

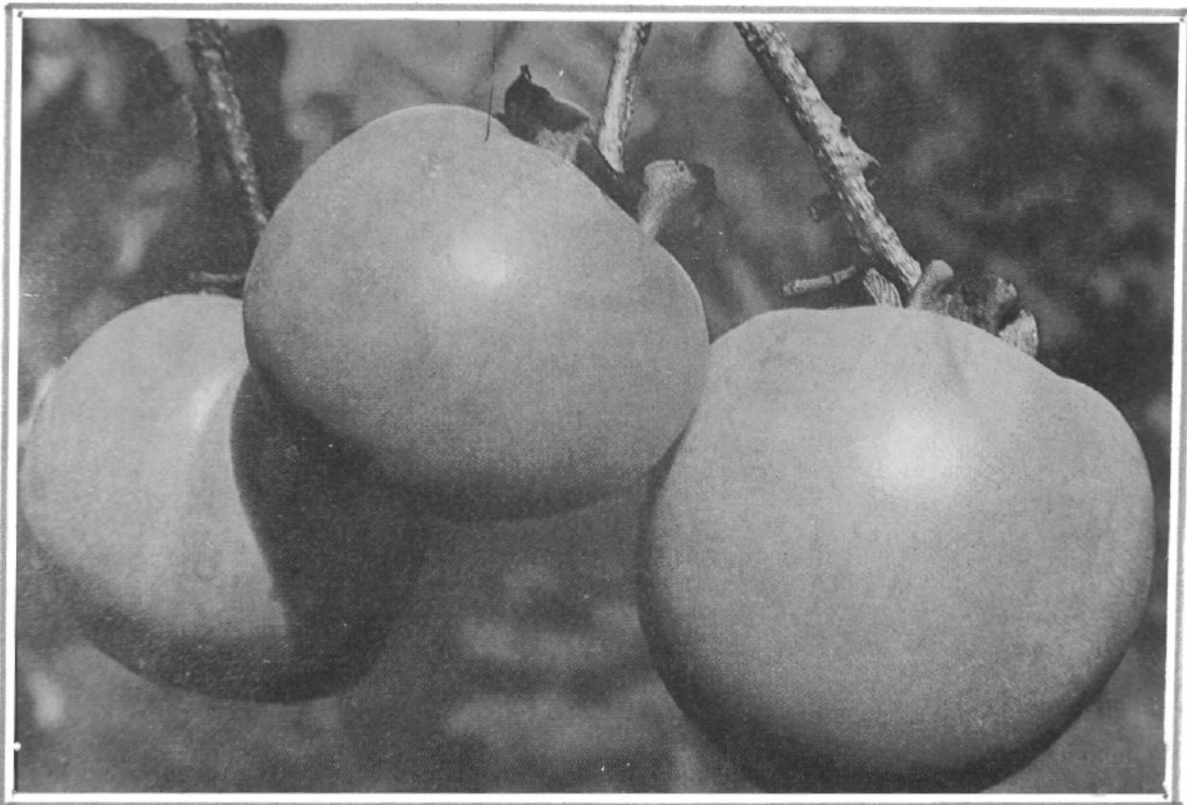


IPM PACKAGE NO. 72



# INTEGRATED PEST MANAGEMENT PACKAGE

FOR  
**PERSIMMON**



Government of India  
Ministry of Agriculture  
Department of Agriculture & Cooperation  
Directorate of Plant Protection, Quarantine & Storage  
N. H. IV, Faridabad - 121 001.

# IPM PACKAGE FOR PERSIMMON

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Government of India  
Ministry of Agriculture  
Department of Agriculture & Cooperation

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**FOREWARD**

Integrated Pest Management (IPM) approach has been globally accepted for achieving sustainability in agriculture. It has become more relevant due to a number of advantages like safety to environment, pesticide-free food commodities, low input cost based Crop Production Programme etc. Though IPM approach has been taken up since 1981, its impact has not been felt until 1994. Human Resource Development has helped to sensitise extension functionaries and farmers about the usefulness of IPM.

For successful implementation of IPM, the scattered information on various components of this eco-friendly approach forms basic necessity. In this direction, initial attempts were made in 1992 to harmonise the IPM Package of Practices of various crops. Subsequently, concerted efforts were made in 1998, 2001, 2002 and 2003 to update and develop IPM Package of Practices for agricultural and horticultural crops. Presently, IPM Package of Practices for 77 crops have been finalized to help the extension workers and farmers to manage the pests and diseases and to minimize the over use/misuse of chemical pesticides. Efforts have been made to incorporate the relevant available technical input provided by the scientists of ICAR Institutes/ SAUs and State Departments of Agriculture/Horticulture. However, suggestions for further improvement in future publication/ revision will be of immense help. Hopefully, these IPM Package of Practices will be useful for the Researchers, Plant Protection Workers and Farmers alike.

