



IPM PACKAGE NO. 60



INTEGRATED PEST MANAGEMENT PACKAGE

FOR JACKFRUIT



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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DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE

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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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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 (AES), 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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- | | |
|-------------------------------------|--|
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| (ii) Co-Chairman Tech. Session | Dr. Raj Singh, JD(Bio) Dte. of P.P.Q. & S., Faridabad |
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IPM PACKAGE FOR JACKFRUIT

I. MAJOR PESTS

A. PESTS OF NATIONAL SIGNIFICANCE

1. Insect pests:

- | | | |
|-----|-------------------------|---|
| 1.1 | Shoot and fruit borer | (<i>Margaronia caesalis</i> , <i>Deaphania caesales</i> .) |
| 1.2 | Spittle bugs | (<i>Cosmocarta relata</i>) |
| 1.3 | Mealy bug | (<i>Drosicha magniferae</i> .) |
| 1.4 | Bud weevil | (<i>Ochymera artocarpi</i>) |
| 1.5 | Bark eating caterpillar | (<i>Indarbela tetraonis</i>) |
| 1.6 | Aphid | (<i>Greenidia artocarpi</i>) |
| 1.7 | Leaf weeber | (<i>Diaphinia bivitralis</i>) |

(2) Diseases:

- | | | |
|-----|-----------------------|--|
| 2.1 | Soft Rot or Fruit Rot | (<i>Rhizopus artocarpi</i>) |
| 2.2 | Die back | (<i>Botryodiphodia theobromae</i>) |
| 2.3 | Leaf spot | (<i>Phyllosticta artocarpina</i>) |
| 2.4 | Pink disease | (<i>Botryobasidium salmonicolor</i>) |

(3) Weeds:

- | | |
|-----|----------------------------|
| 3.1 | <i>Cynodan dactylon</i> |
| 3.2 | Semi parasitic weed |
| 3.3 | <i>Eleusine indica</i> |
| 3.4 | <i>Paspalum conjugatum</i> |
| 3.5 | <i>Ageratum conyzides</i> |

B. PESTS OF REGIONAL SIGNIFICANCE

I. Insect pests:

- | | | |
|-----|----------------------|--|
| 1.1 | Stem borer | (<i>Bactocera rufomaculata</i>) and (<i>Microcolona leucosticata</i>) |
| 1.2 | Pink waxy scale | (<i>Ceroplastes rubens</i>) |
| 1.3 | Thrips | (<i>Pseudodendrothrips dwivarna</i>) |
| 1.4 | Aphid | (<i>Toxoptera aurantii</i>) |
| 1.5 | Castor capsule borer | (<i>Dichochrocis punctiferalis</i>) |

2.

Disease

- | | | |
|-----|------------------------|-------------------------------|
| 2.1 | Rust | (<i>Uredo artocarp</i>) |
| 2.2 | Anthraco | |
| 2.3 | Male inflorescence rot | (<i>Rhizopus nigricans</i>) |

II. PEST MONITORING:

A. Survey

The objective of surveys through roving surveys is to monitor the initial development of pest and disease in the endemic areas. Therefore, for field scouting farmers should be mobilized to observe the pests and disease occurrence at the intervals as stipulated under different development stages. The Plant protection measures to be taken only when biocontrol potential does not show promise and pest and diseases incidence shows increasing trend.

B. Field scouting:

Field scouting for pests/diseases and biocontrol fauna/flora by extension agencies and farmers once in a fortnight should be undertaken to assess increasing/decreasing trend in the pest/disease and availability of biocontrol potential. This should be done soon after the appearance of new flush after the fall of old leaves as such stage of the crop, having succulent tissues are vulnerable to attack by pests and diseases. The State Department of Horticulture should make all possible efforts by using different media, mode and publicity to inform the farmers for scouting in the specific crop area having indication of pest and disease build up.

C. Pest Monitoring through Traps:

1 Through yellow sticky traps: Set up yellow fast coloured sticky traps, for monitoring the aphis, one trap/5 trees. Locally available empty yellow Palmolive-tin coated with grease/Vaseline/caster oil on outer surface may also be used.

