



IPM PACKAGE NO. 28



# INTEGRATED PEST MANAGEMENT PACKAGE

FOR

# CITRUS



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 CITRUS

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**DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE**  
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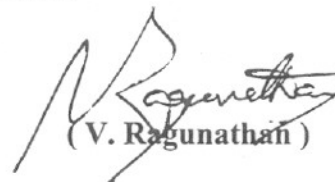
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**FOREWARD**

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 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 and 2002 to update and develop IPM package of practices for agricultural and horticultural crops. Presently, IPM package of practices for 51 crops have been finalised to help the extension workers and farmers to manage the pests/ diseases and to minimise 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. 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.

April 1, 2002

  
(V. Raguathan)

# P R E F A C E

In order to minimise 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 harmonisation of Package of Practices was organized at National Plant Protection Training Institute (NPPTI), Hyderabad during June 29-30, 1992. Subsequently workshops were organized from April 15-17, 1998 and Nov. 5-6, 1998 at Directorate of Plant Protection, Quarantine & Storage, Faridabad and IPM package of practices for 20 crops were evolved 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 May 14-17, 2001 and Feb. 20-22, 2002 respectively to update 20 available IPM Packages and develop 31 new IPM Packages specially for Horticultural crops. In these workshops, 51 IPM Package of Practices for cereal crops (Rice, Wheat, Maize, Sorghum, Millets), commercial crops (Cotton, Sugarcane, Tobacco, Tea), pulse crops (Pigeonpea, Gram, Black gram/Green gram, Pea, Rajma), oilseeds (Groundnut, Soybean, Rapeseed/Mustard, Sesame, Safflower, Castor, Sunflower, Oilpalm), vegetables (Potato, Onion, Tomato, Brinjal, Okra, Chillies, Cruciferous vegetables, Leguminous vegetables, Cucurbitaceous vegetables), fruit crops (Citrus, Banana, Apple, Mango, Guava, Grapes, Pineapple, Sapota, Pomegranate, Litchi), spice and plantation crops (Small Cardamom, Large Cardamom, Black Pepper, Ginger, Coriander, Cumin, Fennel, Coconut, Cashew and Arecanut) have been finalised.

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 encompasses various management strategies for containing the pest and disease problems. Pest monitoring is also one of the important component 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 Agriculture 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 Indian Agriculture and Horticulture. These will also be useful in reducing the pesticide residues in exportable 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 packages will be useful for the researchers, extension workers and farmers alike who are engaged in the agricultural practices.

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(A.D. Pawar)  
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# IPM PACKAGE FOR CITRUS

## I. MAJOR PESTS

### A. Pests of National Significance

#### 1. Insect Pests

- 1.1 Aphids (*Aphis gossypii*, *Toxoptera aurantii*)
- 1.2 Citrus psylla (*Diaphorina citri*)
- 1.3 Citrus leaf miner (*Phyllocnistis citrella*)
- 1.4 Scale insects (*Aonidiella spp*, *Aspidiotus destructor*)
- 1.5 Fruit flies (*Dacus spp*)

#### 2. Diseases

- 2.1 Gummosis (*Phytophthora spp*)
- 2.2 Leaf fall & Fruit rot (*Phytophthora palmivora*)
- 2.3 Anthracnose (*Colletotrichum gloesporioides*,  
*Gloesporium spp*)
- 2.4 Sooty mould (*Capnodium citri*, *Meliola bulteri*,  
*Cladosporium herbarium*)
- 2.5 Citrus canker (*Xanthomonas citri*)
- 2.6 Tristeza (*Tristeza virus*)
- 2.7 Greening (*Mycoplasma*)

#### 3. Weeds

##### Monocots

- 3.1 *Cyperus rotundus*
- 3.2 *Cynodon dactylon*
- 3.3 *Commelina benghalensis*
- 3.4 *Dinebra retroflexa*
- 3.5 *Brachiara mutica*
- 3.6 *Dicanthus annulatum*
- 3.7 *Echinochloa crusgalli*

## Dicots

- 3.8 *Amaranthus spinosus*
- 3.9 *Portulaca oleracea*
- 3.10 *Trianthema monogyna*
- 3.11 *Parthenium hysterophorus*
- 3.12 *Euphorbia hirta*
- 3.13 *Physalis minima*
- 3.14 *Xanthium strumarium*

## B. Pests of regional significance

### 1. Insect Pests

- 1.1 Citrus white fly  
(*Dialeurodes citri*)      Assam, U.P. Maharashtra, Bihar,  
Punjab
- 1.2 Citrus black fly  
(*Aleurocanthus spp.*)      Maharashtra, M.P., Assam
- 1.3 Fruit sucking moth  
(*Othreis spp., Achoeajanata,*  
*Calpe emarginata*)      Tamilnadu, M.P. U.P. Punjab,  
Maharashtra
- 1.4 Bark eating caterpillars  
(*Indorbela quadrinotata*)      Punjab, Maharashtra, M.P.
- 1.5 Stem and shoot borer  
(*Chloridolum alcameno,*  
*C. cincium*)      M.P., Maharashtra, A.P., Tamilnadu,  
Karnataka
- 1.6 Citrus mealy-bug  
(*Pseudococcus filamentosus*)      Assam, M.P., Maharashtra
- 1.7 Lemon Butterfly  
(*papilio spp*)      Assam, Bengal, M.P., Maharashtra,  
Sikkim, Meghalaya
- 1.8 Citrus mites (*Tetranychus spp.,*  
*Typhlodromus spp., Lasioseius*  
*quadristosus paratetranychus*  
*citri*)      Maharashtra, A.P., Karnataka,  
Tamilnadu
- 1.9 Citrus blossom midge  
(*Dasineura citri*)      Punjab, Assam, Sikkim, A.P.,  
Maharashtra, Karnataka.
- 1.10 Citrus thrips (*Scirothrips spp,*  
*Meliothripshaemorrhaeodalis*)      Maharashtra, M.P., Assam

