



IPM PACKAGE NO. 30



INTEGRATED PEST MANAGEMENT PACKAGE

FOR

SAPOTA



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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IPM PACKAGE FOR SAPOTA

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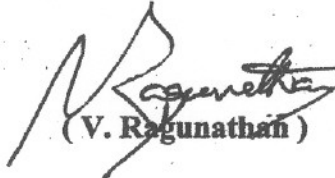
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FOREWARD

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 SAPOTA

I. MAJOR PESTS:

A. Pests of National Significance:

1. Insect Pests:

1.1 Sapota moth, *Nephoteryx eugraphella*

1.2 Green scale, *Coccus viridis*

2. Diseases

2.1 Leaf spot

2.2 Leaf blight

2.3 Fruit rot

3. Weeds

3.1 Perennial weeds

B. Pests of Regional Significance:

1. Insect pests:

1.1 Mealy bug (Karnataka)

1.2 Leaf-hopper, *Idioscopus nagpurensis*

1.3 Seed borer, *Spodoptera* sp.

2. Diseases:

2.1 Faciation

2.2 Phanerogamic parasites

3. Weeds:

3.1 Perennial

II. PEST MONITORING:

A. Survey:

The objective of survey 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 pest and disease occurrence at the intervals as stipulated under different developmental stages. The plant protection measures are required to be taken only when biocontrol potential does not show promise and pest and diseases incidences 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 incidence 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 is variable to attack by pests and diseases. The state Departments 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. Pest Monitoring through Traps:

1. Through yellow sticky traps: Setup yellow fast coloured sticky traps for monitoring sucking one trap/ 5 trees. Locally available empty yellow palmolive-tin coated with grease / vaseline / castor oil on outer surface may also be used.
2. Through pheromone traps: Certain pests of fruit crops required installation of pheromone traps to monitor initial pest build up and suppression of its increasing population. Sticky pheromone traps may also be used 5-7 traps per ha. for effective monitoring.

III. IPM STRATEGIES:

1. Cultural Practices

1.1 **FYM incorporate:** Apply decomposed farm yard manures, It helps soil microbes in gluing soil particles. This improves soil health and ensures good standing fruit trees.

1.2 **Layout of orchard:** Plant it by maintaining plant to plant spacing, to regulate moths population in orchard.

1.3 **Usage of neem cake extract:** Neem cake 4% per tree should be incorporated, to soil, so as reduction in pest menace .

1.4 **Select tolerant varieties:** Cricket Ball, Bangalora.

1.5 **Removal of all affected branches and pasting of cut ends with copper fungicides.**

2 Weed Management:

2.1 The recommended agronomic practices should be followed for land preparation; and application of balanced doses of NPK, inside the basin and away from trunk of tree, below the anterior end of canopy for achieving healthy crop stand, which would be capable of competing with weeds, in initial years.

2.2 The crop should be maintained weed free by growing forage crops, in between spacing of fruit trees eg. Lucerne, Berseem.

3. Mechanical practices:

3.1 Collection of infested and dried leaves should be burnt for lessen incidence of Sapota moth, in the Orchards.

3.2 Prune and burn affected twigs for the control of scales and mealy bug.

Sticky bands should be fixed on main trunk of trees, to prevent the movement of ants.

4 Biological control:

4.1 Conservation of natural biocontrol fauna:

Cryptolaemus montrouzieri and *Leptomastix dactylopti* play a significant role in bringing down mealy bug nymphal and adult stages of the pest. So, conserve through minimum use of toxic chemicals, so as to exploit maximum potential of biocontrol fauna.

Conserve *Fulgoreacia* sp. which is the active parasite of leafhopper.

4.2 Augmentation:

Release of *C. montrouzieri* @ 10 grubs / plant or at the optimal dosage @ 5000/ha against all stage of mealy bugs. Alkathene banding should be made, 24 hrs before release. Apply grease on the lower edge of band.

4.3 Spray *Verticillium lacoani* (1×10^8) against scale insects and hoppers. For the removal of black sooty mold falls.

4.4 Spray starch @ 1% for removal of sooty mold.

5. Chemical control:

4.5 Application of pesticides should be made judiciously, need based and resorted at the last, before the pest population reaches to injury level and cause heavy losses.

4.6 The spraying of zineb 75% WP @1.5-2.0kg/ha is recommended at monthly intervals starting from June to February months to control leaf spot, leaf blight and fruit rot diseases.

4.7 To control Sapota moth, spray *monocrolophos 40 EC @ ½ ml per litre of water or *carbaryl 50 WP @4 g/ litre or *malathion 50 EC @ 2ml/ litre of water, before buds emerge out.

4.8 Apply *carbaryl 50WP, @4g/ litre or *quinalphos 25EC @ 2ml/ litre after pruning infested twigs, for the control of mealy bug and scale infestation, prior fruiting.

