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

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

**A.General information about Agroeco-region**

**District:** Bageshwar

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

**Main Blocks in Region:** 3 (Bageshwar, Garur & Kapkot)

**Main village cluster in blocks:**

**Irrigated Clusters:** Billona mandalsera, Amsarkot and Rithagarh ghati in Bageshwar Block, Katyurghati and Kamsyar ghati in Garur Block, Majhkhet and Bhanar ghati in Kapkot Block (1000m to 2000m above msl).

**Rainfed Clusters:** Kanda area, Supi, Shama, Reema Bohla Devaldhar Khanker areas etc.

**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
7. Very less facilities are available in the district

**B. Productivity Enhancement**

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

1. Low cost lining material to check seepage
2. Efficient water application systems (sprinkler and drip)
3. Rejuvenation and popularisation of traditional water harvesting systems
4. Cost effective lifting devices
5. Roof top water harvesting system

**2. Existing practices for soil health improvement**

1. Use of FYM, Vermi-compost. Bio- fertilizers for soil health improvement.
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
7. Soil health card scheme launched in 2015

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

**Cereals and oilseeds**

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

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

**Pulses**

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. Low availability of Phosphorus in soil can be mitigated by use of Di ammonium phosphate (DAP) or Zinc phosphate application.

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

1. High yielding (HY) crops varieties were adapted in irrigated areas while drought resistant crop varieties were demonstrated in rain fed areas.
2. Mostly rainfed agriculture with low cropping intensity
3. Mainly field crops like rice, wheat, barley, potato are grown.
4. Growing of vegetable and horticultural crops over small scattered regions

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

1. Full package of practices should be given during demonstration of HY crop varieties for getting optimum production.
2. The climatic projection suggests increasing air temperature and erratic distribution of rainfall. Therefore following strategy should be followed to increased income under changing climatic scenario.
3. The coverage of GKMS should be increased for enabling farmers to take farm decisions as per ensuing weather conditions.
4. In event of erratic distribution of rainfall (approximately 1500 mm per annum) it should be properly conserved and harvested in (In polythene, to make bund).
5. The southern area (specially valley region of Bageshwar and Garur) is suitable for cultivation of subtropical fruit crops such as Mango, Litchi and Guava.
6. Area with 10-30% slope (Kapkote) should be used for cultivation of temperate horticultural fruits like Apple, peach, pear, plum, apricot, walnut etc.
7. Micro irrigation technique should be encouraged for enhancing water use efficiency.
8. In order to minimize the impact of hail storms in mango and litchi the canopy geometry should be managed in a way that upper portion (one third) of tree should bear least fruit and bottom (one third) and middle portion (one third) should bear maximum fruits.
9. Upland rice should be replaced by horse gram and buckwheat.

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

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

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

Region A:VL Gehun 829, VL Gehun 892, VL Gehun 907, VL Gehun 953 and UP 2572

Region B: VL Gehun 832, VL Gehun 829, VL Gehun 892, VL Gehun 907, VL Gehun 953, HS 507, HPW 349 and UP 2572

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

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

1. **Wheat-POP-** seed rate 100kg/ha, Line to line distance 23cm, right time for sowing –15th October to 15th November, Fertilizer requirement- N-P-K: 60-30-20kg/ha (For rainfed) and N-P-K: 120-60-40kg/ha(For irrigated condition)
2. Most of the farmers using their own produced seed, Farmers do not applied proper dose of fertilizers, farmers also not adopting proper plant protection measures and effective herbicide for weed management. Use of undecomposed FYM.

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

1. Use of HYV seed with seed rate 100kg/ha, Line to line distance 23cm, right time for sowing – 15th October to 15th November, Fertilizer requirement- N-P-K: 60-30-20kg/ha (For rainfed) and N-P-K: 120-60-40kg/ha(For irrigated condition) For ranunculus spp. weeds specially prevalent in irrigated areas can be controlled by use Pendamethiline @3Lit/ha before seed germination and Metsulfuron/sulphosulfuron @ 8gm/acre after 30 to 45 days after sowing.
2. Application of proper seeds rate to maintain optimum crop density.
3. Promotion of inter/mix cropping with other crops to minimize the loss of crop failure in case of drought.
4. Proper weed management, proper monitoring and management of insect and pest.
5. Besides the above measure need to create irrigation facilities by construction of water harvesting tank.
6. Balanced use of nutrients to be applied in the soil as per the soil testing report.
7. Quality seed of high yielding varieties should be chosen after that seed must be treated with proper fungicide to check the various seed born disease.
8. Promotion of Cluster based farming in integrated approach, Proper Utilization of Fallow land by planting short duration pulse ,vegetable and other horticulture crops,

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

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

Aphids

**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 | |

**White grub**

For management of white grub, drenching of chlorpyriphos 1 ml per liter of water should be done. Light trap be used during adult emergence in the month of June-July for mass trapping.

**vii. Major disease associated with crop:** Yellow rust and loose Smut.

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

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

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

| Name of the Insecticides | (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 Insecticides | g/(Kg/lit.) | 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. |

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

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

**ix. Major weeds associated with crop:** *Ranunculus arvensis*, *Phalaris minor*, *Oxalis latifolia* etc.

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

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

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

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

**in specific agro-ecological region:**

1. For management of white grub, drenching of chlorpyriphos 1 ml per liter of water should be done.
2. Light trap be used during adult emergence in the month of June-July for mass trapping.

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

1. Most of the areas (>75%) are under rainfed condition.
2. Unfavourable environmental condition (hail storm, Frost, Heavy rainfall, drought etc.).

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

**i. Existing varieties being used:**

Region A: Pant dhan-11, Govind, HKR-47, Pant Dhan -6, VL-62, VL 91, VL-16, Sarju-52
Region B & Region C- VL- 81, Vl-82, Pant Dhan-10, Pant Dhan-12, VL-221, VL-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:**

Region A: VL Dhan 65, VL Dhan 85, VL Dhan 68 and Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355, Pusa Basmati 1509 & PRH 10

Region B: VL Dhan 65, Vivek Dhan 85 and Vivek Dhan154, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355, Pusa Basmati 1509 & PRH 10

Region C: VL Dhan 86

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

Seed rate 100kg/ha, Line to line distance 20cm, right time for sowing –First fortnight of June.

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

Paddy rainfed –Vivek Dhan 154

**POP1.-** seed rate 100kg/ha, Line to line distance 20cm, right time for sowing –First fortnight of June, Fertilizer requirement- N-P-K: 60-30-20kg/ha,

For weed control use Butachlore @1.5L/ha or Pendamethiline @3Lit/ha before seed germination.

**Paddy irrigated –- POP2** Vivek Dhan 62 & 85 and VL dhan 65 & 66 - seed rate 40kg/ha, Line to line distance 20cm, right time for sowing of nursery –First fortnight of May, Fertilizer requirement- N-P-K: 100-60-40kg/ha,

For weed control use Butachlore @1.5kg/ha after 2-3days of transplanting of nursery.

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

Stem borer, leaf folder, green leaf hopper, brown plant hopper

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

**Stem borer:**

1. In the stem borer endemic area raise the nursery away from light source.
2. Raise nursery in narrow strip and mechanically destroy egg masses and moths
3. Remove seedling with Stem borer eggs before transplanting.
4. Use nitrogenous fertilizer moderately and split the application of it over three growth stages to reduce the damage.
5. For the monitoring install the pheromone traps in the field at the rate of 3 trap per acre at a distance of 60 m in a triangular pattern and record the males trapped daily to access the peak population.
6. For the management of yellow stem borer through pheromone mediated mass trapping of male install the pheromone trap in field at the rate of 20 traps/ha in rows maintaining a distance of 20 and 25 meters between traps and rows, respectively. The traps in the first rows are installed 10 m inside from the boundary of the field. The traps are tied on 1.25-1.5m long straight bamboo sticks or poles with the help of jute or plastic strings.The lures containing 3 and 5 mg pheromone are changed after 3 and 4 week, respectively, whereas 10 mg lure work for whole season. Adjust the trap height at 0.5 m and 1.0 m in the early vegetative and reproductive stage of crop, respectively, or 30 cm above crop canopy in all the stages of the crop.To check the escape of

trapped males put a tea spoonful insecticidal dust in the polythene sleeve of dry sleeve trap. Dust is not required in funnel type trap. To Ascertain the quality use lures supplied by 2-3 manufacturers in alternate traps initially and after recording their performance replace the ineffective lures by highly effective lure. Relocate the traps displaced in bad weather and replace the polythene sleeve damaged by weather or animals.

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

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

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

**50 Days after tranplanting**

| **Name of the Insecticides** | **(gm/ml)/ha** | **Waiting period (days)** |
|---|---|---|
| Chlorantraniliprole 18.5 %SC | 150 | 47 |
| Fipronil 5% SC | 1000-1500 | 32 |
| Fipronil 80 %WG | 50-62.5 | 19 |
| Cartap hydrochloride 50 %SP | 1000 | 21 |
| Cartap hydrochloride 75 %SG | 425-500 | 35-89 |
| Flubendamide 39.35% SC | 50 | 40 |
| Flubendamide 20% WG | 125 | 30 |
| Thiacloprid 21.7 %SC | 500 | 30 |
| Acephate 75% SP | 666-1000 | 15 |
| Acephate 95 %SG | 592 | 30 |
| Chromafenozide 80% WP | 94-125 | 32 |
| Monocrotophos 36% SL | 1400 | |
| Chlorpyriphos 20 %EC | 2500 | 30 |
| Quinalphos 25% EC | 2000 | 40 |

| | | |
|---|---|---|
| Carbosulfon 25 %EC | 800-1000 | 14 |
| Chlorpyriphos 20% + Acetamiprid 0.4% EC | 2500 | 10 |
| Phosphamidon 40% + Imidachlorpid 2 %SP | 600-700 | 22 |
| Flubendamide 4%+ Buprofezin 20% SC | 175+700 | 30 |
| Flubendamide 3.5%+ Hexaconazole 5 %WG | 1000 | 20 |

**Bio-insecticides**

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

**Leaf folder:**

Following insecticides may be used to control leaf folders of rice

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

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

**50 Days after transplating**

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

**Bio-insecticides**

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

| | | |
|---|---|---|
| *Beauveria bassiana* 1.15%WP Strain BB-ICAR-RJP | 2500 | |
| *Beauveria bassiana* 1.15%WP Strain ICAR | 2500 | |

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

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

**Bio- insecticides**

| Name of the 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 | |

**Major disease associated with crop:** Blast, brown spot and false smut.

**vii. 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

$P_2O_5$= 60 kg/ha

$K_2O$ = 40 kg/ha

Zinc sulphate 25kg/ha

After 30 days crop stage Nitrogen= 50 kg/ha

At Panicle initiation = 40 kg/ha

**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 |

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

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

**Biofungicides**

| **Name of the Bio-Fungicides** | **(Kg)/ha** | **Treatment** |
|---|---|---|
| *Pseudomonas fluorescens* 1.5% WP (BIL-331 Accession No. MTCC 5866) | 2.5 Kg/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 |

**viii. Major weeds associated with crop:** *Echinochloa crusgali*, *Setaria* sp. and *Cyperus* sp. etc.

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

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

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

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

**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) |

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

1. Sowing of compatiable cropping pattern under irrigated condition.
2. Need of agriculture diversification with horticultural crops along with live stocks management.
3. Adoption of proper cropping pattern,

4. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop, Cluster based farming, Inter cropping,

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

1. Most of the areas (>75%) are under rainfed condition.
2. Unfavourable environmental condition (hail storm, Frost, Heavy rainfall, drought etc.).

**6C. Name of Field Crop: Barley**

**i. Existing varieties being used:** Region A, B &C: Azad, Jagriti, PRB-502, HBL-113

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

Region A: VL Jau 118 and VLB 94

Region B & C: VL Jau 118 and VLB 94

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

**Barley-POP**

1. Seed rate 100kg/ha,
2. Line to line distance 23cm,
3. Right time for sowing –15$^{th}$ October to 15$^{th}$ November,
4. Fertilizer requirement- N-P-K: 40-20-20kg/ha.

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

1. Use of HYV seed with seed rate 100kg/ha,
2. Line to line distance 23cm, right time for sowing –15$^{th}$ October to 15$^{th}$ November,
3. Fertilizer requirement- N-P-K: 40-20-20kg/ha
4. For control of weeds Isoproturon @1 kg/ha after 35days after sowing.