  
(P. S. CHANDURKAR)<sup>14/8/03</sup>

**August, 2003**

## P R E F A C E

In order to minimize the indiscriminate and injudicious use of chemical pesticides, INTEGRATED PEST MANAGEMENT (IPM) has been enshrined as cardinal principle of Plant Protection in the overall Crop Protection Programme under the National Agricultural Policy of the Govt. of India. IPM is an eco-friendly approach for managing pest and disease problems encompassing available methods and techniques of pest control such as cultural, mechanical, biological and chemical in a compatible and scientific manner. The greater emphasis has been given on biological control including use of biopesticides.

With a view to provide technical knowledge to the extension functionaries and farmers in the States, first National Workshop on IPM for harmonization of Package of Practices was organized at National Plant Protection Training Institute (NPPTI), Hyderabad during June 29-30, 1992. Subsequently workshops were organized on April 15-17, 1998 and Nov. 5-6, 1998 at the Directorate of Plant Protection, Quarantine & Storage, Faridabad and IPM Package of Practices for 20 crops were finalized on rice, cotton, vegetables, pulses and oilseeds. In this series, two National Workshops on IPM have been conducted at NPPTI, Hyderabad and Dte. of PPQ&S, Faridabad during 14-17, 2001 and Feb. 20-22, 2002 respectively to update 20 available IPM Packages and develop 31 new IPM Packages especially for horticultural crops. Sixth and Seventh National Workshop held at Central Insecticides Laboratory, Faridabad on 4<sup>th</sup>-5<sup>th</sup> July, 2002 and 9<sup>th</sup>-10<sup>th</sup> January, 2003 respectively for 18 IPM Packages and Eighth National Workshop was held at NPPTI, Hyderabad on 28<sup>th</sup>-29<sup>th</sup> May, 2003 for 8 IPM Packages. In these Workshops, 77 IPM Package of Practices for cereal crops (Rice, Wheat, Maize, Sorghum, Millets), commercial crops (Cotton, Sugarcane, Tobacco, Tea, Betelvine, Saffron), pulse crops (Pigeonpea, Gram, Black gram/Green gram, Pea, Rajma), oilseeds (Groundnut, Soybean, Rapeseed/Mustard, Sesame, Olive, Safflower, Castor, Sunflower, Oilpalm), vegetables (Potato, Onion, Tomato, Brinjal, Okra, Chillies, Cruciferous vegetables, Leguminous vegetables, Cucurbitacious vegetables, Broccoli, Spinach, Lablab bean, Garlic), fruits (Citrus, Banana, Apple, Mango, Guava, Grapes, Jackfruit, Pineapple, Sapota, Pomegranate, Litchi, Papaya, Apricot, Peach, Pear, Cherry, Walnut, Ber, Amla, Loquat, Strawberry, Watermelon, Fig, Phalsa, Persimmon, Custard apple, Raspberry, Kiwi, Passion fruit), spice and plantation crops (Small Cardamom, Large Cardamom, Black Pepper, Ginger, Coriander, Cumin, Fennel, Coconut, Cashew and Arecanut) have been finalized.

IPM technology manages the pest population in such a manner that economic loss is avoided and adverse side effects of chemical pesticides are minimized. The IPM packages encompass various management strategies for containing the pest and disease problems. Pest monitoring is one of the important components of IPM to take proper decision to manage any pest problem. It can be done through Agro-Ecosystem Analysis (AESA), field scouting, light, pheromone, sticky/yellow pan traps. The economic threshold levels (ETL) of important pests and diseases are also given in the packages to take appropriate control measures when pest population crosses ETL.

These IPM packages developed with the technical inputs from experts from Indian Council of Agricultural Research, State Agricultural Universities, Central Directorate of Plant Protection, Pesticide Industries and State Departments of Agriculture/Horticulture will provide technical backup in the management of pests, diseases, weeds, nematodes and rodents in the agriculture and horticulture. These will also be useful in reducing the pesticide residues in agricultural commodities and would also help in the management of pests/diseases/weeds/nematodes which may get inadvertently introduced in the country.

IPM Package of Practices for agricultural and horticultural crops will be helpful to minimize the ill-effects of chemical pesticides to promote the IPM for sustainable production. These IPM packages will be useful for the researchers, extension workers and farmers alike who are engaged in the agricultural practices.

7<sup>th</sup> October, 2003



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# IPM PACKAGE FOR PERSIMMON

## **(DIOSPYROS SPP.)**

### **1. MAJOR PESTS:**

#### **A. INSECT PESTS**

- |                           |   |
|---------------------------|---|
| 1. Mealy bugs             | ( <i>Pseudococcus</i> sp.)                                |
| 2. Scale insects          | ( <i>Parthenoleucanium</i> sp. & <i>Hemiberlesia</i> sp.) |
| 3. Fruit flies            | ( <i>Bactrocera</i> spp.)                                 |
| 4. Twig girdlers & borers | ( <i>Chrysobothris</i> sp.)                               |
| 5. Persimmon psylla       | ( <i>Psylla</i> sp.)                                      |
| 6. Leaf rollers           | ( <i>Hyplocala rostrata</i> )                             |
| 7. Mites                  | ( <i>Orthotydeus</i> sp.)                                 |