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

IV. CROP STAGE-WISE IPM PRACTICES:

Sl.No.	Crop Stage/Pests	IPM Practice
1.	PRE-PLANTING	<p>Cultural Practices</p> <ol style="list-style-type: none"> 1. Deep ploughing in summer to expose bulbs of perennial weeds. 2. Harrowing, leveling and application of FYM to the soil help in achieving to conserve soil moisture, and ensure excellent bearing of fruits and resist to insect invasion later. <p>Mechanical practice</p> <ol style="list-style-type: none"> 1. Remove weeds so prevent from taking alternate hosts by insect pests.
2.	<p>PLANTING</p> <p>Insects</p> <p>Weeds</p> <p>Insect & Diseases</p>	<p>Cultural practices</p> <ol style="list-style-type: none"> 1. Layout the field and plant selected tolerant variety in square type. 2. Prepare basins for each sapling, and clean cultivation practice should be adopted. <p>Mechanical practices</p> <ol style="list-style-type: none"> 1. Neem cake must be incorporated @ 40kg/acre, to protect from pest attack. 2. Apply basal dose of fertilizer, N:P:K at recommended dosage. Add nitrogenous fertilizer less in quantity. 3. Growing of forage crops as a mixed crop, helps in "maintaining ecological balance".
3.	<p>(2nd to 4th year)</p> <p>VEGETATIVE phase</p> <p>weeds</p> <p>Sapota moth</p> <p>(<i>N. eugraphella</i>) Leaf hopper</p>	<p>Cultural practices</p> <ol style="list-style-type: none"> 1. Soil solarizing by polythene mulch, for controlling weeds. 2. Irrigate the soil according to season, changes micro climate in orchard suited for plant growth, and adversing effect to moths and sap sucking insect pests. 3. Add phosphatic fertilizer, @ 300 g/tree, for better root growth.

IV. CROP STAGE-WISE IPM PRACTICES

Mechanical practices

1. Removal of infested, brown patched leaves.

Chemical control

1. Spray insecticide (EFT) *malathion 50EC, @0.1% concentration (2ml/ litre), when moths incidences are observed frequently.
2. Spray *V. laccani* followed by starch application.

Scale insects

2. Spray Zineb 75%WP @1.5-2.0 kg/ha.

Leafspot & sooty mold

4. FLOWERING Phase **Mechanical control**

Sapota moth

1. Destroying of removed the infested parts, Check the infestation, to the some extent.

5. FRUIT LADEN Phase **Cultural methods**

Insect pests and diseases

1. Application of fertilizer should be accomplished.

- Do -

2. Need-wise irrigation

Mechanical practice

Sapota caterpillar

1. Remove infested fruits.

(N. eugraphella)

Biological application

Mealy bug

1. Release *C. monotrouzieri* @ 10 Nos. per tree for the control of sucking 'IP'

Chemical control

Insect pests

1. Undertake judicious spraying of *malathion (0.05%), if the infestation is more.
2. Spray "NSKE" @ 5% or neem oil 0.4%.

6. HARVESTING Phase **Cultural practice**

1. Fruits should be harvested in the month of January.

V. 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)
INSECTICIDES								
ORGANOPHOSPHATE PESTICIDES								
1.	Quinalphos	Highly toxic	Yellow	Class II - Moderately Hazardous	Remove the person from the contaminated environment.	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.	
2.	Monocrotophos	Extremely toxic	Bright red	Class I b - Highly hazardous	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.	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.	
3.	Malathion	Moderately toxic	Blue	Class III - Slightly hazardous	Remove the person from the contaminated environment. 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. Medical aid: Take the patient to the docotr/Primary Health Centre immediately along with the original container, leaflet and label.	Severe - diarrhoea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.		

							<p>In addition to atropine give 2-PAM (2-pyridine aldoxime methiodide). 1 g 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.</p> <p>Avoid morphine, theophyllin, aminophyllin, barbiturates or phenothiazines.</p> <p>Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.</p>
CARBAMATES							
4.	Carbaryl	Highly toxic	Yellow	Class II - Moderately hazardous	<p>Constriction of pupils, salivation, profuse sweating, lassitude, muscle incoordination, nausea, vomiting, diarrhoea, epigastric pain, tightness in chest.</p>	<ul style="list-style-type: none"> - 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. - Keep airway 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 	

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							<ul style="list-style-type: none"> area. Oxygen Morphine, if needed. <p>Avoid theophyllin and aminophyllin or barbiturates, 2-PAM and other oximes are not harmful and in fact contra indicated for routine usage.</p> <p>Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.</p>
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FUNGICIDES							
5.	Ziram	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.
6.	Zineb	Moderately toxic	Blue	Class III - Slightly hazardous			

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 some 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.