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

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

**Barley aphid: *Macrosiphum* sp.)**

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

**White grub:**

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

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

Flag smut

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

**Flag smut: *Urocystis agropyri* or *U. tritici***

| Name of the Fungicides | (gm/ml)/ha | Waiting period (days) |
|---|---|---|
| Thiram 75% WS (Seed Treatment/Kg) | 2.5-3.0 | 7-10 |
| Tebuconazole 2% DAS | 1.00 | |

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

*Ranunculus arvensis, Phalaris minor, Oxalis latifolia* etc.

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

**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 |

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

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

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

1. Most of the areas (>75%) are under rainfed condition.
2. Unfavourable environmental condition (hail storm, Frost, Heavy rainfall, drought etc.).

**6D. Name of Field Crop: Ragi (Finger millet)**

**i. Existing varieties being used:** Region A, B & C: PRM-1, VLM 149, VLM 315, VLM176, PM3, VLM 146.

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

Region A: VL Mandua 324, VL Mandua 352
Region B: VL Mandua 324, VL Mandua 352, , PRM1
Region C: VL Mandua 352 and PRM1

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

1. Seed rate 10kg/ha,
2. Line to line distance 20cm,
3. Right time for sowing –First fortnight of June,
4. Fertilizer requirement- N-P-K: 40-20-20kg/ha.

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

1. Use of HYV seed with seed rate 10kg/ha,
2. Line to line distance 20cm, right time for sowing –01$^{st}$ June to 15$^{th}$ June,
3. Fertilizer requirement- N-P-K: 40-20-20kg/ha
4. For control of weeds Isoproturon @0.75 kg/ha after 30-35 days after sowing.

**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, cartap 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:** Broad leaf and narrow leaf weeds

**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. Need of agriculture diversification with horticultural crops along with live stocks management.
2. Adoption of proper cropping pattern,
3. Utilization of fallow land left after harvesting of main crop by growing short duration vegetables, oilseeds and pulse crop, Cluster based farming,
4. Inter cropping.
5. 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,
4. Lack of awareness about pest and disease management among farmers,
5. Difficulties to use heavy modern agriculture implement due to hilly terrain.
6. Proper marketing of agriculture produce is not available,
7. Crop damaged by wild animals, agriculture
8. Depends on rain,
9. Scattered agriculture land,
10. Migration and lack of interest in agriculture.

**6E. 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:**

Region A, B & C: PRJ-1,VL Madira 172 and VL Madira 207

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

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

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

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

**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:** Blight, smut

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

Smut

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

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

**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. Organic cultivation,
2. Adoption of low-cost based cultivation practices,
3. Barnyardmillet- Wheat/Lentil/Barley/oat (fodder) (rainfed),
4. Gapfilling
5. Timely Sowing, Seed treatment,
6. Use of HYV, Gapfilling/Transplating
7. Contour cultivation and care soil & water conservation measures
8. Maximum use of value added compost/FYM
9. INM 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 specially from border area,
6. Poor Irrigation facilities

**6F.Name of Field Crop : Maize**

**i. Existing varieties being used:** Region A, B & C: Kanchan, VL-Maize 16, VL-Maize 88, Navin, Shweta

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

Region A, B & C: Vivek Sankul Makka 31, Vivek QPM 9, Vivek Maize Hybrid 45, Vivek Maize Hybrid 53 upto 2000m amsl

**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. Green manuring must be followed before two months of sowing. Moong can be grown during summer season to improve the soil health.
2. Line planting be done to minimize weed infestation, incidence of pests and diseases and for ideal vegetative growth of the plants. Sowing should be done in Ist fortnight of June in plains and hills of state.
3. Water harvesting tank need to be created in rain fed areas to provide timely irrigation.
4. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.
5. Quality seed of high yielding varieties should be preferred after that seed must be treated with

carbendazim 2 g per kg of seed before sowing.

6. In order to avoid lodging problem in hilly areas, hybrids such as 9164 having dwarf in nature and provide yield up to 25 Q per acre should be preferred for commercial cultivation.

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

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

**Maize stem borer: *Chilo partellus***

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

For management of white grub, chlorpyriphos 2 ml per liter of water can be applied in the root zone of the plant on need basis.

**vii. Major disease associated with crop:** Blight, Ergot

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

For management of blight, cymoxanil + carbendazim @ 2 g per liter of water may be applied according to need.

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

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

**ix. Major weeds associated with crop:** *Echinochloa,, Setaria glauca, Makoi laptocloa*, sedges

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

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

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

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

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

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

**Region A:**

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

**Region B & Region C:**

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,

4. Lack of awareness about pest and disease management among farmers,
5. Difficulties to use heavy modern agriculture implement due to hilly terrain.
6. Proper marketing of agriculture produce is not available,
7. Crop damaged by wild animals,
8. Agriculture depends on rain, scattered agriculture land,
9. Migration and lack of interest in agriculture.

**7A. Name of the Pulse Crop : Pigeon pea**

**i. Existing varieties being used:** Region A, B & C: VL arhar 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:**

Region A, B & C: VL arhar 1

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

1. Seed rate 20kg/ha,
2. Line to line distance 45x20 cm,
3. Right time for sowing –20$^{th}$ May to 10$^{th}$ June,
4. Fertilizer requirement- N-P-K: 20-40-20kg/ha.

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

1. Use of HYV seed with seed rate 20kg/ha,
2. Line to line distance 45x20cm,
3. Right time for sowing –20$^{th}$ May to 10$^{th}$ June,
4. Fertilizer requirement- N-P-K: 20-40-20kg/ha
5. For control of weeds pendamethline @ 03 lit/ha before germination.

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

Spotted pod borer(*Maruca vitrata*), Pod borer (*Helicoverpa armigera*), Pod fly (*Melanagromyza obtusa*), Bugs, (*Clavigralla gibossa* and *Nezara viridula)*

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

1. Deep ploughing in summer
2. Intercrop with sorghum for reducing *Helicoverpa armigera*.
3. Early planting (mid- June) for avoiding peak infestation period of *H. armigera* on short duration crop
4. Planting of tall sorghum /maize varieties on borders for conserving natural enemies. These plants also function as live perches for predatory bird.
5. First spray of *Ha* NPV@ 500 LE per ha or *B.t*. 1 kg/ha followed by second spray of NSKE5% followed by third spray of indoxacarb 15.8 EC, 400 -500 ml or spinosad 45 SC, 125 ml/ha at a interval of 12-15 days (when 2-3 egg or one larva)

**Pod borer: *Helicoverpa armigera*)**

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

| | | |
|---|---|---|
| Lambda cyhalothrin 5% EC | 400-500 | 15 |
| Monocrotophos 36% SL | 1250 | |
| Quinalphos 25% EC | 1400 | |

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

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

**vii. Major disease associated with crop:** 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 on need basis
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, Cluster based farming, Inter cropping.
4. Needs to promote local germplasm.

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

**Region A:**

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

**Region B & Region C:**

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,
4. Lack of awareness about pest and disease management among farmers,
5. Difficulties to use heavy modern agriculture implement due to hilly terrain.
6. Proper marketing of agriculture produce is not available,
7. Crop damaged by wild animals, agriculture depends on rain, scattered agriculture land,
8. Migration and lack of interest in agriculture.

**7B. Name of the Pulse Crop : Chickpea**

**i. Existing varieties being used: Region A, B & C :** 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:**

**Region A, B & C:** 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. It is also observed that due to lack of knowledge, most of the farmers adopt improper plant protection measures.

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

1. Use of 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.
2. Seed treatment with *Rhizobium* and P.S.B. Proper application of compost and farm yard manure.
3. Sowing in line must be promoted for proper intercultural operations.
4. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
5. Arrangement of irrigation facilities in case of drought should be available.
6. 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; *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.

**Pod borer: *Helicoverpa armigera***

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

**Bio-insecticides**

| **Name of the Bio-Insecticides** | **(gm/ml)/ha** |
|---|---|
| *Bacillus thuringiensis* var kurstaki 0.5% WP serotype 3a,3b,3c, Strain | 2000 |

| | |
|---|---|
| DOR Bt-1 | |
| *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):**

**Blast disease:**

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

**Yellow mosaic disease**

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, Cluster based farming, Inter cropping.
4. Needs to promote local germplasm.

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

Region A:

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.

Region B & Region C:

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

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

**i. Existing varieties being used:**

**Region A, B & C: N**arendra 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:**

**Region A, B & C:** 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, 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 II$^{nd}$ fortnight of may to first week of July.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and 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 :**

**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 on need basis
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, Cluster based farming, Inter cropping.
4. Needs to promote local germplasm.

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

**Region A:**

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.

**Region B & Region C:**

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

**7D. Name of Pulse Crop: Moong**

**i. Existing varieties being used: Region A, B & C :** 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: Region A, B & C :** 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,
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 II$^{nd}$ fortnight of June to first week of July.
2. Use of quality seed of high yielding varieties should be preferred after that seed must be treated before sowing to avoid the incidence of various seed born disease.
3. Seed treatment with *Rhizobium* and P.S.B.
4. Proper application of compost and farm yard manure.
5. Sowing in line must be promoted for proper intercultural operations.
6. To minimize weed infestation proper management of weed must be done, incidence of pests and diseases should be taken care properly.
7. Arrangement of irrigation facilities in case of drought should be available.
8. Balanced use of nutrients to be applied in the soil as per the soil testing analysis.

**v. Major insect pests associated with crop:** 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 on need basis
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, Cluster based farming, Inter cropping.
4. Needs to promote local germplasm.

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

**Region A:**

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.

**Region B & C:**

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

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

**i. Existing varieties being used:** Region A, B & C: VL soya 47, VL soya 63 and VL bhatt 65

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

Region A, B & C: VLS 47, VL Soya 63 and VL Soya 65

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

**POP-**

1. Seed rate 75kg/ha,
2. Line to line distance 45x7.5cm,
3. Right time for sowing –First fort night of June.

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

POP-

1. Seed rate 75kg/ha,
2. Line to line distance 45x7.5cm,
3. Right time for sowing –First fort night of June,
4. Fertilizer requirement- N-P-K: 20-80-40kg/ha.
5. For weed control use Alachlore@2kg/ha before seed germination.

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

Hairy grub, defoliators, stem fly, leaf minor, girdle beetle, white fly, jassids etc.

**vi. IPM Module for Management of Insect Pests:**

**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 pest | Insecticide | Dosage |
|---|---|---|
| Sucking pests, stem fly | Thiamethoxam 30 FS (Seed treatment) | 10ml/kg seed |
| Sucking pests | Acetamiprid 20 SP | 100 ml/ha |
| Sucking pests | Spiromesifen 22.9 SC | 600ml/ha |
| Sucking pests | Imidacloprid 17.8 SL | 500 ml//ha |
| Sucking pests and girdle beetle | Triazophos 40 EC | 800ml/ha |
| Defoliators | Dichlorovos 76EC | 500 ml/ha |
| Defoliators and pod borer | Quinalphos 25 EC | 1500 ml/ha |
| Sucking pests and defoliators | Monocrotophos 36 SL | 800 ml/ha |
| Pod borer | Indoxacarb 15.8EC | 333 ml/ha |
| Defoliators, stem fly and girdle beetle | Chlorantraniliprole 18.5 SC | 150 ml/ha |
| Leaf miner | Carbaryl 50WP | 2.0 kg/ha |
| Leaf miner and sucking pests | Oxydemeton methyl 25EC | 350 ml/ha |
| Girdle beetle | Phorate 10 G | 10 kg/ha |
| Stemfly and girdle beetle | Carbofuran 3 G | 30 kg/ha |

**Bio-insecticides**

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

| 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:** Frog eye leaf disease

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

1. Use of resistant varieties and recommended dose of fungicides.
2. Maintain proper drainage condition in field.

**ix. Major weeds associated with crop**

Setaria, Cyprus, Galinsoga parviflora etc.

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

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. 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, Cluster based farming, Inter cropping.
3. Needs to promote local germplasm.

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

1. Most of the areas (>75%) are under rainfed condition.
2. Unfavourable environmental condition (hail storm, Frost, Heavy rainfall, drought etc.).

**7F. Name of the Pulse Crop : Toria/sarson**

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

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

PT-303,507,Uttara, PPS-1

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

Traditional seed variety , un decomposed FYM 1.5-2.0qt./nail, 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:**
   ***Toria***: Last week of September.
   **Yellow *sarson* & *rai* (Mustard)**: First fortnight of October.
4. **Seed treatment**
   Seed treatment: Apron 35 SD @ 5g/kg. Only certified seeds should be used.