## 2. Diseases

- |      |  |   |
|------|--|---|
| 2.1  | Diplodia gummosis ( <i>Diplodia natalensis</i> )   | Karnataka, Tamilnadu, A.P., U.P.          |
| 2.2  | Root rot ( <i>Ganoderma lucidum</i> )  | A.P., Karnataka, Tamilnadu                |
| 2.3  | Dry root rot<br>( <i>Macrophomina phaseoli</i> ,<br><i>Fusarium spp</i> , <i>Diplodia natalensis</i> ) | Tamilnadu, A.P.                           |
| 2.4  | Pink disease<br>( <i>Pellicularia salmonicolor</i> )   | Assam, M.P., A.P., Karnataka, Tamilnadu   |
| 2.5  | Scab ( <i>Elsinoe fawcetti</i> )   | Bengal, U.P., Assam, Punjab, Karnataka    |
| 2.6  | Powdery mildew<br>( <i>Acrosporium tingitaninum</i> )  | Assam, West Bengal, Sikkim                |
| 2.7  | Felt disease<br>( <i>Septobasidium spp</i> ;<br><i>S. pseudopedicellum</i> )                           | Andhra Pradesh, Tamilnadu, Assam          |
| 2.8  | Twig blight ( <i>Diplodia natalensis</i> , <i>Botryodiplodia theobromae</i> , <i>Fusarium spp</i> )    | Maharashtra, M.P., Rajasthan, West Bengal |
| 2.9  | Melanose ( <i>Diaporthe citri</i> )  | Assam                                     |
| 2.10 | Sphaeropsis knots<br>( <i>Sphaeropsis tumefaciens</i> )  | Rajasthan                                 |
| 2.11 | Citrus mosaic (Mosaic virus)   | A.P.                                      |
| 2.12 | Yellow-Corky vein (virus)  | A.P.                                      |
| 2.13 | Psorosis<br>(Virus, Psorosis A&B)  | A.P.                                      |
| 2.14 | Woody gall & Tumours<br>(Tumour decline virus)   | Maharashtra                               |

## 3. Nematodes

- |     |  |  |
|-----|--|--|
| 3.1 | Root-knot nematode<br>( <i>Meloidogyne spp</i> )     | Assam, West Bengal, Maharashtra, A.P., Karnataka, Tamilnadu, Rajasthan |
| 3.2 | Citrus nematode ( <i>Tylenchulus semipenetrans</i> ) | Punjab, Delhi, Rajasthan.  |



## 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 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. 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 surveys through roving surveys is to monitor the initial development of pest and disease in endemic areas. Therefore, survey routes based upon the endemic areas are required to be identified to undertake roving surveys. Based upon the results of the roving surveys, the state extension functionaries have to concentrate for greater efforts at block and village levels as well as through farmers to initiate field scouting. Therefore, for field scouting farmers should be mobilised to observe the pest and disease occurrence at the intervals as stipulated hereunder. The plant protection measures are required to be taken only when pests and diseases cross ETL as per results of field scouting.

1. **Roving Survey:-** Undertake roving survey at every 10 km distance at 7-10 days intervals (depending upon pest population). Record incidence of major insect-pests and disease on citrus tree and other all host plants of the locality. Observe at each spot 20 trees at random and 5 samples in each tree all around. Record the population of all insect-pests on 3 leaves of new shoots of these plants. Record other insect-pests and disease occurring on other parts of the tree-plant. Record population potential of different biocontrol fauna.
2. **Field scouting:-** Field scouting for pests and biocontrol fauna by extension agencies and farmers once in a week should be undertaken to workout ETL. For sucking pests viz., blackfly, whitefly, psylla, population should be counted on three leaves (top and middle portion) of new shoot at 5 sites randomly in each tree. For lemon butterfly, select five apical twigs per tree, each from top, middle and bottom portion randomly and record number of larvae per twig.

The State Department of agriculture should make all possible efforts by using different media, mode of publicity to inform the farmers for field scouting in the specific crop areas having indication of pest or disease development.

### C. Pest Monitoring through Pheromones / Yellow pan / Sticky traps / Light traps etc.

Certain pests require positioning of various kinds of traps like pheromones, yellow pan, sticky traps to monitor the initial pest build-up. Therefore, the state Department of Agriculture is to initiate action for positioning of different kinds of traps based upon the results of roving surveys at the strategic locations at village level. While the concept needs to be popularised amongst farming community, the State Department of Agriculture is to take greater initiatives for pest monitoring through specific pheromone trapping methods as per following details.

1. **Pheromone trap-monitoring:-** Use Pheromone traps for monitoring of fruit flies, leaf miner and mealybug. Install pheromone traps at distance of 50 meter @ five trap per hectare for each insect pest. Use specific lure for each insect pest species and change it after every 20 days. Trapped moths should be removed daily.
2. **Yellow pan/Sticky traps:-** Set up yellow pan/ sticky traps for monitoring whitefly @ 10 yellow pans/sticky trap per ha. Locally available empty yellow palmolive tins coated with grease/vasline/castor oil on outer surface may also be used.
3. **Light trap:-** yellow colour traps reflecting light at the wave length of 550 nano meter may be installed and operated for 2 hours in the evening for the monitoring of blackfly.

