

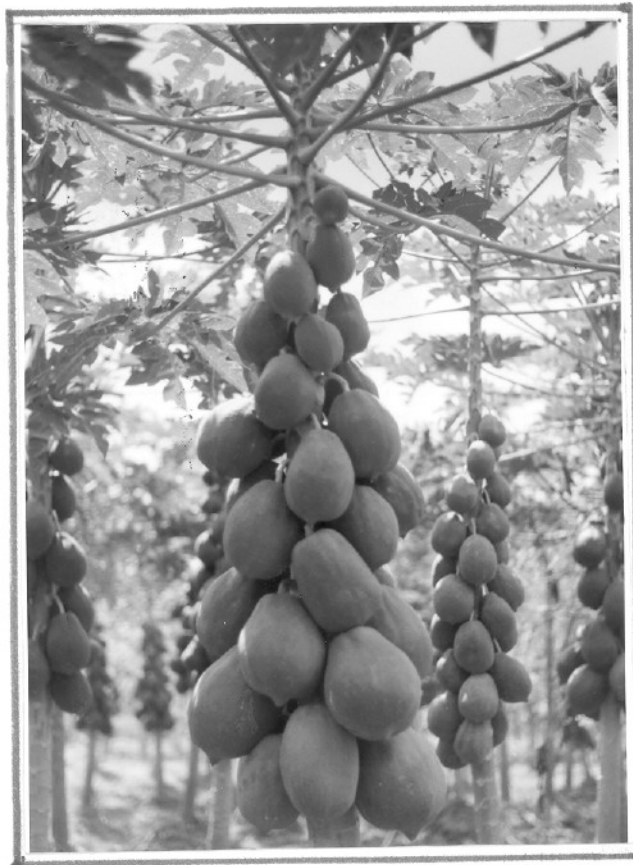


IPM PACKAGE NO. 52



INTEGRATED PEST MANAGEMENT PACKAGE

FOR
PAPAYA



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

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Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation
DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE
N. H. IV, FARIDABAD - 121 001 (HARYANA)

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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)
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(IPM Package for Papaya)

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 4th-5th July, 2002 and 9th-10th January, 2003 respectively for 18 IPM Packages and Eighth National Workshop was held at NPPTI, Hyderabad on 28th-29th 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, Cucurbitaceous 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.

7th October, 2003



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(IPM Package for Papaya)

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- | | | |
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IPM PACKAGE FOR PAPAYA

I. MAJOR PESTS

A. PESTS OF NATIONAL SIGNIFICANCE:

1. Insect pests

- 1.1 Ak grasshopper (*Poecilocerus pictus*)
- 1.2 Red spider mite (*Tetranychus telarius*)

2. Nematodes

- 2.1 Reniform nematode (*Rotylenchulus reniformis*)

3. Diseases

- 3.1 Stem or Foot or Collar rot (*Pythium spp.*, *Phytophthora spp.*, *Calonectria spp.*)
- 3.2 Anthracnose (*Collectotrichum gloeosporioides*)
- 3.3 Mosaic (Vector- *Aphis gossypii*, *Myzus persicae*)
- 3.4 Leaf curl (Vector – *Bemisia tabaci*)

4. Weeds

- 4.1 *Cyperus rotundus*
- 4.2 *Digitaria sanguinalis*
- 4.3 *Setaria glaucae*
- 4.4 *Cleome viscosa*
- 4.5 *Tridox procumbens*
- 4.6 *Cynodon dactylon*

5. Birds

- 1. King crow
- 2. Myna
- 3. Parrot

B. PESTS OF REGIONAL SIGNIFICANCE:**1. Insect pest**

- | | | |
|-----|--------------|---|
| 1.1 | Whitefly | (<i>Bemisia tabaci</i>) |
| 1.2 | Aphid | (<i>Aphis gossypii</i> , <i>Myzus persicae</i>) |
| 1.3 | Stem borer | (<i>Dasydes rugosellus</i>) |
| 1.4 | Scale insect | (<i>Aspidiotus destructor</i>) |
| 1.5 | Mealy bug | (<i>Drosicha mangiferae</i>) |
| 1.6 | Fruit flies | (<i>Bactrocera diversus</i> , <i>B. cucu bitae</i>) |

2. Nematode

- | | | |
|-----|--------------------|----------------------------------|
| 2.1 | Root knot nematode | (<i>Meloidogyne incognita</i>) |
|-----|--------------------|----------------------------------|

3. Diseases

- | | | |
|-----|----------------------------|--|
| 3.1 | Damping off | (<i>Pythium spp.</i> , <i>Phytophthora spp.</i> , <i>Rhizoctonia spp.</i>) |
| 3.2 | Powdery mildew | (<i>Oidium caricae</i>) |
| 3.3 | Distortion ring spot virus | (<i>Vector – Aphis gossypii</i> , <i>Myzus persicae</i>) |
| 3.4 | Root rot | (<i>Pythium spp.</i>) |
| 3.5 | Bunchy top | (<i>Vector – Empoasca papayae</i>) |
| 3.6 | Fruit rot | (<i>Phytophthora spp.</i> , <i>Rhizopus spp.</i>) |
| 3.7 | Leaf spot | (<i>Ascochyta caricae</i>) |

