce cultivation cost in all blocks such as:**

1. Promotion of well decomposed FYM, self prepared vermicompost and biofertilizers to minimize the use of costly chemical fertilizers.
2. Promotion of line/cross sowing and recommended dose of 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. Adoption of Power tillers/ Power weeders, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/operated threshers.
7. Promotion of mulching (bio or degradable plastic) in vegetables and fruits to maintain moisture and reduce intercultural operation cost.
8. Promotion of pressurized irrigation techniques in horticultural crops.
9. Promotion of tillers and other garden tools (serrated sickle, wheel hoe, handle fork, handle kutla) for reduction of drudgery.

**Strategy 7 : Off-farm income**

1. Promotion of subsidiary occupations like handicraft articles (aipen, squash, Rambaans products, pickles, mushroom production, home made/ valueadded products (bari, papad, namkeen, biscuit), copper/ iron utensils .
2. Promotion of sericulture in all blocks.
3. Promotion of cultivation and collection of medicinal plants in all blocks.
4. Promotion of skill development in women and youth in all blocks.
5. Promotion of textile based articles.

**Strategy 8 : Enabling Policies**

1. Increasing institutional support by providing subsidises and incentives to small and marginal farmers.
2. Labelling of organic inputs and certification mechanism for various crops.
3. Popularization of Udhyan and Krishak Cards for widespread use of government incentives/subsidies to farmers.
4. Establishment of wood bank at *Shaharphatak and Chaubatiya areas* to meet the present and future demand of germplasm in horticultural crops.
5. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
6. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
7. Compulsion of Soil Health Card Scheme, Kisan Credit Card and Crop Insurance for all farmers.

**Strategy 9 :Marketing and value addition in specific agro-ecological region**

1. Creation of better transportation facilities with cool chain van at Block level (particularly vegetable/fruit/ floriculture).
2. Establishment of collection center of fruit/ vegetable processing unit (Saharfatak, Tarikhet, Dhauladevi) and its direct linkage with food processing industries for better prices.
3. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.

4. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
5. Installation of mini grading machines at village level.

7. Establishment of cold room in different clusters e.g. *Shaharfathak, Chaubatia, Dunagiri, Jageshwar* areas

**Strategy 10 : Online Management and Evaluation**

1. Strengthening of internet connectivity.
2. Development of Mobile apps/ software for online management and evaluation at district level.
3. Development of e-Marketing and kiosk at district level to have information of surplus commodities at block level.
4. Organization of monthly review meeting at district to solve the problems related with farmers.
5. Promotion of use of radio, TV talks and Whatsapp etc. for effective implementation of program.