### D. Economic Threshold levels (ETLS)

Based upon the results of survey/field scouting etc., the extension functionaries are to determine the ETLs for different pests to advise farmers to initiate pest management practices accordingly. The ETLs for major pests are as under:

S.NO.	Insect-pests	Economic Threshold levels (ETLs)
1.	Aphids	
	<i>Aphis spiraecola</i>	5-10% infected shoots
	<i>Aphis gossypii</i>	25% infected shoots
	<i>Toxoptera aurantii</i>	25% infected shoots
2.	Whiteflies	
	<i>Dialurodes citri</i>	5-10 nymphs/leaf on mandarin 20-30 nymphs/leaf on orange and lemon

	<i>Aleurocanthus spp</i>	First colonies occurrence
	<i>Parabemisia myricae</i>	First colonies occurrence
3.	Mealy bug	
	<i>Planococcus citri</i>	5-10% infested fruits (Summer) 15% infested fruits (autumn)
4.	Soft scale	1 Female/10 cm twig or
	<i>Saissetia oleae</i>	3-5 nymphs/leaf
5.	Armored scale	1 Female/10 cm twig or
	<i>Aonidiella aurantii</i>	3-5 nymphs/leaf
6.	Moth	
	<i>Prays citri</i>	50% infested flowers
7.	Fruit fly	
	<i>Ceratitis capitata</i>	20 adults/trap/ week (clementine) 40-50 adults/trap/week (orange)
8.	Mites	
	<i>Eriophyes shedoni</i>	50-70% infested buds.
	<i>Panonychus citri</i>	3 specimens/leaf or 50% infested leaves
	<i>Tetranychus urticae</i>	2% infected fruits or 10 infested leaves
	<i>Aeulops pelekassi</i>	2-3% infested fruits

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### III. INTEGRATED PEST MANGEMENT STRATEGIES

#### A. Cultural Practices

1. Summer deep ploughing to expose soil inhabiting/resting stages of insect, pathogen and nematode population.
2. Select deep, well levelled with good drainage soil.
3. Only certified seeds should be used. Hot water treatment (51-52°C) of seeds for 10 minutes may be done.
4. Use resistant rootstocks and select disease free nursery plants.
5. Use *Trichoderma* spp with organic matters to improve soil health and management of certain soil borne diseases.

6. Avoid flood and channel irrigation.
7. Keep bud union as high as from soil to avoid infection of soil borne pathogens.
8. Avoid injuries to trunk and root during farm operations.
9. Water shoots should be pruned regularly to avoid infection of powdery mildew.
10. Overhead sprinklers should be avoided to reduce the spread of citrus scab.
11. Adopt proper spacing, irrigation and nutrient management. Avoid application of high nitrogenous fertilizers. Use neem cake @ one tonne/ha under assured moisture conditions in nematode infected fields only.
12. For the management of citrus white/black fly and mealy-bug intermingling branches should be pruned and spacing trees at closed distance should be avoided so that sunlight can reach through the canopy from all the sides.
13. Fallen fruits should be destroyed by burying them in the ground. There should be clean cultivation of orchard to avoid further development of fruit sucking moths.
14. Remove cover crops early in the seasons, which effectively checks the fruits sucking bugs, since the nymphs are unable to move far away.
15. Ant colonies in the orchards should be destroyed as they are the carriers of mealy bugs to their feeding sites.
16. Following inter-cropping system is recommended to colonize the bioagents fauna such as lady bird beetles, *Chrysoperla* etc.

(1) Citrus + cowpea

(2) Citrus + soybean

#### B. Mechanical practices:

1. Hand picking and removal of fallen leaves be ensured.
2. Light traps may be operated for the management of citrus black fly, fruit fly and lemon butterfly.
3. Spraying of 2% starch solution is recommended in sooty mould affected gardens. It facilitates detachment of sooty mould from the leaf surface, which under dry condition is blown off in fragments by the hot wind currents.

#### C. Biological practices:

##### 1. Management of soil borne diseases

Apply *Trichoderma spp* alongwith organic matter in the ratio of 1:40 @2.00 kg mixed culture/plant for the management soil-borne disease, especially species of *Phytophthora*, *Fusarium* and *Pythium*.

## 2. Conservation

2.1 Conserve predators viz., *Amblyscius tetranychivorus*, *Chrysoperla carnea*, coccinellids, *Cryptolaemus montrouzieri*, *Mallada boninsis* *Menochilus sexmaculatus*, spiders and parasitoids viz., *Apanteles*, *Aphytes proclia* *Leptomastix dactylopii* etc.

## 3. Augmentation

Monitor the incidence of citrus black/white flies and aphids and release 10-15 eggs or first instar larvae of *Chrysoperla* or *Mallada* per plant. Avoid spraying with insecticides for atleast one week after the release of bio-control agents.

## D. Chemical Control Measures:

1. Need based, judicious and safe applications of pesticides are the most vital triplicate 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, observing ETL and conserving natural biocontrol potential before deciding in favour of use of chemical pesticides as a last resort. Therefore, it is necessary to rely upon pesticides as per the list in annexure - III.

2. Following suggestions have important bearings for the success of control measures in the context of IPM strategy.

2.1 Minimise number of sprays as many as possible

2.2 Avoid mixing of two or more insecticides/tank mixing.

2.3 Repeated application of same pesticide should be avoided.

2.4 Avoid using of synthetic pyrethroids which results in resurgence of sucking pests.

2.5 Use selective insecticides (endosulfan) during early phase of season.

2.6 Use neem based formulations individually.

2.7 Pyrethroids usage should be restricted.

2.8 Proper spray equipments should be used:

a) Knapsack sprayer is ideal for citrus gardens

b) Discourage using undescriptive inefficient sprayers and also CDA sprayers.