5. **Seed rate and spacing:**

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

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

6. **Thinning:** About 20-25 days after sowing maintaining a plant to plant space of 10 cm. The thinned out plants could be used as **green forage**.

**7. Nutrient management:**

i. Vermicompost: 5t/ha or FYM: 10t/ha at the time of field preparation about 20 days before sowing.

ii. Excess use of nitrogenous fertilizers should be avoided.

iii. **Nitrogen:** 120kg/ha **;** 60-80 kg/ha for *toria* **;** Half of the N as basal and remaining half be top dressed about 25- 30DAS

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

v. **Potassium**: 20 kg/ha as basal

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

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

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

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

**Mustard aphid: *Lipaphis erysimi***

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

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

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

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

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

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

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

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

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

**White rust : *Albugo candida***

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

| | | |
|---|---|---|
| Metalaxyl 4%+ Mancozeb 64% WP | 2500 | 60 |

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

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

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

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

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

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

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

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

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

1. Less availability of agriculture inputs, use of imbalance and un decomposed FYM, climate changing, Wild animal damages
2. Migration specially from border area, Poor Irrigation facilities

**8A. Name of the Fruit crop : Mango**

**i. Existing varieties being used:** Seedlings origin ,Dashehari, Langra, Chausa, & local varieties

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

Dashehri, Langda, Chausa, Bombay Green, Amrapali, Mallika, Pusa Surya, Pusa Arunima & Arunika.

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

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

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

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

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

Leaf Hopper, mango stem borer, mealy bug, shoot gall, fruit fly.

**vi. IPM Module for Management of Insect Pests:**

**Mango Hopper:**

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

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

**Mango mealy bug:**

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

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

**Mango shoot gall:**

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

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

**Mango fruit fly:**

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

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

**Mango stem borer:**

1. Pruning of old infested branches.

2. Scraping the loose bark to prevent oviposition by adult beetles.
3. Insert cotton plug soaked in kerosene or petrol.

**vii. Major disease associated with crop:** Powdery mildew, dieback, shooty mould, bacterial canker, anthracnose, internal necrosis.

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

**Powdery mildew: *Oidium mangiferae***

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

**Anthracnose: *Colletotrichum gloeosporioids***

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

**ix. Major weeds associated with crop**

*Chenopodium album, Ciprus rotundus, Cynodon dactylon, Parthenium, etc.*

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

Hand weeding and adoption of other IPM modules

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

1. Intercropping with cowpea (Kharif) and mustard (rabi) in newly orchards and turmeric in bearing orchards
2. In the beginning period of newly established orchard (10yrs), the filler crops like papaya, guava, low chill peaches in plains while cultivation of vegetable crops i.e. potato, peas, urd, moong and beans etc in hills.

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

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

**8B. Name of the Fruit Crop : Citrus**

**i. Existing varieties being used:** Seedling origin, Malta, Kinno, Hill lemon, Santra etc.

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

Blood red malta, Uttaranchali kagzi, Pant lemon-1, Grafted / budded planting material available in the State and outside State.

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

1. FYM manuring
2. Rainfed farming mostly.

3. Lack of irrigation facilities.
4. Least emphasis on cultural operations.
5. Less awareness of IPM and INM.

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

1. Use of balanced organic and chemical fertilization , Basin preparation, removal of over fibrous roots, use of micronutrients (Cu, Zn)
2. Irrigation Facilities
3. Canopy Management.
4. Integrated nutrient management is required.
5. Introduction of Quality planting material.
6. Cultural practices.

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

Citrus psylla, **Lemon** butterfly, citrus black fly, scale insect

**vi. IPM Module for Management of Insect Pests:**

**Citrus psylla**

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

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

**Lemon butterfly:**

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

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

**Citrus white flies:**

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

**Scale insects:**

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

**Citrus leaf miner: *Phyllocnistis citrella***

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

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

Canker , Dieback, Gummosis

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

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

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

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

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

**ix. Major weeds associated with crop**

*Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium, etc.*

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

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

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

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

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

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

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

| | | |
|---|---|---|
| Mesoulfuron methyl 3%+ Iodosulfuron methyl 0.6 %WG | 400 | 96 |
| Sulfosulfuran 75%+Metsulfuron methyl 5%WG | 40 | 110 |

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

1. Proper Canopy Management (Training and Pruning)
2. Spraying schedule is required to avoid the diseases and pest in orchard.
3. INM modules to overcome the early senility of plants.

PHM & marketing to be enhanced.

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

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

**8C. Name of the Fruit Crop : Guava**

**i. Existing varieties being used:** Seedling origin, Allahabad Safeda , Lucknow-49

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

L- 49, Pant Prabhat, Allahabad Safeda, Lucknow-49, Lalit, Sweta and Allahabad Surkha.

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

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

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

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

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

Fruit fly, guava fruit borer

**vi. IPM Module for Management of Insect Pests:**

**Guava fruit borer/ castor capsule borer:**

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

**Guava fruit fly:**

1. Cover fruits with paper bags in small orchards.
2. Removal and destruction the infested fruits regularly.
3. Pomegranate should not be cultivated close to guava as this is the most preferred host of this pest.
4. Remove weeds of compositae family.

Detect early infestation by Installing light trap @ 1/acre to monitor and mechanical collection of insects. Monitor adult fruit flies emergence by using methyl eugenol/ sex pheromone traps. First spray Deltamethrin @ .0025% + Molasses0.1%. Second spray after 10-12 days with Dimethoate @ 0.045% + molasses 0.1%.

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

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

1. Use of COC for Anthracnose and canker.
2. Spraying of di thane M-45, Dithane Z-78 carbendazim etc. for fungal diseases.

**ix. Major weeds associated with crop**

*Chenopodium album, Cyperus rotundus, Cynodon dactylon, Parthenium, etc.*

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

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

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

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

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

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

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

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

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

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

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

**8D. Name of the Fruit Crop : Peach**

**i. Existing varieties being used:** Alexander, Alberta, Saharanpur Prabhat ,Red June , FLA-1633

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

Red june, Alexander, Alberta, Saharanpur Prabhat ,Red June , FLA-1633 ,Nectarine, Paradelux

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

1. Manual training and pruning
2. Use of traditional measures for applying the nutrients.
3. Nutrient application without proper soil testing.
4. No proper scientific approach for digging the pits for new orchard establishment.
5. Rainfed farming of apple.

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

1. Adaptation of advance technology for training and pruning.
2. Training of farmers regarding holistic approach of apple cultivation.
3. Moisture conservation through poly mulching sheets.
4. Creation of water bodies for irrigational means.
5. Adequate use of available water through micro irrigation system.
6. Plantation of adequate no. of pollinizing varieties during layout of orchard.
7. Promotion of other means of pollinating agent to enhance the yield.
8. Use of anti hail net.
9. High and ultra high density plantation is required.
10. Promotion of organic apple cultivation.

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

San jose scale, tent caterpillar, codling moth, peach leaf curl aphid, 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, peach leaf curl (taphrina)

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

Clean the weeping wounds during dormancy, apply chaubatia paste at affected sites,
Spray Streptocycline (1 g/ 10 l) before mansoon, spray copper oxy chloride (3 g/l) after leaf fall.

**Peach leaf curl**

| Name of the Fungicides | (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**

Through mechanical, chemical control.

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

1. Intercropping of leguminous crops like rajma, bhat and gahat crops etc.
2. Cultivation of potato as inter crop during the period of beginning of orchard.
3. Cultivation of some vegetable crops as an intercrops i.e. cabbage cauliflower , French bean etc.

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

1. Excess Rainfall, adverse weather during season hits the spraying schedule of apple.
2. Negligence of drainage cause 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.

**8E. Name of the Fruit Crop : Pear**

**i. Existing varieties being used:** Gola, Victoria, China, Baggugosha, Kashmiri, Thumb pear etc.

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

Max Bartlette, Red Bartlette, Willium, Starkrimson, Hokoi, Sukoi (Low Hills)

**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 36strengthened.
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 curl aphid, 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 Herbicides** | **(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**

Mechanical 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

**8F. Name of the 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
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:**

High density plantation with drip irrigation system.

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

San jose scale, tent caterpillar, coddling moth, peach curl aphid, peach frui 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 Insecicides | (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**

Mechanical control.

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

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

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

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

**9A. Name of the vegetable crop: Cabbage**

**i. Existing varieties being used:**

Use of high yielding cultivars with and suitable placement of pollinizer in high density planations with sufficent irrigation facility as drip for establishment of model and commercial orchards.

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

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

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

Diamond black moth,cabbage butterfly,Aphid and *Helicoverpa*

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

i. 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 Bio-Insecticides | (gm/ml)/ha | Waiting period (days) |
|---|---|---|
| Azadirachtin 0.03% WSP (Neem oil based) | 2500-5000 | 7 |

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

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

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

1. For *Sclerotenia* stem rot - Summer deep ploughing ,burn the infected crop debris,two spray at 10-12 days interval of carbendazim @ 1.0 gm / litre
2. *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.
3. Downy Mildew - Burn the infected crop debris,spray of mencozeb @ 2.5 gm/litre at initial stage of disease appearance.

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

*Parthenium, Chenopodium album*, Krishnil, Teepatiya

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

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

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

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

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

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

**9B. Name of 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:**

Region A- 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.
Region B-(Partial irrigated)
Mid- Snow crown
Late- Pusa Snowball-16, PSBK-1, PSBK-25, Pusa Hybrid-2.
Region C- (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
8. Region A- Early: May- June; Mid: July – Aug; Late: Oct
   Region B -Early: May- June (Irrigated condition); Mid: June- July; Late: Aug – Mid Sept
   Region C -June-July (Rainfed)
9. Cultivars-In cauliflower, there are three group of varieties as early, medium and late. Due to unawareness farmers sow the seeds of early variety in late and late in early season so as a result there will not be curd formation.
10. Transplanting- Farmers practices improper planting distance.
11. Manures and fertilizers- Farmers incorporated cow dung in immature stages in the field.
12. Irrigation- Farmers do not apply water in the field at proper stage of the crop.
13. Weed control- Farmer generally not aware about the proper stage of weed elimination from the field as well as losses takes place in the crop.
14. Harvesting- The harvesting/ picking should not follow as per maturity standards or as per object

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

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

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

Diamond black moth, Aphid

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

**Before Planting**

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

**After Planting**

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

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

| Name of 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 |

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

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

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

1. For *Sclerotenia* stem rot - Summer deep ploughing ,burn the infected crop debris,two spray at 10-12 days interval of carbendazim @ 1.0 gm / litre
2. *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.
3. Downy Mildew - Burn the infected crop debris,spray of mencozeb @ 2.5 gm/litre at initial stage of disease appearance.

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

*Parthenium, Chenopodium album*, Krishnil, Teepatiya

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

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

**9C. Name of the vegetable crop: Radish**

**i. Existing varieties being used:**

Mixture of varieties from unknown source

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

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

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

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

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

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.
   Region A: Sept- Dec
   Region B: Sept- Oct
   Region C: June-Aug
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:**

Aphid

**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:**

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:**

Farmers should be adopted intensification of the crop such as he should grow at least 3-4 crops in a year

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

1. Lack of Irrigation facilities
2. Lack of improved varieties.
3. Abundance of wild animal.

**9D. Name of the vegetable crop: Tomato**

**i. Existing varieties being used:**

Private company varieties like Himsona, Rakshhak etc.in all zones.