#### **B. DISEASES**

- |                              |   |
|------------------------------|---|
| 1. Crown gall                | ( <i>Agrobacterium radiobacter</i> )          |
| 2. Root rot                  | ( <i>Dematophora necatrix</i> )               |
| 3. Cercospora Leaf spot      | ( <i>Cerospora kaki</i> )                     |
| 4. Circular leaf spot        | ( <i>Mycospharella nawae</i> )                |
| 5. Bitter rot or Anthracnose | ( <i>Gloesporium kaki</i> )                   |
| 6. Leaf spots                | ( <i>Alternaria</i> & <i>Glomerella</i> spp.) |
| 7. Post—harvest fruit rot    | ( <i>Penicillium</i> spp.)                    |

#### **C. DISORDERS**

1. Calyx cavity
2. Skin russeting
3. Calyx end cracking
4. Sujika

## **D. WEEDS**

1. Hariali/Dubgrass (*Cynodon dactylon*)
2. Vish-ki-grass (*Bromus mollis*)
3. Bathua (*Chenopodium album*)
5. Dudh kunditeh (*Lactuca turririx.*)
6. Gur doadh (*Euphorbia sp.*)
7. Troper (*Marroluim vulgaris*)
8. Kuklipot (*Cascuta sp.*)

## **E. RODENTS**

1. Indian mole rat (*Bandicota bengalensis*)
2. Soft furred field rat (*Rattus meltada*)
3. Vole (*Alticola sp.*)
4. Field mouse (*Mus beoduga*)

## **II. PEST MONITORING :**

### **A. AGRO ECO SYSTEM ANALYSIS (AESA) :**

AESA is an approach, which can be gainfully employed by extension functionaries and farmers to analyse field situations with regard to pests, defenders, soil conditions, plant health, the influence of climatic factors and their inter-relationship for growing healthy crop. Such a critical analysis of the field situations will help in taking appropriate decision on management practices. The basic components of AESA are:

1. Plant health at different stages.
2. Built-in-compensation abilities of the plants.
3. Pest and defender population dynamics.
4. Soil conditions.
5. Climatic factors.
6. Farmers' past experience.

The details of the AESA are given in Annexure-I.

## **B. SURVEY/FIELD SCOUTING :**

The objective of roving surveys is to monitor the initial development of pest and disease in the endemic areas. Therefore, in the beginning of crop season, survey routes based upon the endemic areas are required to be identified to undertake roving surveys from mid of March. Based on the results of the roving surveys, the state extension functionaries have to initiate field scouting to know the proper bud stage for applying the delayed dormant oil spray. For field scouting farmers should be mobilized to observe the pest and disease occurrence at the intervals as stipulated under different fruit developmental stages. The plant protection measures are required to be taken only when pest and diseases cross ETL as per result of field scouting.

### **1. Roving Survey:**

Undertake roving survey at every 5 km. distance or after every 5 orchards depending on the plantation stretch both in linear and deep horizontal magnitudes, initially at 10 days intervals and thereafter at weekly intervals depending again on pest population. Observe/identify the proper bud stage for applying Delay Dormant Spray. Observe 10 plants randomly in zig zag fashion in each orchard for identifying the proper growth stage initially for recording the internal population of sucking pests and defoliators at the later growth stages. Record population of potential different biocontrol fauna to arrive at the decision making stage. Record the major disease, their intensity along with deficiency related diseases.

### **2. Field Scouting :**

Field scouting for pests and biocontrol fauna by extension agencies and farmers once in a week should be undertaken to work out ETL or pest defender ratio. For sucking pests different methodology is to be adopted. In case of scale, scale count should be taken per unit area after flagging the particular limb of the plant, while in case of aphid, count should be taken per leaf randomly from periphery of the selected trees. The State Department of Horticulture should make all possible efforts by using different media, mode and publicity to inform the farmers for field scouting in the specific crop area having indication of pest and disease build up.



## **C. MONITORING THROUGH TRAPS:**

1. **Through light traps:** Most of the moths of caterpillars and a few beetles of root/stem borers get attracted towards light during night. Therefore, installation of light traps in the orchards help in monitoring of initial build-up of pest population.

## **III. I.P.M. STRATEGIES:**

### **A. CULTURAL PRACTICES :**

1. Proper selection of cultivars, having commercial value and suitable for effective cross pollination be made.
2. Avoid planting of saplings infested with scale and borers.
3. For raising of nurseries, the soil selection be made which is free from pest infestation.
4. Make use of balanced dose of chemical fertilizers at the recommended crop stages.
5. Avoid excessive use of nitrogen and phosphorus fertilizers, which increase susceptibility of plants.
6. Growing of flower plants, especially marigold and maize on the peripheries will help in conserving of both predators and parasitoids.
7. 3-4 bee hives should be provided /ha. for better pollination and good yield.
8. Under rain fed/ drought conditions tree canopy should be weeded and hoed in late spring and basins should be prepared and covered with 10-15 cms. of Mulch (Rotten Pine needles, Straw, Hay, Cut grasses, FYM etc.).
9. Light to moderate pruning should be done in bearing trees.
10. Pruning cuts should be made close to the branches leaving no stubs.
11. Large wounds should be covered with superior white lead paint/ bordeaux paint.
12. Collect and destroy grubs of root borers, while preparing basins.
13. Change the nursery site after every two to three years.