2.9 Use proper spray volume for unit area.

## E. Integrated management of diseases caused by *Phytophthora spp.*

1. Cultivation of susceptible seedlings in the established endemic areas should be immediately discouraged.

2. Select resistant rootstocks for plantation .
3. Excessive use of nitrogenous fertilizers should <sup>be</sup> avoided.
4. Select seedling from *phytophthora* free certified nurseries with high budding (above 9" height).
5. Keep the bud union as high as possible so that irrigation water does not touch the scion. Double ring method of irrigation helps in avoiding direct contact of water with trunk.
6. Keep the soil well drained and avoid flood irrigation and stagnation of water for longer period in the basin.
7. Avoid injuries to trunk and root system during farm operations.
8. Use *Trichoderma* with organic matter in the ratio 1:40 @ 2kg mixture per plant. Ensure 60-70% moisture in the soil.
9. Use copper fungicides, copper oxychloride 50% WP @2.5kg/ha at right time for the management of foot and root rot and of gummosis.
10. Apply bordeaux paste before the onset of monsoon on tree trunk as prophylactic measures. Scrap out foot rot or gummosis affected portions with sharp knife taking care not to damage the wood before application of Bordeaux paste.

#### F. Weed management practices:

1. Follow recommended agronomic practices for land preparation, fertilizer and irrigation management.
2. The garden should be maintained weed free by resorting timely interculture and hand weeding.
3. Mulching with alkathene films, wheat bran, rice husk, paddy straw etc., also keep the weeds under check.

#### G. Nematode management practices:

1. Summer hoeing to expose inhabiting nematodes
2. Growing resistant rootstocks.
3. Application of neem oil cakes (40 g/plant) and *Paecilomyces litacinus* or *Pseudomonas fluorescens* ( $10^8$  cfu).
4. Application of carbofuron <sup>@</sup> 1.00 kg a.i/ha.



#### IV. STAGE/PEST-WISE IPM PACKAGES TO BE ADOPTED

SLNo.	Crop stage/Pest		IPM Practices to be adopted	
1.	<b>At sowing</b>	Soil and seed borne diseases	Cultural practices <ol style="list-style-type: none"> <li>1. Select tolerant/resistant seeds for rootstocks.</li> <li>2. Keep the bud union as high as possible.</li> </ol>	
			Chemical practices <ol style="list-style-type: none"> <li>1. Seed treatment with fungicides.</li> <li>2. Seed dipping in antibiotics in canker endemic area.</li> </ol>	
		Sucking pests	Chemical practices <ol style="list-style-type: none"> <li>1. Seed treatment with insecticides.</li> </ol>	
2.	<b>Pre-planting</b>		<ol style="list-style-type: none"> <li>1. Deep ploughing in summer.</li> <li>2. Removal of alternate hosts.</li> <li>3. Soil solarization.</li> <li>4. Adequate manuring in pits.</li> <li>5. Use of <i>Trichoderma</i> spp. with organic matter in the ratio of 1:40 @ 2kg/pit.</li> <li>6. Select disease free and certified root stocks.</li> </ol>	
3.	<b>Vegetative growth stage (1-5 yrs)</b>	Weeds	Cultural practices <ol style="list-style-type: none"> <li>1. Interculture and hand weeding.</li> <li>2. Mulching with alkathene, wheat bran or rice bran.</li> </ol>	
			Chemical practices <ol style="list-style-type: none"> <li>1. Atrazine (0.5 kg a.i/ha) or Glyphosate (2 kg a.i/ha).</li> </ol>	
4.	<b>Fruiting stage (5-20yrs)</b>	Weeds	Cultural practices <ol style="list-style-type: none"> <li>1. Inter-culturing and hand weeding.</li> </ol>	
		Citrus white & black flies	Cultural practices	<ol style="list-style-type: none"> <li>1. Inter mingling branches should be pruned.</li> <li>2. Spacing between trees at close distance should be avoided.</li> <li>3. Well drained soil.</li> </ol>
			Mechanical practices	<ol style="list-style-type: none"> <li>1. Use of light trap (yellow colour of wave length of 550 mm).</li> <li>2. Use yellow sticky trap.</li> </ol>
			Biological practice	<ol style="list-style-type: none"> <li>1. Conservation of indigenous natural enemies.</li> <li>2. Augmentation of <i>Chrysoperla</i> spp and <i>Mallada borinensis</i> @ 10-15 eggs/grubs per plant.</li> </ol>
			Chemical practice	<ol style="list-style-type: none"> <li>1. Use neem product.</li> <li>2. Spray monocrotophos (0.06%) or endosulfan (0.1%).</li> </ol>