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

**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. Balanced nutrient fertilization, area specific time of planting
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:**
Pod borer,Fruit fly,White fly

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

**i. 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 |

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

Late blight, Early blight,Buck eye rot,Bacterial wilt and Powdery mildew

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

**Frout rot or Buck eye rot:** ***Phytophthora parasitica***

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

**Early blight:** ***Alternaria solani***

| Name of the Fungicides | (gm/ml)/ha | Waiting period (days) |
|---|---|---|
| Azoxystrobin 23% SC | 500 | 3 |
| Pyraclostrobin 20% WG | 375-500 | 3 |
| Iprodione 50% WP | 1500 | 15 |
| Kitazin 48% EC | 1000 | 5 |
| Mancozeb 75% WP | 1000 | 5-6 |

| | | |
|---|---|---|
| Mancozeb 35% SC | 0.5% | 10 |
| Metiram 70% WG | 2500 | 6 |
| Metiram 55% + Pyraclostrobin 5% WG | 1500-1750 | 5 |
| Famoxadone 16.6%+ Cymoxanil 22.1% SC | 500 | 3 |
| Zineb 75% WP | 1500-2000 | |
| Ziram 80% WP | 1500-2000 | 3 |
| Captan 50% WP | 2500 | |
| Copperoxychloride 50% WP | 1250 | |
| Azoxystrobin 18.2%+ Difenoconazole 18.2% SC | 0.1% | 5 |

**Late blight:** ***Phytopthora infestans***

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

**Bacterial wilt-** use crop rotation of maize,wheat and mustard,deep ploughing,keep proper drainage of water in field,drenching of 30 gm COC +1.0 gm Streptocyclin + 10 litre of water.

**Powdery mildew-** spray of wettable sulphur 3.0 gm/L or Karathen @ 0.5 ML/L of water.

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

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

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

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

**9E. Name of the vegetable crop: Potato**

**i. Existing varieties being used:**

Region A: K. Bahar, K Badshah and Kufri Jyoti
Region B : Tumari Local and Kufri Jyoti
Region C: Tumari Local and Kufri Jyoti

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

Region A: K. Khyati, K. Pukhraj K. Ashok, K. Sadabahar, K. Anand, etc
Region B: K Jyoti, K. Ashok , K. Himsona
Region C: K Girdhari, K Himalini and K. Shailja

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

1. Planting time:
   Region A (up to 1000 m): October
   Region B (1000-1500) : Feb-March
   Region C (1500-2400): March-April
2. Spacing: 50-60 x 15-20 cm
3. Seed rate: 25-30 qtl/ha
4. Farmers are only using FYM along with urea at hills but the farmers in plains are using FYM + 160:100:120kg/ha NPK.

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

1. Region C: 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.
2. Dehaulming practise should be adopted for long duration storage of tubers.
3. Suitable fungicides should be used for control of Late blight disease e.g. mancozeb, cardendazim alone and in combination.
4. Balanced nutrient fertilization, area specific time of planting, mulching with farm resedues

**v.Major insect pests associated with crop:** Potato butterfly, aphid, Epilachna beetle, Cut worm,Termite,white grub

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

**Cut worm -** Use light trap at night,drenching of Chlorpyriphos @ 3.0 ml/L

**Termite-** deep ploughing,seed treatment with Chlorpyriphos and drenching of Chlorpyriphos @ 5 ml/L

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

**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

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**Aphids: *Myzus persicae***

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

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

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

**vii. Major disease associated with crop:** Early blight,Late blight,Bacterial rot

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

**Early blight of potato: *Alternaria solani***

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Chlorothaonil 75% WP (per lit. water) | 0.875-1.250 | 14 |
| Kitazin 48% EC | 0.20% | 48 |
| Hexaconazole 2% SC | 3000 | 21 |
| Mancozeb 75% WP | 1500-2000 | |
| Propineb 70% WP | 0.30% | 15 |
| Zineb 75% WP | 1500-2000 | |
| Captan 50% WP | 2500 | |
| Ziram 80% WP | 1500-2000 | 3 |
| Copperoxychloride 50% WP | 1250 | |
| Captan 70%+Hexaconazole 5% WP | 500-1000 | 21 |

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

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

| Name of the Fungicides | (gm/ml) /ha | Waiting period (days) |
|---|---|---|
| Cyazafamid 34.5% SC | 200 | 27 |
| Chlorothaonil 75% WP (per lit. water) | 0.875-1.250 | 14 |
| Azoxystrobin 23% SC | 500 | 12 |
| Mandipropamid 23.4% SC (per lit. water) | 0.8 | 40 |
| Propineb 70% WP | 0.30% | 15 |
| Captan 50% WG | 1500 | 21 |
| Captan 75% WP | 1667 | 8 |
| Copperoxychloride 50% WP | 1250 | |
| Copperhydroxide 53.8% DF | 1500 | 22 |
| Dimethomorph 50% WP | 1000 | 16 |
| Hexaconazole 2% SC | 3000 | 21 |

| | | |
|---|---|---|
| Mancozeb 75% WP | 1500-2000 | |
| Zineb 75% WP | 1500-2000 | |
| Metalaxyl 8%+ Mancozeb 64%WP | 2500 | 49 |
| Metalaxyl 4%+ Mancozeb 64%WP | 2500 | 24 |
| Capatan70%+ Hexaconazole 5% WP | 500-1000 | 21 |
| Carbendazim 25%+ Mancozeb 50%WS | 0.6-0.7/Kg | Seed Treatment |
| Cymoxanil 8%8% +Mancozeb 64%WP | 1500 | 10 |
| Famoxadone 16.6%+Cymoxamil 22.1% SC | 500 | 40 |
| Fenamidone 10%+ Mancozeb 50% WG | 1250-1500 | 30 |
| Metiram 55%+ Pyraclostrobin 5% WG | 1500-1750 | 15 |
| Metalaxyl 3.3%+ Chlorothanil 33.1% SC | 0.02% | 34 |

**ix. Major weeds associated with crop:** *Anagallis arvensis, Convolvulus arvensis, Cyperus rotundus, Fagopyrum* sp.

**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 |

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

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

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

**9F. Name of the vegetable crop: Pea**

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

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

Region A & C: Vivek Matar 10 & 12

Region B: Vivek Matar 10 & 11

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

1. Sowing by broadcasting method, no seed treatment, using ownsaved seeds to grow crop.
2. Nursery Management.
3. Preparation of field.
4. Earthing of plant.
5. Plant protection measures.
6. Irrigation through gal and sense with sprinkler.
7. Injudicious use of pesticides

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:
   Region A: Oct & Mid Nov
   Reigion B: Nov- Dec
   Region C: Mid Aug
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:** Pod borer, Aphid

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

Pod borer - release of *Tricogramma* spp insect eggs @ 50000 / ha at the time of initation of flowering to 7- 10 days,spray of profenophos @ 2.0 ml/L or indoxacarb @ 1.0 ml/L of water.
Aphid- Spray of imidacloprid @ 0.3 ml/L or Acitamprid @0.3 gm /L of water

vii. **Major disease associated with crop:** *Scleretonia* white rot,Powdery mildew

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

***Scleretonia* white rot** Use crop rotation,keep recommended plant to plant distance for proper aeration,early plantation may escape the disease,spray of carbendazim @ 1.0 gm /L

**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 alexendrium , Cyperus rotundus, Cynodon dactylon, Fagopyrum* species

x. **IPM Module for management of weeds:** Pre-emergence spray of Pendamethalin @ 750 ml ai in 700-750 l water/ ha

xi. **Specific workable and sustainable intensification capable of doubling agricultural income in specific agro-ecological region:** In addition to normal sowing time, grow early season pea also at mid- higher (1600-2000 m amsl) that get ready in Oct- Nov.

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

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

**9G. Name of the vegetable crop: Leafy vegetables**

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

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

Palak- All Green, Pusa Harit
Methi- Pant Ragini, Pusa Early Bunching and Kasuri Selection
Amaranth- Chhoti Chaulai, Badi Chaulai, Pusa Kiriti,
Pusa Kiran and Pusa Lal Chaulai.

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

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

1. Seed- Farmers should use improved varieties/ hybrids of leafy vegetables
2. Seed Treatment- to protect crops from different diseases, farmers must treat the seed by Captan @ 2g/kg of seed or Carbandazim @2g/kg of seed or T*richoderma viride* 4g/kg before sowing of seeds.
3. Seed sowing: Seed is sown by line sowing method
4. Seed Rate- It is recommended to use the seed quantity for different as follows-
   Palak- winter crop-10-15 kg seeds/ha
   Summer crop-25-30 kg/ha
   Methi- direct sowing -20-30 kg/ha
   Amaranthus
   direct sowing-2kg/ha
5. Transplanting- 1kg/ha
6. Spacing: sowing of seed should be done at proper spacing
   Palak: Row to Row- 20cm and plant to plant -5cm
   Methi: Row to Row-20-30 cm and plant to plant 10-15cm Amaranth: Row to Row-20-30 cm and plant to plant-10 cm
7. Manures and fertilizers- Farmers should incorporate well rotten cow dung (10-15 tonnes/ha) and NPK (50: 50:20). On the basis of soil testing. Top dressing of nitrogen after each cutting.
8. Application of Vermicompost @ 5qt/ha in the field is beneficial for leafy vegetables
9. Cutting: cutting should be done at proper stage at 25-30 days after sowing.

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

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

**vii. Major disease associated with crop:** Leaf spot, White rust, Downey Mildew

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

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

Palak- jangli palak( Rumex acutus)
senji( *Melilotus alba)*
Amaranthus- Jungli Chauli( *A. viridis*) kataili chauli, Bathua

**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. Follow deep summer / winter ploughing

2. Line sowing should be prefer
3. Follow proper crop rotation
4. Use of improve varieties of leafy vegetable
5. Timely weeding and hoeing should be done
6. Timely cuttings of leaves

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

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

**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:** 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:** Farmers are not aware

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

**xii. Production constraints in agro-ecological region:** Disease and insect pest problem.

**C1. Livestock: Cattle**

**1.A Existing breeds available:** Jersey cross, HF cross , Red Sindhi graded, Sahiwal Graded, Badri

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

1. Jersey breed needs to be promoted through sexed semen.
2. Jersey Bulls for natural insemination in remote hilly areas.
3. Buffalo bulls for natural insemination in remote hilly areas

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

1. There is no specially trained staff and techniques to calculate the exact availability of Tree leaves, Grasses, perennial herbs and seasonal fodder crops. Therfore the exact deficiency can't be calculated.
2. However as per prevailing practices and facts, there is a deficiency of fodder to the magnitude of about 30 percent approximately.
3. Rural woman go to the forests and remote areas to collect Local Jungle grasses and tree leaves.
4. Hay made from local jungle grasses, Wheat straw and paddy straw is being used to feed in lean period.
5. Compact feed blocks available from deptt. Fodder banks are also used.
6. Concept of balanced concentrate feeding is not clear, as a result livestock owners usually feed only wheat husk to the livestock. Some aware farmers feed locally available Black beans etc. to include protein in animals's diet.

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

1. Compact feed block supply needs to be strenghthened, it would be helpful to give some subsidy in price of CFB and transport subsidy should be continued.
2. Forest grazing rules needs to be more flexible for Goatary farmers.
3. Fodder seed distribution programme should be strenghthened.
4. More fodder development programmes in the van panchayats, community lands, barren lands, etc should be introduced with the help of community participation.
5. Special attention to strengthen the irrigation system and revival of old natural water sources would be highly appreciated.
6. Special wing of agriculture graduates, for fodder development needs to be created for implementations of such programmes and fodder development schemes.

**3.A Existing health services:**

Diseases covered under vaccination: HS, BQ, FMD, Rabies, FMD CP programme.

Deworming schedule: Dewormers are provided in hospitals as well as through camps to make sure that deworming is done in every three months

Other Disease Control Programs/ Health Camps (criteria, target): ASCAD programme, Infertility camps at Hospitals and villages.

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

1. Because of lack of staff, Duration of time for which this programme is being run needs to be extended.
2. Provision of full staff and Mobile treatment vehicle should be done.
3. More ambulatory clinics are required in hills.

**4.A Existing management practices:**

1. Stall fed system and grazing systems are being adopted.
2. Housing is of primitive type at high altitude areas with animals on ground floor and family on first floor.
3. The floor of the animals shed are kachcha type with no facility for drainage of excreta, thus making the animals prone to infectious diseases.
4. Many sheep farmers move to high altitude pasture lands for approx. 06 month with their sheep flocks and then come back to native places for another 06 months

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

1. More coverage of cattle shed renovation, goat shelter, poultry she4d programmes should be taken up under the MGNAREGA.
2. Departmental schemes to be framed in convergence with MGNAREGA.
3. More awareness camps for farmers to be organized.
4. Extension of best management practices should be encouraged.
5. Mobile dipping tanks should be introduced for migratory sheep/goat owners.
6. Backyard poultry scheme should be drastically changed to make it sustainable and should be opened to all weaker sections of society.

**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: Buffalo**

**1.A Existing breeds available:** Graded Murrah

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

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

1. There is no specially trained staff and techniques to calculate the exact availability of Tree leaves, Grasses,perennial herbs and seasonal fodder crops. Therfore the exact deficiency can't be calculated.