III. INTEGRATED PEST MANAGEMENT STRATEGIES

A. Cultural practices:

- Deep ploughing of orchard immediately after harvest to expose eggs and pupae of mealy bugs.
- Heavy irrigation of orchard in October also helps in destruction of eggs of mealy bug.
- After removing the webs of bark eating caterpillars following measures should be adopted:
 - i) All the borer holes except the fresh one, should be plugged with mud plastering.
 - ii) The fresh holes should be plugged with 0.5% DDVP.
- Raking of soil around the tree trunk and mixing with methyl parathion 2% dust @ 250 gm per tree for controlling early instar nymphs of mealy bug in the month of November-December.
- KNO_3 (Potassium Nitrate) 2% spray to prevent premature fruit drop.

B. Mechanical control:

- After mud plastering 25 cm. wide, 400 gauge alkathene (polythene) should be fastened to the tree trunk with the help of sutli, about 30 cm. above the ground level to prevent migration of freshly hatched first instars nymphs of mealy bugs in the month of December-January.
- The affected leaves and young shoots may be pruned and they may be destroyed along with the pest. This practice will help in bringing down the pest population.
- Prune and burn affected twigs for the control of scales and mealy bugs. Sticky band should be fixed on main trunk to prevent the movement of ants.
- The affected parts should be nipped off and destroyed.

C. Biological control:

- *Cryptolaemus montrouzieri* and *Leptomastix danylopi* play a significant role in bringing down mealy bug nymphal and adult stages of the pest. So conserve them through minimum use of toxic chemicals, so as to exploit maximum potential of biocontrol fauna.
- Conserve the parasites and predators. A large number of parasites, predators and pathogens are very active against pests of jackfruit. They are *Rodolia fumida*, *Suminus nensidi*, *Coccinellids*, *Syrphid*, *Carabids*, *Dragonfly*, *Spiders*, *beauveria bassiana* and *Chrysoperla spp.*
- Spray *Verticillium laccani* (1x10) against scale insects.
- Treat the seeds with *Trichoderma viride* @ 4g/kg of seed for controlling seed rot/seedling rot.
- Mix *Trichoderma viride* @ 100 g/tree during intercultivation or drenching around the tree to prevent fungal infection like fruit rot/soft rot etc.
- Add 1.5 kg *T. viride* and *T. harzanium* with 25 kg. FYM and use 200 g material for each plant.

D. Chemical control:

Insect/pests management

- Use botanical pesticides such as NSKE 5% or 0.3% Neem oil against the insect pests.
- Use of 2% mahua oil spray to check aphid infection.
- Use of 0.7% synthetic garlic oil to control mealy bug.
- Spray Carbaryl (0.2%) or quinalphos (0.05%) or monocrotophos (0.04%) at fortnightly intervals from the commencement of new flush for controlling shoot, trunk and stem borer. A total of 2-3 sprays may be done depending on the intensity of infestation.
- Remove the webs from tree trunks and put emulsion of *DDVP (0.05%) in each hole and plug them with mud for control of stem borer and bark eating caterpillars.

- Apply carbaryl 50 WP @ 4 g/litre after pruning infested twigs, for the control of mealy bug and scale infestation, prior to fruiting.
- Spraying of nicotine sulphate in water (1:600) can give effective control for mealy bug. Metacid @ 0.1% spray is also effective for mealy bug.

Diseases management

- After pruning, application of blitox or Bordeaux paste on pruned surface are suggested to check the infection.
- Spray Bordeaux mixture (0.4%) or copper oxy chloride (0.25%) during January to March at an interval of 21 days for soft rot of fruits.
- Spray Bordeaux mixture (1%) or copper oxychloride (0.25%) for brown leaf spot.
- For the control of dieback spray carbendazin (0.1%) or Thiophonate methyl (0.2%).

IV. INTEGRATED WEED MANAGEMENT PRACTICES FOR JACKFRUIT

1. Preventive Measures

- i) Before establishing the orchard follow the summer deep ploughing to expose and destroy the underground vegetative parts of the deep rooted perennial weeds and hibernating/resting stages of various pests.
- ii) Follow the recommended agronomic management practices of land preparation, planting distance, fertilizer and irrigation etc. to have healthy plants stand.

2. Control Measures

- i) Smothering of weeds by using mulching with straw/hay/plastic sheets etc.
- ii) Use bullock driven or power operated or hand operated implements for controlling weeds as and when needed.

V. BASIC PRECAUTIONS IN PESTICIDE USAGES

A. Purchase

1. Purchase only JUST required quantity e.g. 100, 250, 500 or 1000 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 head with cap.
4. Use polythene bags as hand gloves, handkerchiefs or piece of clean cloth as mask and a cap or towel to cover the head (Do not use polythene 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.

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 toothbrushes 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 doses 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.