Citrus Psylla	Cultural practice	<ol style="list-style-type: none"> <li>1. Collateral host like curry leaf (<i>Murraya koenigii</i>) plant should not be grown. However, it can be used as trap crop.</li> <li>2. Use yellow sticky traps.</li> <li>3. Eradication of affected plants.</li> </ol>
	Biological practice	<ol style="list-style-type: none"> <li>1. Conservation of indigenous natural enemies.</li> <li>2. Augmentation of predators.</li> </ol>
	Chemical practice	<ol style="list-style-type: none"> <li>1. Use recommended neem products.</li> <li>2. Spray monocrotophos (0.1%), aminophos (0.1%) or thiometan (0.08%).</li> </ol>
Leaf miner	Cultural practice	<ol style="list-style-type: none"> <li>1. Be alert at the active phase of the growth.</li> <li>2. Avoid pruning during active growth periods.</li> <li>3. Manage nitrogenous fertilizers.</li> </ol>
	Mechanical practice	<ol style="list-style-type: none"> <li>1. Removal of early and late growing flushes and pre-flush pruning.</li> </ol>
	Chemical practice	<ol style="list-style-type: none"> <li>1. Use recommended neem products</li> <li>2. Soil drenching with lindane @ 15 kg/ha</li> <li>3. Use selective insecticides at the new flush only.</li> </ol>
Aphids	Cultural practice	<ol style="list-style-type: none"> <li>1. Use trap crops.</li> </ol>
	Biological practice	<ol style="list-style-type: none"> <li>1. Conservation of natural enemies.</li> <li>2. Augmentation of predators.</li> </ol>
	Chemical practice	<ol style="list-style-type: none"> <li>1. Spray methyl demeton (0.02%) or Imidacloprid (confidor 200 SL) at 10 g a.i./ha.</li> <li>2. Use neem product.</li> </ol>
Thrips	Chemical practice	<ol style="list-style-type: none"> <li>1. Use dimethoate or phosphamidon or monocrotophos (1 ml/litre).</li> </ol>
Fruit sucking moths	Cultural practice	<ol style="list-style-type: none"> <li>1. Clean cultivation.</li> <li>2. Destroy fallen fruits.</li> </ol>
	Mechanical practice	<ol style="list-style-type: none"> <li>1. Use light traps.</li> </ol>
	Chemical practice	<ol style="list-style-type: none"> <li>1. *Poison baiting with 20 gm malathion WP or 50 ml diazinon + 200 gm gur with some Vineger in 2 litres of water.</li> </ol>
Fruit fly	Cultural practice	<ol style="list-style-type: none"> <li>1. Clean cultivation.</li> <li>2. Destroy infested fruits.</li> <li>3. Allow egg laying on punctured fruits under the trees and then destroy.</li> </ol>
	Mechanical practice	<ol style="list-style-type: none"> <li>1. Use pheromone traps containing 0.1% methyl euginol and 0.05% malathion.</li> </ol>
	Biological practice	<ol style="list-style-type: none"> <li>1. Conservation and augmentation of natural enemies.</li> </ol>



	Chemical practice	1. Spray malathion (0.05%) or trichlorfon (0.05%) + 1% crude sugar.
Lemon butterfly	Mechanical practice	1. Pick and destroy larvae.
	Biological practice	1. Conserve and augmentation natural enemies. 2. Spray <i>Bacillus thuringiensis</i> @ 0.05%.
	Chemical practice	1. Spray monocrotophos (0.04%) or quinalphos (0.05%) or phosalone (0.05%).
Bark eating caterpillar, scales	Cultural practice	1. Insert a cotton swab soaked in kerosene/petrol and plug with mud.
	Chemical practice	1. Use selective insecticides
Mealy bug	Cultural practice	1. Prune affected shoots during winter and allow canopy to open from centre so that sufficient sunlight is intercepted below the canopy. 2. Destroy ant colonies.
	Mechanical practice	1. Sticky bands on the trunk portion of the tree. should be kept to avoid climbing of the crawlers from the ground. 2. Raking the soil around trunk during summer months helps in the desiccation of eggs and help in exposing the mealy bugs to natural enemies. 3. Use pheromone traps.
	Biological practice	1. Conserve indigenous natural enemies. 2. Release <i>Leptomastix dactylopi</i> @ 5000-7000 adults/ha.
	Chemical practice	1. *Spray dimethoate 150 ml + Kerosene oil 250 ml in 100 litre of water or carbaryl 10 ml + Kerosene oil 10 ml or malathion 20 ml in 10 liter of water.
	Citrus mites	Cultural practice
Biological practice		1. Conservation of indigenous natural enemies. 2. Release <i>Chrysoperla</i> grubs @ 10-15/plant.
Chemical practice		1. Use neem product like neem oil or pongamia oil and mahna oil. 2. Spray monocrotophos 1 ml or oxydemeton methyl 1.5 ml or wettable sulphur 80 WP 3 g/lit of water on the basis of monitoring.
Diseases	Cultural practice	1. Use canker tolerant/resistant varieties like Eustis, Lakeland. 2. Prune all the canker infected twigs before monsoon and destroy.
	Chemical Practice	1. Spray streptomycin+tetacycline hydrochloride @ 50 to 100 ppm 0.01% and copper oxychloride (0.3%) or mancozeb(0.2%).

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\* Not as per approved usage under Insecticide Act, 1968

## V. DO's AND DON'Ts IN CITRUS PEST MANAGEMENT

Sl.No.	Do's	Don'ts
1.	Use only certified disease free rootstocks and nurseries.	Don't use susceptible rootstocks and nurseries
2.	<b>AGRONOMIC PRACTICES</b>	
	a) Careful weeding and hoeing may be done.	a) Avoid injury on roots or trunks during weeding and hoeing .
	b) Judicious use of fertilizers.	b) Avoid overuse of nitrogenous fertilizers as crop becomes more susceptible to pest and diseases.
	c) Always use recommended NPK fertilizers in balanced proportion based on soil testing report.	c) Do not use under or imbalanced fertilizer applications which might result in poor plant health and reduced resistance to various insect-pests and diseases.
	d) Keep the soil well drained	d) Avoid flood irrigation and stagnation of water for longer period in the basin .
	e) Keep the bud union as high as possible to avoid infection of soil borne diseases .	
3.	<b>PEST MANAGEMENT</b>	
	a) Regular Surveillance: Ensure regular scouting/monitoring for timely detection of economic threshold values which are required for need based application of control measures against different insect pests.	a) Do not keep diseases affected shoot parts especially due to die-back to check the farther spread the disease .
	b) Conserve natural enemies of insect pests by avoiding indiscriminate application of chemicals	b) Don't go for blanket sprays without field roving .
	c) Select effective pesticides and its dosages at right stage .	c) Do not use unrecommended mixture of various insecticides in any case.
	d) Use only recommended pesticides at the recommended dosages for the	d) Don't use the insecticides at lower/over dosages other then the recommendation.