2. However as per prevailing practices and facts , there is a deficiency of fodder to the magnitude of about 30 percent approximately.
3. Rural woman go to the forests and remote areas to collect Local Jungle grasse and tree leaves.
4. Hay made from local jungle grasses, Wheat straw and paddy straw is being used to feed in lean period.
5. Compact feed blocks available from deptt. Fodder banks are also used.
6. Concept of balanced concentrate feeding is not clear, as a result livestock owners usually feed only wheat husk to the livestock. Some aware farmers feed locally available Black beans etc. to include protein in animals's diet.

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

1. Compact feed block supply needs to be strenghthened, it would be helpful to give some subsidy in price of CFB and transport subsidy should be continued.
2. Forest grazing rules needs to be more flexible for Goatary farmers.
3. Fodder seed distribution programme should be strenghthened.
4. More fodder development programmes in the van panchayats, community lands, barren lands, etc should be introduced with the help of community participation.
5. Special attention to strengthen the irrigation system and revival of old natural water sources would be highly appreciated.
6. Special wing of agriculture graduates, for fodder development needs to be created for implementations of such programmes and fodder development schemes.

**3.A Existing health services:**

Diseases covered under vaccination: HS, BQ, FMD, Rabies, FMD CP programme.

Deworming schedule: Dewormers are provided in hospitals as well as through camps to make sure that deworming is done in every three months

Other Disease Control Programs/ Health Camps (criteria, target): ASCAD programme, Infertility camps at Hospitals and villages

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

1. Because of lack of staff, Duration of time for which this programme is being run needs to be extended.
2. Provision of full staff and Mobile treatment vehicle should be done.
3. More ambulatory clinics are required in hills.

**4.A Existing management practices:**

1. Stall fed system and grazing systems are being adopted.
2. Housing is of primitive type at high altitude areas with animals on ground floor and family on first floor.
3. The floor of the animals shed are kachcha type with no facility for drainage of excreta, thus making the animals prone to infectious diseases.

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

1. More coverage of Buffalo shed renovation, goath shelter, programmes should be taken up
2. More awareness camps for farmers to be organized.
3. Extension of best management practices should be encouraged.

**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:** Rambouillet cross, Merino cross, Kashmir Merino , Local Rampur bushair cross.

**1.B Specific breeds to be introduced:** Rambouillet and Russian Merino

**2.A Existing feeds being used:** Rural woman go to the forests and remote areas to collect Local Jungle grasse and tree leaves

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

1. Forest grazing rules needs to be more flexible for Goatary farmers.
2. Fodder seed distribution programme should be strenghthened.
3. More fodder development programmes in the van panchayats, community lands, barren lands, etc should be introduced with the help of community participation.
4. Special attention to strengthen the irrigation system and revival of old natural water sources would be highly appreciated.

**3.A Existing health services:**

Housing, hygiene, drainage: PPR vaccination is carried out thoroughly in the area

Feeding & watering practice: Dewormers are provided in hospitals as well as through camps to make sure that deworming is done in every three months.

Other Disease Control Programs/Health Camps (criteria, target): Sheep shows are carried out every year

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

1. Lack of staffs limits the programme
2. Because of lack of staff and convenience vehicle there are limitations

**4.A Existing management practices:**

Housing, hygiene, drainage: Primitive type housing.

Feeding & watering practice: Open grazing on pasture lands is practiced. Stall feeding of tree leaves is also practiced.

Shearing, etc.Normally shearing with hands wiyh the help of scissors is done. ( Manual shearing)

Welfare aspects: Earlier the department of A.H. used to run some schemes related to Life Insurance of Sheep owners and Scholarship to their children, but these schemes are not available these days. These schemes must be revived.

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

1. Dipping tanks/mobile dipping tanks are must for the sheep owners.
2. Some schemes to be introduced for construction of new technologically fit housing of sheep.

**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:** Barbari, gaddi, jamunapari,chaugrakha

**1.B Specific breeds to be introduced:** Promotion of Barbari breed and local chaugarakha

**2.A Existing feeds being used:** Rural woman go to the forests and remote areas to collect Local Jungle grasse and tree leaves.

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

1. Forest grazing rules needs to be more flexible for Goatary farmers.
2. Fodder seed distribution programme should be strenghthened.
3. More fodder development programmes in the van panchayats, community lands, barren lands, etc should be introduced with the help of community participation.
4. Special attention to strengthen the irrigation system and revival of old natural water sources would be highly appreciated.

**3.A Existing health services:**

Diseases covered under vaccination: PPR vaccination is carried out thoroughly in the area

Deworming schedule: Dewormers are provided in hospitals as well as through camps to make sure that deworming is done in every three months.

Other Disease Control Programmes/ Health Camps: Sheep shows are carried out every year

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

1. Lack of staffs limits the programme
2. Because of lack of staff and convenience vehicle there are limitations

**4.A Existing management practices:**

Housing, hygiene, drainage: Primitive type housing.

Feeding & watering practice: Open grazing on pasture lands is practiced. Stall feeding of tree leaves is also practiced.

Shearing, etc.: Normally shearing with hands wiyh the help of scissors is done. ( Manual shearing)

Welfare aspects: Earlier the department of A.H. used to run some schemes related to Life Insurance of Sheep owners and Scholarship to their children, but these schemes are not available these days. These schemes must be revived.

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

1. Dipping tanks/mobile dipping tanks are must for the goat owners.
2. Some schemes to be introduced for construction of new technologically fit housing of goat

**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:** Less productive local breeds & Poor nutritional and health management.

**C5. Livestock: Poultry**

**1.A Existing breeds available:** Croiler/Broiler and layers

**1.B Specific breeds to be introduced:** Croiler should be promoted.

**2.A Existing feeds being used:** As there are no big poultry farms in the Bageshwar district, and most of the poultry is being reared as backyard poultry in small batches of 50 birds, there is no shortage of poultry feed.

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

1. Small scale industries for manufacturing of poultry feed need to be promoted.
2. The availability of finance is the main problem.
3. Banks and financial institutions should be sensitized to make the bank loans easily available to the entrepreneurs

**3.A Existing health services:**

Farmers do not consider deworming as an important part of poultry rearing, though should be carried out on regular basis for healthy growth of the flock.

**3.B Specific health services to be required/ advised for doubling income in specific agro-ecological region:** Because of lack of staff and convenience vehicle there are limitations

**4.A Existing management practices:**

Housing, hygiene, drainage: Mostly Backyard poultry with no proper housing system.

Feeding & watering practice: Backyard type, no proper system.

Slaughtering & dressing, etc: No mechanized slaughter houses available. Slaughtering and dressing is done at the sale point.

Welfare aspects: No welfare programmes available.

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

A big change is required for poultry production in form of providing easy and cheap loans, good extension practices for training, quality treatment and vaccination.

**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:** Less productive local breeds, Poor nutritional and health management.

**Problems of Animal Husbandry**

| | | |
|---|---|---|
| Specific problems due to which income is not increasing | Poor accessibility | 1. Because of non availability of proper marketing facilities for animal produce, people generally rare the livestock for their own requirement and there is lack of zeal to adopt the animal husbandary as prime source of income.<br>2. Decreasing availability of irrigation water affecting fodder production<br>3. Monkey and wild pigs menace.<br>4. Abundance of unskilled para veterinary staff causing irreparable loss of livestock health, thus decreasing production.<br>5. Need of specific area based schemes for providing loans for livestock farming. Provision of loans for livestock farmers will have to be implemented properly and for this cooperation of banking sector is highly required. |
| | Water scarcity | |
| | Natural disasters | |
| | Wild life conflicts | |
| | Marketing of animals | |
| | Marketing of products | |
| | Budget | |
| | Manpower shortage | |
| | Capacity building | |
| | Equipment & Implements (old/ shortage, etc.) | |
| | Mobility | |
| | Risk cover (Insurance) | |
| | 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:**

Following Integrated farming system model may be developed:

**Cropping system (Area 4000m$^2$)**

Rice - Wheat
Maize- Wheat
Horse gram/ Pigeon pea – Lentil
Tomato/ Capsicum – Vegetable Pea
Okra – Potato

**Horticulture**

Mango/Guava/ Lemon (100 plants)

**Livestock**

Cow (01)/ Buffalo(01) + Backyard Poultry (100)

**Others**

Vermi-composting (20m$^2$)

1. Fodder production in terrace risers and bunds.

Region B

**Cropping system (Area 4000m$^2$)**

Rice - Wheat
Maize- Wheat
Horse gram/ Pigeon pea – Lentil
Tomato/ Capsicum – Vegetable Pea
Okra – Potato

**Horticulture**

Citrus fruits (100 plants)

**Livestock**

Cow (01)/ Buffalo(01) + Backyard Poultry (100)

**Others**

Vermi-composting ($20m^2$)

Fodder production in terrace risers and bunds.

**Region C**

**Cropping system (Area $4000m^2$)**

Soybean – Lentil

Cole Crops – Vegatable pea

Maize- Potato

Pea - Wheat

**Horticulture**

Kiwi & Pear fruits (100 plants)

**Livestock**

Cow (01) + Sheep(10)

**Others**

Bee Keeping and poly tunnels for nursery raising

Vermi-composting ($20m^2$)

**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:**

**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
10. Sugarcane crusher, open pan evaporator, moulds for jaggery, packaging unit at village level

**For horticultural crops:**

1. Destoner, pulper, juicer, pasteurizer, open pan evaporator at village level for particular commodity
2. Minimal processing unit for particular commodity

3. Drying unit for particular commodity
4. Canning and bottling unit at district level for particular commodity
5. Maintaining cold chain from farm to folk (depending upon the commodity)

**3.A Existing packing facilities:** 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

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

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

**For grain**:

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

**For Horticultural crop:**

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

**F. Waste land development and waste water**

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

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

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

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

**2.A Existing plantation:** Plantation on eroded/waste lands

**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:**

**Tall fescue**

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

**Rye grass**

1. Seed rate( Kg/ha)- 18-20
2. Spacing (cm)- 30cm x 10cm
3. Sowing time- Onset of monsoon (rainfed) and February to July (Irrigated)
4. Fertilizer management- 30:50:40::N:P205:K20kg/ha (Basal) + 30kg N after each cut
5. Irrigation management- Crop must be irrigated after each cut provided water is available
6. Harvesting management- First cut at 60-65 days after planting and subsequent cuts at 30 days interval.

**White clover**

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

**Red clover**

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

interval.

**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. Effluent from industries
3. 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.
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,Maize-Potato/Lentil/ Mustard / Lahi/Capsicum**

1. Annexure–II is enclosed for N,P and K.
2. In Zn deficient soils, application of 25 (sandy loam)- 50 (Clay loam) kg $ZnSO_4$ (21% Zn) /ha or foliar spray of 0.5% $ZnSO_4$ + 0.25% lime in standing crop
3. Foliar spray of 1% $FeSO_4$ in rice nursery and maize.
4. In Mn deficient soils, application of 30 kg $MnSO_4$/ha, if Mn deficiency exist in field or two foliar spray of 0.5% $MnSO_4$ + 0.25% lime before first irrigation and one month after .
5. Soil application of 215 kg gypsum/ha, if S deficiency exist in field.

**Tomato/Cabbage/Green Pea/French bean/ Okra**

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. In Mn deficient soils, application of 20 kg $MnSO_4$/ha, if Mn deficiency exist in field or two foliar spray of 0.5% $MnSO_4$ + 0.25% lime
3. Foliar spray of 1% $FeSO_4$

**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.

**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 Implements

**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 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.

**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.

**High Hills**

1. Encourage use of well decomposed organic manures and biofertilizers; avoid excessive use of chemical fertilizers.
2. Reduce the dose of chemical fertilizers and avoid broadcasting of chemical fertilizers preferably spraying method should be followed for application of N and micronutrients.
3. Encourage furrow application of P and K fertilizer and half dose of nitrogenous fertilizers at sowing based on soil test value.
4. Need based application of insecticides and pesticides, preferably enhanced the use of bio-agents; avoid the use of costly chemicals.
5. Follow line sowing of seed instead of broadcasting.
6. Encourage water harvest technology for irrigation.
7. Sprinkler and drip method for irrigation should be encouraged to improve water use efficiency.
8. Use of mulches and available composts/organic manures
9. Follow contour farming and grow perennial fodder crop on bunds to check soil erosion.
10. Promote reduced tillage operations.