14. Rogue out infected plants from nursery or main field.
15. Keep the orchard area clean from weeds and bushes to avoid excessive humid conditions and pest infestation.
16. Supporting stakes used in orchards should be free from any borer/ scale infestation.
17. Soil solarization by using polyethylene mulch be adopted before raising plant nursery.
18. All fruits do not ripen at one time, so harvesting has to be done frequently either by hand picking leaving the calyx and a short stem attached to the fruit.

## **B. MECHANICAL PRACTICES:**

1. Remove dead and dieing fruit trees to ward off borer infestation.
2. Prune and destroy scale girdler and borer infested branches.
3. Collection and destruction of egg masses of hairy caterpillars, especially from barks of shade trees (willow and poplar) planted on the peripheries of the orchards be made.
4. Stapling burlap skirts around tree trunks infested with hairy caterpillar and collection of larvae and pupae from May to end of June and their subsequent destruction be done.
5. Clear the stem borer hole with flexible wire and then insert 0.5 gms. Para Dichlorobenzens (PDCB) and plug the hole with pudding material or insert cotton wick soaked with patrol or Methyl parathion 1 ml./lt. water.
6. Clip off terminal shoots with unshed cluster of dry leaves in winter for the destruction of shoot borers.
7. Install light traps near the orchard to collect the insects and destroy them.
8. Destroy diseased seedlings.
9. Complete collection and burning of the foliage and pruned wood in the orchards should be ensured.
10. Solarisation of nursery beds be practiced.
11. Install pheromone traps for monitoring and suppression of pest population.

12. Mealy bugs can be controlled by applying slippery bands or sticky bands around tree trunks.

### C. BIO-CONTROL PRACTICES :

1. Before laying or raising of plant nursery make use of *Trichoderma viride* and *T. harzianum* to control root rot diseases.
2. Make use of neem cakes while raising plant nurseries to ward off any soil insect pests.
3. Spray *Bacillus thuringiensis* var. *Kurstaki* @ 0.5 kg/ha against lepidopteran pests.
4. Conserve the predators like Lady bird beetles, Carabids, Syrphids, Anthocorid bugs, Mirid bugs, Nabid bugs, Capsid bugs, Spiders, Chrysopids, Predatory Ants, different species of parasitoids like *Encarsia*, *Aphytis*, *Metaphycus*, *Trechnites*, *Trichogramma*, *Telenonus* etc. in the orchards.
5. Monitor the incidence of sucking pests and make release of :
  - A. **Predators** (i) Lady bird beetles - *Chlochorus* spp., *Pharoscymnus* spp. *Coccinella septumpunctata*, *Exochomus* spp. *Hippodamia* spp. @ 30-50 adults/ infested tree. ii) Green lace wings - *Chrysoperla* spp. and *Syrphus* spp. 10-20 1st instar larvae /tree.
  - B. **Parasitoids** : Release *Trichogramma* spp. @ 50,000 per ha. The dosage may vary depending upon the intensity and extent of damage.
6. Since all natural enemies are highly sensitive to pesticides, avoiding unnecessary sprays is the best way to conserve them.

### D. CHEMICAL CONTROL MEASURES:

1. Need based, judicious and safe application of pesticides are the most vital tripartite segments of chemical control measures. Under the ambit of IPM, it involves developing IPM skills to play safe with environment by proper crop health monitoring. Observe ETL and pest defender ratio before deciding in favour of use of chemical pesticides.

2. Following suggestions have important bearing for success of control measures in the context of IPM strategy :
  - 2.1 The number of fungicidal and insecticidal sprays recommended, can be minimised as per need after proper surveillance and pest intensity considering both biotic and abiotic factors.
  - 2.2 Avoid mixing of two or more insecticides /tank mixing.
  - 2.3 Repeated application of same pesticides should be avoided.
  - 2.4 Avoid repeated use of synthetic pyrethroids which generally cause resurgence of sucking pests.
  - 2.5 Use relatively safe and selective insecticides where necessary.
3. Where green blotch problem occurs spray of calcium carbonate to young fruits be done.
4. For fruit flies control, spray bait solution (2 ml malathion +10 gm sugar/ litre water) on tree foliage or install bait stations in the orchards.
5. For borers, spray main trunk or swab the main trunk of limbs with methyl parathion (3 ml/ litre water).
6. Mealy bugs can be controlled with the spray of monocrotophos (0.04%) or phosphamidon (0.03%) or endosulphan (0.05%) before flowering or after fruit set.
7. Thrips can be controlled with the spray of fenitrothion (0.05%) or chlorpyrifos (0.02%).
8. Leaf spots & other fungal diseases can be effectively controlled with foliar spray of captan or mancozeb (300 g/100 litre water or carbendazim (50g/100 litre water).