All these can lead :

1. Chemical control failure,
2. Quick development of resistance among insect pests to various insecticides.
3. Resurgence of pest like citrus mite, black flies and citrus psylla.
4. Induction of secondary pest problems like leaf spots.
5. Economical waste and contamination of the environment.

e) Spray technology : Always follow the recommended spray technology using adequate spray material.

e) Don't use substandard nozzles with high discharge rate which lead to poor coverage of the target site.

f) The date expired pesticides should not be used.

g) Don't purchase insecticides without bills and the information on batch number.

4.

#### WEED MANAGEMENT

a) A deep ploughing of surrounding soil is to be done on bright sunny days during the months of May or June.

a) Do not irrigate the field after ploughing to allow desiccation of weed bulbs or rhizomes of perennial weeds

b) Pre-emergence herbicides should be applied before emergence of weeds.

b) Pre-emergence herbicides should not be applied after emergence of weeds as they will not control the germinated weeds as well as they may affect the normal growth of plant.

c) Apply only recommended herbicides at recommended dose, proper time, appropriate spray solution with standard equipment alongwith flat fan or jet nozzles.

c) Pre-emergence as well as soil incorporated herbicides should not be applied in dry soils.

d) Herbicides should not be applied alongwith irrigation water or by mixing with soil, sand or urea.

e) The spray equipment including nozzles used for herbicides application should not be used for insecticides or fungicides application to avoid possible phytotoxicity to crop.

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## VI. SAFETY PARAMETERS IN PESTICIDES USAGE

S. No	Name of pesticide	Classification as per Insecticides Rules, 1971	Colour of Toxicity Triangle	WHO classification by hazard	First aid measures	Symptoms of poisoning	Treatment of poisoning	Waiting period (No. of days)
<b>INSECTICIDES</b>								
<b>ORGANOCHLORINE PESTICIDES</b>								
1.	Endosulfan	Highly toxic	Yellow	Class II – Moderately Hazardous	Remove the person from the contaminated environment.	Nausea, vomiting, restlessness, tremor, apprehension, convulsions, coma, respiratory failure and death	<ul style="list-style-type: none"> <li>- Gastric lavage with 2-4 L. tap water – Catharsis with 30 gm. (10 oz) sodium sulphate in one cup of water</li> <li>- Barbiturates in appropriate dosages repeated as necessary for restlessness or convulsions</li> <li>- Watch breathing closely, aspirate, oxygen and/or artificial respiration, if needed.</li> <li>- Avoid oils, oil laxatives and epinephrine (Adrenalin) – do not give stimulants.</li> <li>- Give calcium gluconate (10% in 10 ml. Ampules) intravenously every four hours.</li> </ul>	
2.	Lindane	-do-	-do-	-do-	<p>In case of (a) Skin contact – Remove all contaminated clothings and immediately wash with lot of water and soap; (b) Eye contamination – Wash the eyes with plenty of cool and clean water; (c) Inhalation – Carry the person to the open fresh air, loosen the clothings around neck and chest, and (d) Ingestion – If the victim is fully conscious, induce vomiting by tickling back of the throat. Do not administer milk, alcohol and fatty substances. In case the person is unconscious make sure the breathing passage is kept clear without any obstruction. Victim's head should be little lowered and face should be turned to one side in the lying down position. In case of breathing difficulty, give mouth to mouth or mouth to nose breathing.</p> <p>Medical aid: Take the patient to the docttr/Primary Health Centre immediately along with the</p>			

					original container, leaflet and label.		
ORGANOPHOSPHATE PESTICIDES							
3.	Monocrotophos	Extremely toxic	Bright red	Class I b - Highly hazardous		Mild - anorexia, headache, dizziness, weakness, anxiety, tremors of tongue and eyelids, miosis, impairment of visual acuity.	For extreme symptoms of O.P poisoning, injection of atropine (2-4 mg., for adults, 0.5-1.0 mg for children) is recommended, repeated at 5-10 minute intervals until signs of atropinization occur.
4.	Quinalphos	Highly toxic	Yellow	Class II - Moderately Hazardous			
5.	Malathion	Moderately toxic	Blue	Class III - Slightly hazardous		Moderate- nausea, salivation, lacrimation, abdominal cramp, vomiting, sweating, slow pulse, muscular tremors, miosis.	Speed is imperative - Atropine injection - 1 to 4 mg. Repeat 2 mg. when toxic symptoms begin to recur (15-16 minute intervals), Excessive salivation - good sign, more atropine needed; - Keep airways open. Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed. - For ingestion lavage stomach with 5% sodium bicarbonate, if not vomiting. For skin contact, wash with soap and water (eyes- wash with isotonic saline). Wear rubber gloves while washing contact areas.
6.	Acephate	-do-	-do-	-do-			
7.	Dimethoate	Highly toxic	Yellow	Class II - Moderately hazardous		Severe - diarrhoea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.	
8.	Phosphamidon	Extremely toxic	Bright red	Class Ia - Extremely hazardous			
9.	Phosalon	Highly toxic	Yellow	Class II - Moderately toxic			
10.	Thiometon	-do-	-do-	Class I b - Highly hazardous			
11.	Chlorpyrifos	-do-	-do-	Class II Moderately toxic			
12.	Diazinon	-do-	-do-	-do-			In addition to atropine give 2-PAM (2-pyridine aldoxime methiodide). 1 g

13.	Oxydemeton methyl	Highly toxic	Yellow	Class I b – Highly hazardous			and 0.25 g for infants intravenously at a slow rate over a period of 5 minutes and administer again periodically as indicated. More than one injection may be required.
14.	Trichlorophos	Slightly toxic	Blue	Class III <sup>c</sup> – Slightly hazardous			Avoid morphine, theophyllin, aminophyllin, barbiturates off phenothiazines.
15.	Fosetyl – I	-do-	-do-	Class III – Slightly hazardous			Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.