**Factors responsible for increasing cost of cultivation**

1. No proper and timely supply of water in canal and govt. owned tube well systems under irrigated condition.
2. Faulty roistering system of water.

3. Unavailability of farm labourers in agricultural operations during sowing to harvesting of crops.
4. Non availability of farm machinery, tools and implements for small and marginal farmers.
5. Gentle to moderate slopes(1-2%) in farm land causing surface runoff of soil and nutrients.
6. Timely non availability of farm inputs viz., HYV seeds, N:P:K fertilizers, micronutrient containing fertilizers, low cost FYM, vermi compost, pesticides and effective insecticides.
7. Application of high rate of fertilizer without knowing the nutrient status of their soil.
8. Non/inadequate application of FYM/Vermi compost.
9. Negligence among farmers for testing of their soils for soil health and application as per crop needs.
10. Non availability of mobile soil testing labs van for spot testing of their soils.
11. No efficient irrigation and fertigation system in orchards.
12. No proper drainage system on farm lands of small and marginal farmers.
13. Lack of storage facilities (cold rooms and houses) and processing units for their produce.
14. Involvement of middle man in crop trading system.
15. Lack of interest among govt. machinery for dissemination of technologies, input and subsidies to small and marginal farmers.
16. Heterogeneous soils – soils of each situation differ widely in their physical, physio-chemical characteristics as they are developed from a variety of rocks and minerals under joint influence of vegetation, physiography and climate.
17. Sloping lands with high rate of removal of soil and nutrients from surface through erosion resulting to depletion of soil fertility.
18. Scattered holding and marginal land size.
19. 90 % of area of mid and high hills is rainfed.
20. High rates of migration from hills to plains of males and young boys in search of jobs.
21. Women based farming system without technical know – how and inputs.
22. Low efficiency of conventional farm tools and implement.
23. Indigenous breed of livestock with low production and working efficiency.
24. 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.
25. 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.
26. Minimum use of fertilizers: farmers are mostly small and marginal economically backward, not able to apply recommended dosses of fertilizers. The average consumption is < 10 kg N:P:K.
27. Non availability of quality seeds of varieties recommended for rainfed upland situations.
28. The inputs are costly and therefore the small and marginal farmers are not able to adopt the improved technology.
29. Non availability of inputs at right time and right place.
30. 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.
31. Farmers follow practice of dry sowing. In such situation the seeds are eaten by birds and grubs resulting in inadequate plant population.
32. Due to limited moisture and nutrient supply the growth of crops is not proper and vegetative phase of growth (flowering and fruiting) are advanced.
33. Improper/Inadequate 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.
34. 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 reach of the farmers. Beside, non availability of water for solution also pose problems.

35. 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 %.
36. Improper terrace management: most of terraces developed by farmers are on steep slopes with outward gradient.
37. Lack of proper drainage system for safe disposal of excess rainwater. The heavy runoff of water washes away the top fertile soil leady to steady depletion of nutrients and organic matter.
38. Coarse textured soils (charty/gravely) with low moisture and nutrient retention capacity.
39. Lack of proper storage facilities for crops (cold storage).
40. 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.
41. No good marketing facilities.
42. Lack of proper irrigation facilities for minor irrigation and drip irrigation with fertigation.
43. Poor connectivity of road transport system.
44. Lack of farmer's participatory 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:** Less in number

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

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

**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:**

Dairy, aipan designing, handloom weaving

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

1. Survey need to be conducted regarding locally available crops, fruits, vegetables and other things.
2. On the basis of these enterprise can be generated. Aipan designing can be promoted in cloth, paper in the form of greeting cards, envelops, calenders etc. That has market value at national and international level.

**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:**

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

**4.A Existing women skilling facilities:** Educational institute and NGOs

**4.B Women skilling 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

**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:**

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 Bageshwar, 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 |
| 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:**

mid hills (1000-1500m): Sept. – Nov.& Feb.-April (02 crop)

high hills (1500-2400m): Feb.-Nov. (03 crops)

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

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

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

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

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

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

**Harvesting of crop:** Pin head initiation takes place after 12-18 days of casing and the fruiting bodies of the mushroom can be harvested for around 50-60 days. The crops should be harvested

before the gills open as this may decrease its quality and market value.

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

**2. Oyster mushroom**

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

**Steps of cultivation process**

**Substrate and its preparation**

The tropical wastes like rice straw, wheat straw, corncobs, dried water hyacinth, sugarcane bagasse, banana leaves, cotton waste or sawdust are used as substrate for cultivation. The straw should be cut into small pieces (3-5cm long) to facilitate proper wetting as well as to increase surface area. Although this mushroom can be cultivated on simple water soaked straw but there are chances of crop failure due to presence of contaminants. In order to avoid contaminations the straw should be treated by hot water and chemical.

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

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

**Proper timing for cultivation**

mid hills (1000-1500m) : March- May & July.-Sept (02 crop)

high hills (1500-2400m): May- Aug. (02 crops)

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

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

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

**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:**

mid hills (1000-1500m) : 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:** Dairy Development Board, KVK, NGOs

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

1. Expend application scientific methods and mechanized cultivation
2. Promotion of secondary agriculture
3. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.
4. Checking migration by attracting rural youth in agriculture.

**2.A Existing Institutions:** ICAR Institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK, NGOs

**2.B Institutions to be suggested for doubling income in the specific agro-ecological region of district:** ICAR Institutes, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Dairy Development Board, KVK, NGOs

**3.A Existing Incentives:**

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

1. KCC must be required for farmers to get subsidy.
2. The crop insurance under PMFBY may be linked with KCC accounts for automatic crop insurance.
3. Subsidised seeds and fertilizers should be provided and the subsidy amount may be transferred in KCC account of farmers.

**4.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 marketing

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

1. Mini mandies to be established at Block level.
2. Cooperative societies may become a tool of marketing channels.
3. Better transportation facilities with cold chain van may be provided at Block level.
4. Fish market, 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

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

1. Transportation problem during rainy season.
2. No government Cold Store is available where as Private cold store are available with higher storage charges.

**K. Online Management and Evaluation**

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

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

1. Mobile app. For Trout farming
2. 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:**

1. Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.
2. District level committees of State line departments with KVK experts may be formed for field and as well as online evaluation.

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

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

Mobile apps/ software for online management and evaluation may be developed and farmers as we well as concerned experts may be linked with it.

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

**4.B: Feedback system required for online management and evaluation in specific agro-climatic region of district:** District level committees of State line departments with KVK experts may be formed for field and as well as online feedback.

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

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

Reading manuals may be developed/ published for easy operation of Mobile apps/ software developed for online management and evaluation for farmers as we well as concerned experts linked with it.

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

**Region A upto 1000m**

**Strategy 1 : Productivity Enhancement**

**Introduction, adoption and popularization of high yielding varieties for increasing productivity**

1. Promotion of high yielding varieties of wheat (VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953 and UP 2572), paddy (VL *Dhan 65,* Vivek *Dhan 85 and* Vivek *Dhan154*, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355, Pusa Basmati 1509 & PRH 10,); Barely (VL Jau 118 and VL Jau 130); Amaranthus (VL *Chua* 44); Buckwheat (VL *Ugal* 7) in *Bageshwar, Kapkot* and *Garur* blocks.
2. Promotion of high yielding varieties of finger millets (VL *Mandua* 324, VL *Mandua* 352, VL *Mandua* 347, PRM1, VL *Mandua* 348) and Barnyard millet (PRJ-1,VL *Madira* 172 and VL *Madira* 207) in *Bageshwar, Kapkot* and *Garur* blocks.
3. Promotion of high yielding variety of lentil (VL *Masoor* 126, VL *Masoor* 507*,* VL *Masoor* 129), horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19), soybean (VL Soya 47, VL Soya 63 and VL Bhat 65) and Pigeon pea (VL *Arhar* 1) in *Bageshwar, Kapkot* and *Garur* blocks.
4. Promotion of high yielding varieties of vegetable pea (Vivek Mattar 10& 11), French bean (VL Boni Bean 1 & VL Bean 2), tomato (VL Tamatar 4), Onion (VL Piyaz 3) and garlic (VL Garlic

1) in *Bageshwar, Kapkot* and *Garur* blocks.

**Strengthening of traditional water storage structure**

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

**Adoption of cluster approach for holistic development**

1. Rejuvenation of existing senile orchards of mango in *Bageshwar* and *Garur* blocks.
2. Cultivation of Cinnemon (Tejpatta) plants at low hills in *Garur* block particularly Katyur cluster.
3. Promotion of ginger cultivation in all *blocks of the region*.
4. Promotion of organic cultivation of turmeric in *Bageshwar, Kapkot* and *Garur* block.
5. Promotion of onion and garlic cultivation in *Bageshwar* and *Garur* block.
6. Promotion of off season vegetables (tomato, capsicum, cole crops etc.,) cultivation in *Bageshwar, Kapkot* and *Garur* blocks.
7. Promotion of production of tomato cultivation in *Bageshwar, Kapkot* and *Garur* block with the use of proper crop rotation.
8. Promotion of production of vegetable pea, okra in *Bageshwar* and *Garur* block.
9. Promotion of production of pigeon pea in *Bageshwar, Kapkot* and *Garur* block.
10. Promotion of production of lentil in *Katyur* and *Gagrigol* cluster of *Garur* block; *Rithagarh valley* of *Bageshwar* block.
11. Promotion of organic production of basmati rice in *Katyur* cluster in *Garur* block, *Rithagarh, Billonasera* and *Mandalsera* clusters of *Bageshwar* block.

**Management of wild animal problem**

1. Promotion of live fencing of lime/ lemon at larger scale in fruit crops, ginger or turmeric in shady areas, Lemon grass to ward off wildlife in cultivated field.
2. Enacting legislative measures for protection of crop from wild animals.
3. Promotion of protected cultivation of vegetables (Tomato, Capsicum, Cabbage, Cauliflower and Cucumber) in *Bageshwar, Kapkot* and *Garur* block.
4. Promotion of cultivation of Kafal, Mango, Hishalu and other wild fruits in different pockets in forest areas for wild animals.

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

1. Popularization of multi crop thresher and Power Tiller/ Mini Tractor at Nyay Panchayat level in all the blocks.
2. Promotion of improved sickle, maize sheller, millet thresher & pearler for drudgery reduction of farm women in all the blocks of the region.

**Adoption of efficient irrigation techniques**

1. Surface irrigation in laser levelled land
2. Micro- irrigation system in Sugarcane, Mango, Litchi, Guava and in Vegetables
3. Drip Irrigation in Green House Cultivation for Cut Flowers and Vegetables

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

1. Popularization of soil testing in intensive mode and distribution of soil health card to farmers for judicious use of fertilisers.
2. Promotion of vermi composting unit and green manuring in all the villages of this region.
3. Promotion of cultivation of green manuring crops like Sesbania and Sunhemp in different blocks.
4. Organic cultivation of local grain and millets in different blocks

**Others**

1. Cluster approach for holistic development
2. Promotion of timely and local availability of high yielding varieties of all the cereal, pulse, High Value Crops like vegetable, fruits, spices, etc.
3. Cultivation of fodder crops & medicinal plants.
4. Adoption of only well decomposed FYM/ value added compost.
5. Promotion of efficient and timely use of IPM and IDM practices.
6. Compulsion of seed treatment through bio agent/ chemical in the cluster.
7. Adoption of moisture conservation practices.
8. Promotion to focus on timely weed management.

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

1. Promotion of high milk breeds of cows (Shaiwal, Red Sindhi & Jersey), buffaloes (Murrah) and goats (Beetal, Sirohi & Jamunapari) in *Bageshwar, Kapkot* and *Garur* block, while promotion of wool yielding breeds of sheep in Kapkot block.
2. Establishment of Fodder Bank in *Bageshwar, Kapkot* and *Garur* block to meet fodder requirement of area particularly during lean period.
3. Establishment of milk chilling plant at *Garur* and *Bageshwar* block.
4. Promotion of Urea, Molasses, and Mineral mixer blocks at *Nyaypanchayat* level.
5. Establishment of hatcheries for need of broilor or croilor at district level to meet out the requirement of chicks to the farmer's.
6. Strengthening of traditional water bodies/ rivulets with Mahaseer or carps at *Garur* block.
7. Availability of feed material with low prices & Timely health check-ups of animals.
8. Introduction and promotion of Cross bred milch breed of animal for increasing income of marginal farmer.