#### **E. RODENT MANAGEMENT:**

1. Adopt orchard sanitation.
2. Do not cultivate fodder crops especially oats in orchards.
3. Make use of Bromodiolon CB mixed with locally available grains in ratio of 1 : 49 and insert 15 g. per burrow.
4. Adoption of community approach may be taken.

## **F. WEED MANAGEMENT:**

1. Removal of weeds by hand/hoeing in one metre diameter around the tree basin is desirable.
2. Use of Glyphosate @ 0.75 kg/ha to 1.0 kg/ha as post emergence against perennial weeds provide substantive degree of weed control.

#### IV. DO'S & DONT'S IN PERSIMMON FRUIT PEST MANAGEMENT

Do's	Dont's
<ul style="list-style-type: none"> <li>• Growing recommended cultivar.</li> <li>• Grafting may be done during dormant season on root stock stems that are at least 9mm in diameter.</li>   <li>• Protect the orchards from wind by growing wind break trees on peripheries.</li>   <li>• Maintain on an average 15ft to 20ft distance apart from tree to tree.</li>   <li>• Take care while transplanting the saplings from nursery to orchard especially of roots from drying and rough handling.</li>   <li>• Train the young plants to a modified central leader structure.</li>   <li>• Open the canopy to prevent self-shading and reduce excessively vigorous shoot growth and regulate crop load.</li>   <li>• Brace the branches to prevent the weight of the fruit from breaking branches. OR</li> <li>• Prune the secondary branches to keep the bearing branches close to avoid drooping habit.</li> <li>• Irrigate to supplement rainfall at times as after transplanting, during spring growth flush and summer especially when weather is dry and soils are shallow.</li> </ul>	<p>Don't grow under script material which vary greatly in fruit crop pattern &amp; pest susceptibility.</p> <p>Avoid windy areas for cultivation of persimmon.</p> <p>Avoid strong shading of orchard from wind break trees.</p> <p>Don't over crowd the orchard by close spacing.</p> <p>Don't keep the roots exposed for long after taking from nurseries for transplanting.</p>  <p>Avoid using saw dust as mulching especially in potter plants</p>

- Remove the fruit from the tree by clipping or breaking the stems, leaving the calyx lobes attached in the fruit.
- Fruit must be handled carefully to avoid damage. Rough handling causes bruising and skin discoloration.
- Curing should be done after maturity to astringent varieties.
- Maintain both female and male trees in the orchard.
- Maintain bee hives in the orchard.
- Interplant atleast one pollinizer tree with every 8 to 10 trees of the commercial cultivars.
- Avoid excessive use of nitrogen to avoid fruit drop.
- Adopt extensive proving as the tree gets older to control tree size.
- Cover the cut ends with Bordeaux paint.
- Gather all prunings and dead wood from the orchard and destroy them.
- Harvest the fruit when colour develops but is still firm.
- Cover the injured portion of the stem of the plant if any to ward off the borer damage.

Don't allow limb crossing of branches.

Don't leave the tree unpruned.

Don't allow the prunings to remain in the orchards or use them as for fencing or staking sticks.

Avoid any damage / injury to plant stem.

## V. STAGEWISE IPM PRACTICES TO BE ADOPTED

S.No	Crop Stage	Pest	Stage-wise IPM Practices	
1.	Bud Swell / Green tip.	Psylla, Scales, Mite, Twig girdlers and borers, Stink and Plant bugs.	Cultural	<p>i) Provide proper drainage in orchards to drain off surface water.</p> <p>ii) Weeds should be kept down and winter cover crops should be removed early before bugs come out of hibernation.</p>
			Mechanical	<p>i) Pruning and destruction of scaled, psylla and girdler affected twigs.</p> <p>ii) Pruning of overcrowded and overlapping branches for the control of leaf webber and tent caterpillar.</p> <p>iii) Prune the twigs having shinning rings of blackish egg masses of caterpillars. Destroy the webbed tents in case of tent caterpillars.</p>
			Chemical	<p>i) Delayed dormant spray is to be impregnated with ethion 50ec @ 1ml/lt. of emulsion just before bud swell/ Green tip stage for controlling Psylla, Mite and Scales.</p> <p>ii) Clear the stem borer hole with flexible wire and then insert 0.5gms of para</p>



				dichloro benzene and plug the hole.
		Crown gall	Cultural	<p>i). Avoid planting of affected nursery trees.</p> <p>ii). Avoid using D. lotus as a root stock.</p> <p>iii). Avoid injury to the roots or the collar.</p> <p>iv). Change the nursery site.</p>
			Mechanical	<p>Dip healthy grafted plants in 1.0% Copper Sulphate (<math>\text{CuSO}_4</math>) solution for 1.5 hours.</p> <p>Rogue out infested plants.</p>
		Root rot	Cultural	<p>Vegetative propagation of resistant root stocks should be done.</p> <p>Improve the drainage in orchards.</p>
			Mechanical	<p>Remove the infested roots and apply chaubatia paste on the cut ends and healthy portions of the roots during November – December.</p>
			Chemical	<p>Atleast 3 drenching of carbendazim @ 0.1% or aureofungin 50gms + <math>\text{CuSO}_4</math> 50 gms in 100 Lts. of water at 15-20 days interval during monsoon months. Application be made in 15-25 cms deep holes; at a distance of 30cms each.</p>