4. Weeds

- | | | |
|-----|----------------|-------------------------------------|
| 4.1 | Burmuda grass | (<i>Cynodon dactypon</i>) |
| 4.2 | Goose grass | (<i>Eleusina indica</i>) |
| 4.3 | Congress grass | (<i>Parthenium hysterophorus</i>) |
| 4.4 | Crab grass | (<i>Digitaria spp.</i>) |
| 4.5 | Nut grass | (<i>Cyperus spp.</i>) |
| 4.6 | Spurge | (<i>Euphorbia spp.</i>) |
| 4.7 | Cock's comb | (<i>Celosia argentia</i>) |

II. Pest Monitoring

Field Survey:

The object of survey is to monitor the initial development of pests and diseases in endemic areas. In the beginning of crop season, survey routes based upon the endemic areas are required to be identified to undertake on going surveys. Based upon the result of the roving survey, the state extension functionaries have to concentrate for greater efforts at block and village level as well as through farmers to initiate field scouting. Farmer should be mobilized to observe the pest and disease occurrence by field scouting at the intervals as stipulated here under. The plant protection measures are required to be taken as per result of field scouting.

A. Agro Eco-System Analysis (AESA)

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

1. Plant health at different stages
2. Pest and defender population dynamics
3. Soil conditions
4. Climatic factors
5. Farmer's past experiences.

III. INTEGRATED PEST MANAGEMENT STRATEGIES

A. Cultural practices:

1. Frequent ploughing around the tree will destroy different stages of insect viz., Ak grasshopper, mealy bug, etc. and rapping of alkathene bands round the tree trunk during November-December prevents climbing mealy bug. Apply Neem Seed Cake after ploughing @ 4 Kg/tree.
2. Repeated hoeing/weeding around the plant.

2. Repeated hoeing/weeding around the plant.
3. Avoid nearby cultivation of all cucurbitaceous plants since they are alternate hosts of the virus infecting papaya.
4. Grow virus resistant varieties of papaya viz., 'Godakavella', 'Bangalore', 'Coimbatore', etc.
5. Soil solarization should be adopted in nursery bed to minimize insect and nematode damage.
6. Proper drainage should be maintained.

B. Mechanical control practices:

1. The mite affected leaves and twigs should be cut and burnt.
2. Proper sanitation should be maintained in the orchard by destroying all infected plant parts.
3. Plants having mature fruits should be covered with gunny bag keeping one end open in below portion to collect ripe fruits and hence protecting them from birds. Over ripening should be avoided.
4. There should not be any scratch while picking fruits to save them from fungal infection.

C. Biological control practices:

1. **Conservation:**

Number of effective parasites, predators and pathogens are used against pests of Papaya e.g. Spiders, *Coccinellids*, *Lindorus*, *Iophanthae*, *Chilocorus bijugus*, *Cryptognatha nodiceps*, *Chrysoperla lacciperda* (Egg predator of whitefly), *Trybliographa daci*, *Spalangia* spp. *Pachycrepoidesis dubiers*, *Opius* spp. *Gitonides perspicax*, *Dirbinus giffardi* (all parasites of scale insect), *Rodolia fumida* (Predator of Mealy bug) *Phygadeum* spp. (Nymphal parasite of Mealy bug), *Eretmoceras massil* (Parasite of white fly), *Azya trintalis* (predator of scale insect) could be conserved by using various conservation methods.

D. Botanical pesticides:

1. Neem Seed Kernel Extract (NSKE) @ 5% helps in reducing the pest population.
2. Spraying of ground nut oil in nursery @ 1 ml./ltr. of water and on papaya plant @ 2 ml./ltrs. of water deters insect vector.

E. Chemical control practices:

1. Dicofol 18.5% or Kelthane 1.5-2.0 ltrs in 1000 ltrs. of water per ha should be sprayed against red spider mite.
2. Alternate foliar spray with Tridomorph (0.1%)/Dinocap (0.1%) at 15 days interval to control powdery mildew.
3. Application of Mancozeb or Zibeb (0.25%) controls anthracnose.
4. In foot rot and root rot prone area, 1 kg. lime alongwith 100 gm. copper sulphate per pit should be applied.
5. Spray the crop with Malathion @ 2 ltr./ha or Endosulphan @ 1.25 ltr/ha against insect vector and grasshoppers.
6. A poison bait (20 gm. Malathion 50% WP or 50 ml of Diazinon +200 gm of gur or molasses in 2 ltr. of water) should be kept in flat containers if fruit fly damage is observed.

IV. 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 sunlight or rain water.
7. Do not store weedicides alongwith 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 solutions:

1. Use clean water.
2. Always protect your NOSE, EYES, MOUTH, EARS and HANDS.
3. Use hand gloves, face mask and cover head with cap.
4. Use polythene bags and hand gloves, handkerchiefs or piece of clean cloth, mask and a cap or towel to cover the head (Do not use polythene bags contaminated with pesticides).
5. Read the lable 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.

E. Equipment:

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 toothbrush 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. Through 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.

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