#### CARBAMATES

16.	Carbofuran	Extremely toxic	Red	Class I b – Highly hazardous		Constriction of pupils, salivation, profuse sweating, lassitude, muscle incoordination, nausea, vomiting, diarrhoea, epigastric pain, tightness in chest.	- Atropine injection 1 to 4 mg. Repeat 2 mg when toxic symptoms begin to recur (15-60 minute intervals). Excessive salivation – good sign, more atropine needed.
17.	Carbaryl	Highly toxic	Yellow	Class II – Moderately hazardous			- Keep airway open. Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed.
18.	Aldicarb	Extremely toxic	Red	Class I a – Extremely hazardous			- For ingestion, lavage stomach with 5% sodium bicarbonate, if not vomiting. For skin contact was with soap and water (eyes – wash with isotonic saline). Wear rubber gloves

							<p>while washing contact area.</p> <ul style="list-style-type: none"> <li>- Oxygen</li> <li>- Morphine, if needed.</li> </ul> <p>Avoid theophyllin and aminophyllin. or barbiturates.</p> <p>2-PAM and other oximes are not harmful and in fact contra indicated for routine usatge.</p> <p>Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.</p>
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FUNGICIDES

19.	Mancozeb	Slightly toxic	Green	Table 5 – Unlikely to present acute hazard in normal use		Headache, palpitation, nausea, vomiting, flushed face, irritation of nose, throat eyes and skin etc..	No specific antidote. Treatment is essentially symptomatic.
20.	Copper oxychloride	Moderately toxic	Blue	Class III – Slightly hazardous			
21.	Metalaxyl	-do-	-do-	-do-			

HERBICIDES

22.	Atrazine	Slightly toxic	Blue	Table 5 – Unlikely to produce hazard in normal use.		Headache, palpitation, nausea, vomiting, flushed face, irritation of nose, throat eyes and skin etc..	No specific antidote. Treatment is essentially symptomatic.
23.	Glyphosate	-do-	-do-	-do-			

OTHERS

24.	Imidacloprid					Headache, palpitation, nausea, vomiting.	No specific antidote. Treatment is essentially
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25.	Dicofol	Slightly toxic	Blue	Class III – Slightly hazardous		flushed face, irritation of nose, throat eyes and skin etc.,	symptomatic.	
26.	Streptocyclin	Slightly toxic	Green	Table –5 Unlikely to produce hazards in normal use				



AGRO ECO SYSTEM ANALYSIS (AES)

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 as under:

**A: Field Observations:-**

- a) Enter the garden at least 5 feet away from the bund. Select a tree and record visual observations in following sequence:
  - i) Flying insect (both pests and defenders)
  - ii) Close observation on pests and defenders which remain on the plants
  - iii) Observe and count nymphs and pseudopupae of citrus blackfly (*Aleurocanthus corglumi*) simultaneously quality of sugar secretion and also sooty mould developed on it and then assess the over all situation.
  - iv) Record insect damage in percentage.
  - v) Record diseases and their intensity.
- b) Record parameters like number of branches plant height, canopy and reproductive parts of the selected branch, which should be flagged for observations in the following weeks.
- c) Record the types of weeds, their size and population density in relation to tree plant.
- d) Record soil conditions viz., flooded, wet or dry.
- e) Repeat the step (a) to (d) in four sites randomly selected
- f) Record the climatic factors viz., sunny, partially sunny, cloudy, rainy etc., for the preceding week.

**B. Drawing:**

First draw the tree-plant with actual no of branches/twigs etc at the centre on a chart. Then draw pests on left side and defender on the right side. Indicate the soil condition, weed

population, irrigation method etc. Give natural colours to all the drawing for instance, draw healthy plant with green colour, diseased plant/pest with yellow colour. While drawing the pests and the defenders on the chart case 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 pests and defenders and their population counts 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 the attribute is sunny. If cloudy, the clouds may be drawn in place of sun. In the 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 by raising questions relating to change in pests and defender population in relation to crop stages, soil condition, 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 (Example)

- i) When large number of egg spirals and early instar larvae of citrus blackfly (*Aleurocanthus cooglumi*) are observed on dorsum of the leaves, the group may consider for judicious, selective and wise application of recommended chemicals.
- ii) When several twigs are dried due to die-back, farmers may take decision for immediate pruning of these twigs.
- iii) While determining the ETL of Specific pests the population of natural enemies may also be considered by the farmers, as while deciding the ETL for particular pest the NES are not generally considered. They play useful role in arriving at P/D ratio.

### AESA by extension functionaries:

The extension functionaries during their regular visit to the village mobilise the farmers conduct AESA and critically analyse the various factors such as the pest population and their role in natural suppression 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, which IPM components like release of defenders, applications of neem formulations/safe pesticides are to be used for specific pest situation. Such an exercise be repeated by the extension functionaries during every visit to the village and motivate the farmers to adopt AESA in their fields.