			Monitoring	Regular monitoring to be conducted.
			Biological	Conduct surveys and surveillance for conservation of natural enemies and observe pest and defender (P:D) ratio.
2.	Petal fall/ fruit set.	Defoliators, Psylla, Mealy Bugs, Scales, Mite, Twig girdlers and borers.	Cultural	Provide proper drainage in orchards to drain off surface water.
			Mechanical	Shaking of non bearing trees over a cloth sheet at dusk and collection and destruction of defoliating beetles in kerosenized water be done.
		Mealy bugs	Cultural	Foliage of trees should not touch the ground.
			Mechanical	Fastening of alkathene sheet of 400 gauge thickness 25cms wide around the base of tree for the control of mealy bug.
			Biological	<p>i). Raking of soil around the trunk and mixing with neem cake for management of mealy bug nymphs.</p> <p>ii) Application of <i>Beauvaria bassiana</i> around tree trunks to manage nymphs of mealy bug.</p> <p>iii) Release of <i>Trichogramma spp.</i> against defoliators.</p>

			Chemical	<p>i) Apply 2% dust of methyl parathion @ 250g / tree or chloropyriphos 2% dust.</p> <p>ii) Conduct sprays (need based) of monocrotophos 0.04% or fenvalerate 0.01% or chloropyriphos 0.1%.</p>
		Borers	Chemical	<p>Clear the steam borer holes with flexible wire and then insert 0.5gms of para dichloro benzene and plug the holes. Or Insert cotton wick soaked with petrol or Methyl Parathion 1 ml/Ltr. or Dichlorvos 2 ml/Ltr. water.</p>
		Root rot	Cultural	<p>Improve the drainage in the orchard.</p>
			Mechanical	<p>Adopt the practices as under S.No. 1 if not done earlier.</p>
			Chemical	<p>Adopt the practices as under S.No. 1 if not done earlier.</p>
3.	Fruit Development	Psylla, Mites, Scales, Mealy Bugs, thrips, Stink bugs and defoliators.	Monitoring	<p>Regular monitoring advocated.</p>
			Biological	<p>i) Conservation of natural enemies.</p> <p>ii) Release of LBB, Chrysoperla, Phytoseiid mites, Syrphids and Trichogramma spp. on the infested trees.</p>
			Chemical	<p>Spray Methyl demeton 25EC 80ml/100 Ltr. water or Phosalane 35EC 140ml/100</p>

				<p>Ltr. water or Dimethoate 30EC 100ml/100 Ltr. water or Endosulphan 35EC 140ml /100 Ltr. water or Chlorpyrifos 20EC 100ml / 100 Ltr. water or Abamectin 1.8EC 555ml /100 Ltr. water or Neem formulation as per the recommendations of S.A.U but no chemical should be repeated twice in any second spray schedule. The spray should be applied need based only.</p>
		Fruit flies	Cultural	<p>i) Avoid planting fruit fly prone trees.</p> <p>ii) Remove any fruit from the tree with dimples or weeping clear sap.</p>
			Mechanical	<p>Destroy all infested fruits by immersing them in water for several days or placing them in a sealed black plastic bag in the sun.</p>
			Biological	<p>Same as under S.No. 2 and go for the release of braconid wasps as egg parasites. Ants, ground beetles, spiders, dragonflies, robber flies and birds-willow are the best predators for the maggot population. Poultry flycatchers and willy wag tails provide enormous help in fruitfully control.</p>
			Chemical	<p>Apply dimeththoate or fenthion called a splash bait or yeast antolysate bait sold commercially as Q fly lure is</p>

				mixed with an insecticide as a foliar application.
		Borer	Cultural	Keep trees well watered and moderately fertilized.
			Mechanical	<p>Young or transplanted trees should be wrapped from ground level to the branches with burlap or heavy paper. Tie wrapping material with twigs and leave in place for 2 years.</p> <p>Remove dead and dying limbs and trees from the orchard each year and destroy them before the following spring.</p> <p>Remove borers from infested tree with a thin wire.</p>
		Leaf spot and disorders.	Monitoring	Regular monitoring for the build up of foliar disease.
			Chemical	<p>Conduct the sprays of hexanazoles,15EC 30 ml / 100 Ltr. water or Fenarimol 12EC 40ml /100lt water. Or Penconazol 10EC 50ml/ 100 Ltr. water or Bitertanol 25WP 50gm/100 Ltr. water.</p>
		Bitter rot	Cultural	<p>Harvest at proper time of maturity.</p> <p>Carefully handle the fruits during harvesting, picking, grading, packing transportation and storage to avoid injury.</p> <p>Keep surroundings of package houses, store houses clean by destroying</p>