**Strategy 3 : Integrating Farming system**

Following Integrated farming system model may be developed:

**Cropping system (Area 4000m$^2$)**

Rice - Wheat
Maize- Wheat
Horse gram/ Pigeon pea – Lentil
Tomato/ Capsicum – Vegetable Pea
Okra – Potato

**Horticulture**

- Mango/Guava/ Lemon (100 plants)

**Livestock**

- Cow (01)/ Buffalo(01) + Backyard Poultry (100)

**Others**

- Vermi-composting (20m$^2$)

Fodder production in terrace risers and bunds.

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

1. Establishment of mini fruit grading plant for mango, pear and stone fruits at *Bageshwar, Kapkot* and *Garur* blocks.
2. Establishment of Food Processing Units for pear at *Garur,* mango at *Bageshwar* & Malta at *Kapkot* blocks.
3. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all the blocks.
4. Promotion of common resources on custom hire basis viz. Power tiller, Mini Thresher and other equipments at Nyay Panchayat level in *Bageshwar, Kapkot* and *Garur* blocks.
5. Tertiary and value addition of mango, citrus fruits, pear in *Bageshwar, Kapkot* and *Garur* blocks by establishment of small processing units.

6. Establishment of Food and Processing Units at *Bageshwar* for pickle making using wild *Aonla, mango & hill lemon*.
7. Promotion of common resources on custom hire basis viz. Power tiller in *Garur & Bageshawr* areas, Mini wheat and Paddy thresher in *Garur, Kapkot & Bageshwar* blocks.

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

1. Contour making for arable purpose in waste land in *Sama, Karmi* and other high hills areas.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in *Garur, Kapkot & Bageshwar* blocks.
3. Plantation of Mulberry plants, Wild fruit plants, Fodder trees (Bheemal, Utees, Oak etc.) may be promoted in *Garur, Kapkot & Bageshwar* blocks.
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland of all blocks.
5. Popularization of trenches or silages for percolation of water to avoid surface run off in *Garur, Kapkot & Bageshwar* blocks.
6. Construction of check dam and artificial structure to maximize water percolation rate in *Garur, Kapkot & Bageshwar* blocks.
7. Construction of tank for storage of water for lean season in all blocks.
8. Establishment of storage system for rain water in monsoon season.

**Strategy 6 : Reduced cultivation cost**

1. Promotion of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc.
2. Provision of mechanization (Use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers etc.)
3. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in *Garur, Kapkot & Bageshwar* blocks.
4. Promotion of line sowing and balanced fertilizers application in crops.
5. Promotion of recommended seed rate, spacing and depth.
6. Promotion of need based application of pesticides and other agricultural inputs. `
7. Promotion of hand tools in agricultural and horticultural operations.
8. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
9. Promotion of pressurized irrigation (Drip and Sprinkler Irrigation) techniques in horticultural crops.

**Strategy 7 : Off-farm income**

1. Promotion of apiculture/ sericulture/ mushroom for small and landless farmers in all blocks of Bageshwar district.
2. Promotion of cultivation and collection of medicinal plants in *Garur* and *Kapkot* blocks.
3. Promotion of skill development in women and youth in all three blocks.
4. Creation of new SHGs in other villages of three blocks.
5. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation, Ghee making & packing, etc. may be provided for better performance in all three blocks.

**Strategy 8 : Enabling Policies**

1. Land consolidation in Bageshwar district is essentially required.
2. Implementation of policies for control of wild animal menace in agricultural areas.
3. Implementation of Soil Health Card Scheme in each block.
4. Increasing institutional support by providing subsidises and incentives to small and marginal farmers in three blocks.
5. Labelling of organic inputs and certification mechanism for various crops in all three blocks.
6. Popularization of Udhyan and KCC for widespread use of government incentives/ subsidies to farmers.

7. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
8. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.

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

1. Establishment of mini *mandies* at Block level.
2. Creation of better transportation facilities with cool chain van at Block level.
3. Creation of direct linkages with food processing industries for better prices.
4. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
5. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
6. Installation of mini grading machines at village level.
7. Establishment of cold room in Garur and Bageshwar blocks.
8. Promotion of local *Hatt* at Tahsil level in all blocks.
9. Development of proper marketing network to check the interference of middle men in marketing of agricultural produce of the farmers.

**Strategy 10 : Online Management and Evaluation**

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

**Region: B (1000 to 1500 m)**

**Strategy 1 : Productivity Enhancement**

**Introduction, adoption and popularization of high yielding varieties for increasing productivity**

1. Promotion of high yielding varieties of wheat (VL *Gehun* 832, VL *Gehun* 829, VL *Gehun* 892, VL *Gehun* 907, VL *Gehun* 953 and UP 2572), paddy (VL *Dhan 65,* Vivek *Dhan 85 and* Vivek *Dhan154*, Pant Dhan-19, HKR-127, PB-1509, PA 6444, VNR 2355, Pusa Basmati 1509 & PRH 10,); Barely (VL Jau 118 and VL Jau 130); Amaranthus (VL *Chua* 44); Buckwheat (VL *Ugal* 7) in *Bageshwar, Kapkot* and *Garur* blocks.
2. Promotion of high yielding varieties of finger millets (VL *Mandua* 324, VL *Mandua* 352, VL *Mandua* 347, PRM1, VL *Mandua* 348) and Barnyard millet (PRJ-1, VL *Madira* 172 and VL *Madira* 207) in *Bageshwar, Kapkot* and *Garur* blocks.
3. Promotion of high yielding variety of lentil (VL *Masoor* 126, VL *Masoor* 507*,* VL *Masoor* 129), horse gram (VL *Gahat* 10, VL *Gahat* 15 and VL *Gahat* 19), soybean (VL Soya 47, VL Soya 63 and VL Bhat 65) and Pigeon pea (VL *Arhar* 1) in *Bageshwar, Kapkot* and *Garur* blocks.
4. Promotion of high yielding varieties of vegetable pea (Vivek Mattar 10& 11), French bean (VL Boni Bean 1 & VL Bean 2), tomato (VL Tamatar 4), Onion (VL Piyaz 3) and garlic (VL Garlic 1) in *Bageshwar, Kapkot* and *Garur* blocks.

**Strengthening of traditional water storage structure**

1. Strengthening of existing water storage structures like ponds, Naula and Check dam in most of the villages of all blocks of the region.
2. Creation of rain water harvesting structure in private as well as government buildings in all the villages of the region.
3. Creation of trenches for high percolation of water in most of the area of *Bageshwar, Kapkot* and *Garur* blocks.
4. Promotion of water conservation techniques like mulch, sprinkler and drip in juvenile plants in

low or valley areas of all the blocks of this region.

**Adoption of cluster approach for holistic development**

1. Cultivation of citrus fruit (lime/ lemon/ malta) plants at mid hills in *Garur and Kapkot* blocks.
2. Promotion of ginger cultivation in all *blocks of the region*.
3. Promotion of organic cultivation of turmeric in *Bageshwar, Kapkot* and *Garur* block.
4. Promotion of onion and garlic cultivation in *Bageshwar* and *Garur* block.
5. Promotion of off season vegetables (tomato, capsicum, cole crops etc.,) cultivation in *Kapkot* block.
6. Promotion of production of vegetable pea, okra in *Bageshwar* and *Garur* block.
7. Promotion of production of pigeon pea in *Bageshwar, Kapkot* and *Garur* block.
8. Promotion of production of lentil in Katyur and Gagrigol cluster of Garur block; Rithagarh vellay of Bageshwar block
9. Promotion of organic production of basmati rice in Katyur cluster in Garur block, Rithagarh, Billonasera and Mandalsera clusters of Bageshwar block.

**Management of wild animal problem**

1. Promotion of live fencing of lime/ lemon at larger scale in fruit crops, ginger or turmeric in shady areas, Lemon grass to ward off wildlife in cultivated field.
2. Enacting legislative measures for protection of crop from wild animals.
3. Promotion of protected cultivation of vegetables (Tomato, Capsicum, Cabbage, Cauliflower and Cucumber) in *Bageshwar, Kapkot* and *Garur* block
4. Promotion of cultivation of Kafal, Mango, Hishalu and other wild fruits in different pockets in forest areas for wild animals.

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

1. Popularization of multi crop thresher and Power Tiller/ Mini Tractor at Nyay Panchayat level in all the blocks.
2. Promotion of improved sickle, maize sheller, millet thresher & pearler for drudgery reduction of farm women in all the blocks of the region.

**Adoption of efficient irrigation techniques**

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available,
2. Drip Irrigation in integration with water harvesting structure where irrigation water is not available
3. Green House Cultivation for Vegetables

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

1. Popularization of soil testing in intensive mode and distribution of soil health card to farmers for judicious use of fertilisers.
2. Promotion of vermi composting unit and green manuring in all the villages of this region.
3. Promotion of cultivation of green manuring crops like Sesbania and Sunhemp in different blocks.
4. Organic cultivation of local grain and millets in different blocks.

**Others**

1. Cluster approach for holistic development.
2. Promotion of timely and local availability of high yielding varieties of all the cereal, pulse, High Value Crops like vegetable, fruits, spices, etc.
3. Cultivation of fodder crops & medicinal plants.
4. Adoption of only well decomposed FYM/ value added compost.
5. Adoption of efficient and timely use of IPM and IDM practices.
6. Compulsion of seed treatment through bio agent/ chemical in the cluster.
7. Promotion of moisture conservation practices.
8. Promotion to focus on timely weed management.

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

1. Promotion of high milk breeds of cows (Shaiwal, Red Sindhi & Jersey), buffaloes (Murrah) and

goats (Beetal, Sirohi & Jamunapari) in *Bageshwar, Kapkot* and *Garur* block, while promotion of wool yielding breeds of sheep in Kapkot block.

2. Establishment of Fodder Bank in *Bageshwar, Kapkot* and *Garur* block to meet fodder requirement of area particularly during lean period.
3. Establishment of milk chilling plant at *Garur* and *Bageshwar* block.
4. Promotion of Urea, Molasses, and Mineral mixer blocks at *Nyaypanchayat* level.
5. Establishment of hatcheries for need of broilor or croilor at district level to meet out the requirement of chicks to the farmer's.
6. Strengthening of traditional water bodies/ rivulets with Mahaseer or carps at *Garur* block.
7. Promotion of availability of feed material with low prices & timely health check-ups of animals.
8. Introduction and promotion of Cross breed and Milch breed of animal for increasing income of marginal farmer.

**Strategy 3 : Integrated Farming system**

Following Integrated farming system model may be developed:

**Cropping system (Area 4000m$^2$)**

Rice - Wheat
Maize- Wheat
Horse gram/ Pigeon pea – Lentil
Tomato/ Capsicum – Vegetable Pea
Okra – Potato

**Horticulture**

Citrus fruits (100 plants)

**Livestock**

Cow (01)/ Buffalo(01) + Backyard Poultry (100)

**Others**

Vermi-composting (20m$^2$)

Fodder production in terrace risers and bunds.

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

1. Establishment of mini fruit grading plant for mango, pear and stone fruits at *Bageshwar, Kapkot* and *Garur* blocks.
2. Establishment of Food Processing Units for pear at *Garur,* mango at *Bageshwar &* Malta at *Kapkot* blocks.
3. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all the blocks.
4. Promotion of common resources on custom hire basis viz. Power tiller, Mini Thresher and other equipments at Nyay Panchayat level in *Bageshwar, Kapkot* and *Garur* blocks.
5. Establishment of small processing units for tertiary and value addition of mango, citrus fruits, pear in *Bageshwar, Kapkot* and *Garur*.
6. Establishment of Food and Processing units at *Bageshwar* for pickle making using wild *Amla, mango & hill lemon*.
7. Promotion of common resources on custom hire basis viz. Power tiller in *Garur & Bageshawr* areas, Mini wheat and Paddy thresher in *Garur, Kapkot & Bageshwar* blocks.

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

1. Contour making for arable purpose in waste land in *Sama, Karmi* and other high hills areas.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in *Garur, Kapkot & Bageshwar* blocks.
3. Plantation of Mulberry plants, Wild fruit plants, Fodder trees (Bheemal, Utees, Oak etc.) may be promoted in *Garur, Kapkot & Bageshwar* blocks.
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland of all blocks.
5. Popularization of trenches or silages for percolation of water to avoid surface run off in *Garur,*

*Kapkot & Bageshwar* blocks.
6. Construction of check dam and artificial structure to maximize water percolation rate in *Garur, Kapkot & Bageshwar* blocks.
7. Construction of tank for storage of water for lean season in all blocks.
8. Establishment of storage system for rain water in monsoon season.