### AESA by farmers:

After a brief exposure during IPM demonstration/field trainings, farmers can practice AESA in their own fields. Wherever, trained farmers are available their experiences could be utilized in training their fellow farmers in their own villages. Thus a large group of farmers could be made proficiently 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 IPM on a large area on sustainable basis.

CITRUS CULTIVARS IN INDIA**A. Zone-Wise**

- |                    |  |
|--------------------|--|
| 1. North Zone      | Kinnow (sweet orange x Mandarin)<br>Fortunella sp (kumquat)<br>Sweet orange ( <i>Citrus sinensis</i> )                     |
| 2. Central Zone    | Nagpur mandarin ( <i>C. reticulata</i> )<br>Sweet orange/”mosambi” ( <i>C. reticulata</i> )                                |
| 3. West Zone       | Acid lime ( <i>C. aurantifolia</i> )   |
| 4. North-east zone | Khasi & Darjeeling mandarin ( <i>C. reticulata</i> )   |
| 5. South Zone      | Coorg mandarin ( <i>C. reticulata</i> ) sathgudi’ sweet orange ( <i>C. sinensis</i> ) Acid lime ( <i>C. aurantifolia</i> ) |

**B: Pest/Disease Resistant/Tolerant:**

Pest and disease	Cultivar
Mealy bugs	Assam lemon, Satkara and Pumelo
Citrus leaf minor	In Punjab : Carrizo, Sacaton, Savage, Troyer, Yama Citrange, Citrumelo, Cam’bell. Valencia, Pomany.
Aphids	Nagpur mandarin, Ikeda unshin
Phytophthora spp.	Narangi

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**SAFER INSECTICIDES FOR NATURAL ENEMIES IN CITRUS  
ECO-SYSTEM**

Sl.No.	Natural Enemies	Insect pest	Safe pesticides identified
<b>PARASITOIDS</b>			
1.	<i>Apanteles papilionis</i>	Lemon butterfly	Fenvalerate, permethrin, phosalone
2.	<i>Aphytis proclia</i>	San Jose scale	Fenvalerate
3.	<i>Leptomastix dactylopii</i>	Citrus mealy bug	Monocrotophos, phosalone
<b>PREDATORS</b>			
4.	<i>Amblyseius tetranychivorus</i>	Red spider mites	None
5.	<i>Chrysoperla carnea</i>	Jassids, aphids	Endosulfan, Fenvalerate, phosalone
6.	<i>Coccinella septempunctata</i>	Aphids	Alcoholic extract of dharek drupes and sweetflage rhizomes, methyldemeton
7.	<i>Cryptolaemus montrouzieri</i>	Mealy bugs	Alcoholic extract of dhrack drupes and sweetflag rhizomes, endosulfan, endrin, methyldemeton
8.	<i>Mallada boninensis</i>	Aphids, whitefly	Cypermethrin, dichlorvos, endosulfan, fenvalerate, fluvalinate, oxydemethon methyl
9.	<i>Menochilus sexmaculatus</i>	Aphids, whitefly	None

RECOMMENDED PESTICIDES IN CITRUS PEST MANAGEMENT

Pest/Pesticide	Dosage rate (a.i./ha)
<b>White/black flies</b>	
Neem products (300 ppm)	2.5 l/ha
Monocrotophos 36 SL	0.06%
Endosulfan 35 EC	0.01%
<b>Citrus psylla</b>	
Neem product (300 ppm)	2.5 l/ha
Monocrotophos 36 SL	0.01%
Thiometan 25 EC	0.08%
<b>Leaf miner</b>	
Monocrotophos 36 SL	0.07%
Phosphamidon 85 WSC	0.03%
Quinolphos 20 AF	0.02%
<b>Fruit sucking moths and fruit fly</b>	
Matathion 50 EC	0.01%
Endosulfan 35 EC	0.01%
<b>Lemon butterfly</b>	
Monocrotophos 36 SL	0.04%
Quinolphos 20 AF	0.05%
Phosalone 35 EC	0.05%
<i>Bacillus thuringiensis</i>	0.05%
<b>Scales</b>	
Monocrotophos 36 SL	0.08%
Dimethoate 30 EC	0.07%
Chlorpyrifos 20 EC	0.01%
Neem oil	2%
<b>Mealy Bugs</b>	
Carbaryl 50 WDP	10 ml
+	+
Kerosene oil	10ml in 10 litre water
Malathion 50 EC	0.01%

BASIC PRECAUTIONS IN PESTICIDE USAGE**A. Purchase:**

1. Purchase only JUST required quantity e.g. 100,250,500 or 1000 g/ml 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 the house premises.
2. Keep only in original container with intact seal.
3. Do not transfer pesticides to other container.
4. Never keep them together with food or feed/ fodder.
5. Keep away from the 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 sprayer tank.
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. Equipment:**

1. Select right kind of equipment.
2. Do not use leaky, defective equipment.
3. Select right kind of nozzle.
4. Don't 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 bucket 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 pesticide container for any purpose.

**H. Other Precautions:**

**1. Seed Treatment:**

- 1.1. For seed dressing, use either metal seed dresser earthen pots or polythene bags.
- 1.2. After seed treatment, do not open lid/cover of the polybag/earthen pot immediately to avoid inhalation of pesticide/fungicide.

**2. Cautions during spraying:**

- 2.1. Operator should not see up while spraying
- 2.2. If operator feels giddiness, uneasy, he must discontinue spraying, dusting at once.
- 2.3. Operator should not spray/dust more than 4 hours at a stretch in a day
- 2.4. Operator should not take up spray/dusting work with empty stomach.