				<p>the culled fruits at least on every day.</p> <p>Cool the fruit to storage temperature (32-38°F) as rapidly as possible.</p> <p>Use protective packing to reduce number of cuts and bruises.</p>
			Chemical	<p>Preharvest sprays 2-3 weeks before harvest with manzeb, zineb, capatan or any other organic fungicide 0.2-0.3%.</p> <p>Dip the fruit in sodium ortho phenyl phenate 1000-2000 ppm solution or dip the fruit in Diphenyl ammine (1000-2000 ppm) solution to control storage scald.</p>
4.	Dormant	Scale, Girdlers, Psylla, Mealy bugs, Borers mites	Mechanical	<p>Pruning and destruction of scale infested branches and twigs.</p> <p>Remove and destroy severely / heavily infested trees from the orchard.</p> <p>Removal and destruction of left over / culled / infested fruit from the orchards.</p> <p>Removal of mummified fruits from the orchards.</p> <p>Prune and destroy the girdled limbs.</p> <p>Removal and destruction of weeds.</p> <p>Deep ploughing of orchards Immediately after harvest for exposing eggs and pupae of mealy bugs.</p> <p>Prune galled shoots to check psylla infestation.</p> <p>Clip off terminal shoots with</p>

				unshed clusters of dry leaves in winter for destruction of shoot borers.
			Chemical	Dormant sprays impregnated with eithon 50EC @ 1ml/lt of emulsion will check the infestation of scales, mites, psylla and borers before bud swell.
		Crown gall, Root rot	Cultural and Mechanical	Same as under S.No. 1.

**AGRO ECO SYSTEM ANALYSIS (AESAs)**

AESA is an approach, which can be gainfully employed by extension functionaries and farmers to analyse field situations with regard to pests, defenders, soil conditions, plant health, the influence of climatic factors and their interrelationship for growing healthy crop. Such a critical analysis of the field situations will help in taking appropriate decision on management practices. The basic components of AESA are :

1. Plants health at different stages.
2. Built-in-compensation abilities of the plants.
3. Pest and defender population dynamics.
4. Soil conditions.
5. Climatic factors.
6. Farmers past experience.

The methodology of AESA is an under :

A. **Field observations :**

- a) Enter the orchard atleast 10 feet away from road/bund. Select a Persimmon tree of medium size randomly.
- b) Record the visual observations on the following parameters :
  - i) Flying insects (both pests & defenders).
  - ii) Close observation on pest and defenders which remain on the plant.
  - iii) Observe the pests like Scale insect, Mites, Thrips, Defoliators and Defenders like LBB, Green Lace wings, Spiders, Predatory Ants, Anthocorids, Syrphids and Phytoseiid Mites
  - iv) Record various diseases and their intensities / incidence.



- v) Record insect damage in percentage or otherwise in case of non uniform pests like Scale insects, Psylla etc.
  
- c) The No. of trees selected for sampling would depend largely on the size of the orchard. The trees selected for sampling should be the representative of the entire orchard in size and cultivar. Preferably the cultivars which are sensitive to key pests like Scales, Mites, Psylla etc. should be taken for sampling. The predator population is surveyed on the same tree as the pest and is accomplished by slowly walking around the periphery of the tree and recording the No. of adults and larvae visually. The predator surveys should be done before leaves / samples are collected/observed for determining the pest population or extent of damage. For example for sampling scale insects, select 2 trees with some degree of scale infestation on various limbs randomly. Mark / flag infested limb on each tree as sampling area say 50.0 - 60.0 cm length, with paint. From the marked area remove a sample approximately of 1.6cm. Take 1st sample from the area at the lowest point on the branch and later one's about 1.3cm above. Take samples monthly from each limb. Count all live scales from the sample. Process the data of selected trees separately to co-relate the population density changes over time between the 2 trees.
  
- d) Record soil conditions viz dry, wet or water lodged.
  
- e) Observe Rodent live burrows.
  
- f) Repeat the steps from b to e on at least 5 trees in a diagonal row or criss cross fashion across the orchard to have overall average assessment of the orchard.
  
- g) Record the climatic factors size, sunny partially sunny, cloudy, rainy etc. for the proceeding week.

B. **Drawing :**

First draw the plant with actual no. of main limbs in the centre of a chart. Then draw pests on left side and defender on the right side. Indicate the soil condition, Rodent damage, etc. Give natural colours to all the drawings, for instance draw healthy plant with green colour, diseased plant/leaves with yellow colour. While drawing the pests and the defenders on the chart, care should be taken to draw them at appropriate part of the plant, where they are seen at the time of observation. The common name of the pest and defenders and their population count should also be given alongwith diagram. The weather factor should be reflected in the chart by drawing the diagram of sun just above the plant, if it is sunny. If cloudy the clouds may be drawn in place of sun. In case of partially sunny, the diagram of sun may be half masked with clouds.