**Strategy 6 : Reduced cultivation cost**

1. Promotion of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc. may be provided.
2. Provision of mechanization (Use of Power tillers, Power weeders, Paddy threshers, Wheat threshers, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, Manual/ power operated Wheat/Paddy reapers etc.).
3. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in *Garur, Kapkot & Bageshwar* blocks.
4. Promotion of line sowing and balanced fertilizers application in crops.
5. Promotion of recommended seed rate, spacing and depth.
6. Promotion of need based application of pesticides and other agricultural inputs. `
7. Promotion of hand tools in agricultural and horticultural operations.
8. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
9. Promotion of pressurized irrigation (Drip and Sprinkler Irrigation) techniques in horticultural crops.

**Strategy 7 : Off-farm income**

1. Promotion of apiculture/ sericulture/ mushroom for small and landless farmers in all blocks of Bageshwar district.
2. Promotion of cultivation and collection of medicinal plants in *Garur* and *Kapkot* blocks.
3. Promotion of skill development in women and youth in all three blocks.
4. Creation of new SHGs in other villages of three blocks.
5. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation, Ghee making & packing, etc. may be provided for better performance in all three blocks.

**Strategy 8 : Enabling Policies**

1. Land consolidation in Bageshwar district is essentially required.
2. Policies must be implemented for control of wild animal menace in agricultural areas.
3. Implementation of Soil Health Card Scheme in each block.
4. Increasing institutional support by providing subsidises and incentives to small and marginal farmers in three blocks.
5. Labelling of organic inputs and certification mechanism for various crops in all three blocks.
6. Popularization of Udhyan and KCC for widespread use of government incentives/ subsidies to farmers.
7. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
8. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.

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

1. Installation of mini *mandies* at Block level.
2. Creation of better transportation facilities with cool chain van at Block level.
3. Creation of direct linkages with food processing industries for better prices.
4. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
5. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural

surplus with proper labelling.
6. Installation of mini grading machines at village level.
7. Establishment of cold room in Garur and Bageshwar blocks.
8. Promotion of local *Hatt* at Tahsil level in all blocks.
9. Development of proper marketing network to check the interference of middle men in marketing of agricultural produce of the farmers.

**Strategy 10 :Online Management and Evaluation**

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

**Region: C (1500 to 2400 m)**

**Strategy 1 : Productivity Enhancement**

**Introduction, adoption and popularization of high yielding varieties for increasing productivity**

1. Promotion of high yielding varieties of wheat (VL *Gehun* 832), paddy (Vivek *Dhan154*) in *Kapkot* and *Garur* blocks.
2. Promotion of high yielding varieties of finger millets (VL *Mandua* 347, VL *Mandua* 352 and PRM1), Barnyard millet (PRJ-1, VL *Madira* 172 and VL *Madira* 207) and in *Kapkot* and *Garur* blocks.
3. Promotion of high yielding variety of lentil (VL *Masoor* 126, VL *Masoor* 507*,* VL *Masoor* 129) and soybean (VL Soya 47, VL Soya 63 and VL Bhat 65) in *Kapkot* and *Garur* blocks.
4. Promotion of high yielding varieties of vegetable pea (Vivek Mattar 11 & 12), French bean (VL Bean 2), tomato (VL Tamatar 4), Onion (VL Piyaz 3) and garlic (VL Garlic 1) in *Kapkot* and *Garur* blocks.

**Strengthening of traditional water storage structure**

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

**Adoption of cluster approach for holistic development**

1. Cultivation of citrus fruit (lime/ lemon/ malta) plants, Kiwi (Allison/ Haward/ Monty + Tomari) at mid & high hills in *Garur and Kapkot* blocks.
2. Promotion of ginger cultivation in all *blocks of the region*.
3. Promotion of organic cultivation of turmeric in *Bageshwar, Kapkot* and *Garur* block.
4. Promotion of onion and garlic cultivation in *Bageshwar* and *Garur* block.
5. Promotion of off season vegetables (tomato, capsicum, cole crops etc.,) cultivation in *Kapkot* block.
6. Promotion of production of vegetable pea in *Kapkot* and *Garur* blocks.

**Management of wild animal problem**

1. Promotion of live fencing of lime/ lemon at larger scale in fruit crops, ginger or turmeric in shady areas, Lemon grass to ward off wildlife in cultivated field.
2. Enacting legislative measures for protection of crop from wild animals.
3. Promotion of protected cultivation of vegetables (Tomato, Capsicum, Cabbage, Cauliflower and

Cucumber) in *Bageshwar, Kapkot* and *Garur* block.

4. Promotion of cultivation of Kafal, Mango, Hishalu and other wild fruits in different pockets in forest areas for wild animals.
5. Promotion of chestnut and stone fruits.

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

1. Popularization of multi crop thresher and Power Tiller/ Mini Tractor at Nyay Panchayat level in all the blocks.
2. Promotion of improved sickle, maize sheller, millet thresher & pearler for drudgery reduction of farm women in all the blocks of the region.

**Adoption of efficient irrigation techniques**

1. Micro Irrigation (Drip and Sprinkler Irrigation) where water is available,
2. Drip Irrigation in integration with water harvesting structure where irrigation water is not available
3. Green House Cultivation for Vegetables

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

1. Popularization of soil testing in intensive mode and distribution of soil health card to farmers for judicious use of fertilisers.
2. Promotion of vermi composting unit and green manuring in all the villages of this region.
3. Promotion of cultivation of green manuring crops like Sesbania and Sunhemp in different blocks.
4. Organic cultivation of local grain and millets in different blocks.

**Others**

1. Cluster approach for holistic development.
2. Promotion of timely and local availability of high yielding varieties of all the cereal, pulse, High Value Crops like vegetable, fruits, spices, etc.
3. Cultivation of fodder crops & medicinal plants.
4. Adoption of only well decomposed FYM/ value added compost.
5. Promotion of efficient and timely use of IPM and IDM practices.
6. Compulsion of seed treatment through bio agent/ chemical in the cluster.
7. Adoption of moisture conservation practices.
8. Promotion to focus on timely weed management

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

1. Promotion and up-gradation of local breeds with high milking breeds of cows (Jersey & Holstein friesian), and goats (Sirohi) in *Bageshwar, Kapkot* and *Garur* block, while promotion of wool and meat yielding breeds of sheep (Rambouillet and marino) in Kapkot block.
2. Establishment of Fodder Bank in *Bageshwar, Kapkot* and *Garur* block to meet fodder requirement of area particularly during lean period.
3. Establishment of milk chilling plant at *Garur* and *Kapkot* block.
4. Promotion of Urea, Molasses, and Mineral mixer blocks at *Nyaypanchayat* level.
5. Establishment of hatcheries for need of broilor or croilor at district level to meet out the requirement of chicks to the farmer's.
6. Strengthening of traditional water bodies/ rivulets with Mahaseer, Rainbow trout *in Kapkot* block.
7. Promotion of availability of feed material with low prices & timely health check-ups of animals.
8. Introduction and promotion of Cross bred milch breed of animal for increasing income of marginal farmer.

**Strategy 3 : Integrated Farming system**

Following Integrated farming system model may be developed:

**Cropping system (Area 4000m$^2$)**

Soybean – Lentil

Cole Crops – Vegatable pea

Maize- Potato
Pea - Wheat

**Horticulture**

Kiwi & Pear fruits (100 plants)

**Livestock**

Cow (01) + Sheep(10)

**Others**

Bee Keeping and poly tunnels for nursery raising

Vermi-composting ($20m^2$)

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

1. Establishment of mini fruit grading plant for Kiwi, pear and stone fruits at *Kapkot* and *Garur* blocks.
2. Establishment of Food Processing Units for pear at *Garur, Kiwi & Malta* at *Kapkot* blocks.
3. Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables in all the blocks.
4. Promotion of common resources on custom hire basis viz. Power tiller, Mini Thresher and other equipments at Nyay Panchayat level in *Bageshwar, Kapkot* and *Garur* blocks.
5. Establishment of small processing units for tertiary and value addition of Kiwi, citrus fruits, pear in *Kapkot* and *Garur* blocks.
6. Promotion of common resources on custom hire basis viz. Power tiller in *Garur & Bageshawr* areas, Mini wheat and Paddy thresher in *Garur, Kapkot & Bageshwar* blocks.

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

1. Contour making for arable purpose in waste land in *Sama, Karmi* and other high hills areas.
2. Afforestation of plants and perennial grasses in steep slope of more than 40% slope in *Garur, Kapkot & Bageshwar* blocks.
3. Plantation of Mulberry plants, Wild fruit plants, Fodder trees (Utees, Oak, Mulberry etc.) may be promoted in *Garur & Kapkot* blocks.
4. Popularization of soil bunds to save excessive loss of nutrients in wasteland of all blocks.
5. Popularization of trenches or silages for percolation of water to avoid surface run off in *Garur & Kapkot* blocks.
6. Construction of check dam and artificial structure to maximize water percolation rate in *Garur & Kapkot* blocks.
7. Construction of tank for storage of water for lean season in all blocks.
8. Establishment of storage system for rain water in monsoon season.

**Strategy 6 : Reduced cultivation cost**

1. Promotion of specific fertilizers and micronutrients like Zink, Boron, Phosphorus, etc. may be provided.
2. Provision of mechanization (Use of Power tillers, Power weeders, Mandua/ Madira threshers, Maize Sheller, Wheel Hand hoe, horticulture improved kits etc.)
3. Promotion of well decomposed FYM, Vermicompost and Biofertilizers to minimize the use of chemical fertilizers in *Garur & Kapkot* blocks.
4. Promotion of line sowing and balanced fertilizers application in crops.
5. Promotion of recommended seed rate, spacing and depth.
6. Promotion of need based application of pesticides and other agricultural inputs. `
7. Promotion of hand tools in agricultural and horticultural operations.
8. Promotion of mulching (bio or degradable plastic) to maintain moisture and reduce intercultural operation cost.
9. Promotion of pressurized irrigation (Drip and Sprinkler Irrigation) techniques in horticultural crops.

**Strategy 7 : Off-farm income**

1. Promotion of apiculture/ sericulture/ mushroom for small and landless farmers in all blocks of Bageshwar district.
2. Promotion of cultivation and collection of medicinal plants in *Garur* and *Kapkot* blocks.
3. Promotion of skill development in women and youth in all three blocks.
4. Creation of new SHGs in other villages of three blocks.
5. Encouragement to existing SHSs for collective farming, opening small scale enterprise like Candle making, Pickle making, Jam & Jelly making, Spice cultivation, Ghee making & packing, etc. may be provided for better performance in all three blocks.

**Strategy 8 : Enabling Policies**

1. Land consolidation in Bageshwar district is essentially required.
2. Implementation of Policies for control of wild animal menace in agricultural areas.
3. Implementation of Soil Health Card Scheme in each block.
4. Increasing institutional support by providing subsidises and incentives to small and marginal farmers in three blocks.
5. Labelling of organic inputs and certification mechanism for various crops in all three blocks.
6. Popularization of Udhyan and KCC for widespread use of government incentives/ subsidies to farmers.
7. Implementation of effective and workable Nursery Act to avoid spurious or unreliable planting material in the state.
8. Ensure sustainable agriculture through more efficient utilization of land, water and other resources.

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

1. Installation of mini *mandies* at Block level.
2. Creation of better transportation facilities with cool chain van at Block level.
3. Creation of direct linkages with food processing industries for better prices.
4. Establishment of strong linkages with various stack holders to furnish information on crop produce and surplus.
5. Establishment of procurement and collection centre at *Nyaypanchyat* level for agricultural surplus with proper labelling.
6. Installation of mini grading machines at village level.
7. Establishment of cold room in Garur and Bageshwar blocks.
8. Promotion of local *Hatt* at Tahsil level in all blocks.
9. Development of proper marketing network to check the interference of middle men in marketing of agricultural produce of the farmers.
10. Development of policies to ensure the purchasing of farm produce/ products at farmers field site to encourage the farmers.

**Strategy 10 :Online Management and Evaluation**

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