C. **Group Discussion and Decision Making :**

The observations recorded in the previous and current charts should be discussed among the farmers and apprentice trainees by raising questions relating to change in pest and defender population in relation to crop stages, soil conditions, weather factors, such as rainy cloudy or sunny etc. The group may evolve a strategy based upon weekly AESA, ETL and corresponding change in P:D ratio and take judicious decision for specific pest management practices.

D. **Strategy for Decision Making :**

- i) The group members may closely observe the representative fruit trees for the prominent / characteristic symptoms of various diseases and their extent along with prevailing weather conditions and may accordingly suggest for sprays or no sprays.
- ii) In case of scale insects & Psylla if 50% of scales/ Psylla are parasitized by its parasitoids or 2-3 lady bird beetles/2-3 Ist instar larvae of green lace wings / syrphid grubs are present / infested twig, then there is no need of chemical spray.

- iii) When it is hot and dry without any rains, group may suggest for No. sprays, otherwise recommend against disease or can suggest for monitoring and surveillance only till ETL is crossed by the disease.

#### **AESA BY EXTENSION FUNCTIONARIES :**

The extension functionaries during the regular visit to the village, mobilize the farmers ,conduct AESA and critically analyse the various factors such as the pest population vis-à-vis defender population and their role in natural suppression of the pest, the influence of prevailing weather condition /pest population. They may also take the decision based on the AESA, with IPM components like release of defenders, application of neem formulations/safe pesticides are to be used for specific pest situation. Such an exercise may be repeated by the extension functionaries during every visit to the village and motivate the farmers to adopt AESA in their orchards.

#### **AESA BY FARMERS :**

After a brief exposure during IPM demonstrations/field trainings, farmers can practice AESA in their own orchards. Wherever trained farmers are available their experiences could be utilised in training their fellow farmers in their own villages. Thus a large group of farmers could be made efficiently competent in undertaking weekly AESA thereby empowering themselves in decision making on any specific pest situations. Farmers-to-farmers training approach will go a long way in practicing the farmers, conduct AESA and critically analyse the various factors such as the pest population viz-a-viz defender population and their role in natural suppression of the pest, the influence of prevailing weather condition/soil conditions on the likely build up of defender/pest population. They may also take the decision based on the AESA, with IPM on a large area on sustainable basis.

## **BASIC PRECAUTIONS IN PESTICIDE USAGE**

### **A. Purchase :**

1. Purchase only just required e.g. 100, 250, 500 or 1000 g/l for single application in specified area.
2. Do not purchase leaking containers, loose unsealed or torn bags.
3. Do not purchase pesticides without proper / approved labels.

### **B. Storage :**

1. Avoid storage of pesticides in house premises.
2. Keep only in original container with intact seal.
3. Do not transfer pesticides to other containers.
4. Never keep them together with food or feed/fodder.
5. Keep away from reach of children and livestock.
6. Do not expose to sun-light or rain water.
7. Do not store weedicides along with other pesticides.

### **C. Handling :**

1. Never carry/transport pesticides along with food materials.
2. Avoid carrying bulk-pesticides (dusts/granules) on head, shoulders or on the back.

### **D. Precautions for Preparing Spray Solution :**

1. Use clean water.
2. Always protect your Nose, Eyes, Mouth, Ears and Hands.
3. Use hand gloves, face mask and cover your head with cap.
4. Use polyethylene bags as hand gloves, handkerchiefs or piece of clean cloth as mask and a cap or towel to cover the head (do not use polyethylene bag contaminated with pesticides).
5. Read the label on the container before preparing spray solution.
6. Prepare spray solution as per requirement.
7. Do not mix granules with water.

8. Concentrated pesticides must not fall on hands etc. while opening sealed containers. Do not smell the pesticides.
9. Avoid spilling of pesticide solution while filling the sprayer tank.
10. Do not eat, drink, smoke or chew while preparing solution.
11. The operator should protect his bare feet and hands with polyethylene bags.

E. **Equipments** :

1. Select right kind of equipment.
2. Do not use leaky, defective equipment.
3. Select right kind of nozzle.
4. Do not blow/clean clogged-nozzle with mouth. Use old tooth-brush tied with the sprayer and clean with water.
5. Do not use same sprayer for weedicide and insecticide.

F. **Precautions for Applying Pesticides** :

1. Apply only at recommended dose and dilution.
2. Do not apply on hot sunny day or strong windy condition.
3. Do not apply just before the rains and also after the rains.
4. Do not apply against the wind direction.
5. Emulsifiable concentrate formulations should not be used for spraying with battery operated ULV sprayer.
6. Wash the sprayer and buckets etc. with soap water after spraying.
7. Containers, buckets etc. used for mixing pesticides should not be used for domestic purposes.
8. Avoid entry of animals and workers in the fields immediately after the spraying.

G. **Disposal** :

1. Left over spray solution should not be drained in ponds or water lines etc. Throw it in barren isolated area, if possible.
2. The used/empty containers should be crushed with a stone/stick and buried deep into soil away from water source.
3. Never re-use empty pesticides container for any purpose.