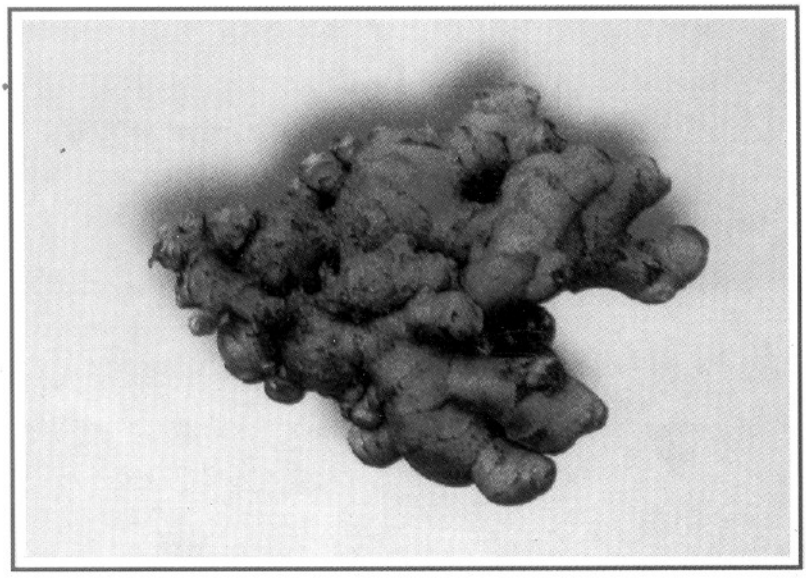
सत्यमेव जयते

IPM PACKAGE NO. 41

INTEGRATED PEST MANAGEMENT PACKAGE

FOR

GINGER



Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation
Directorate of Plant Protection, Quarantine & Storage
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IPM PACKAGE FOR GINGER

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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 Progamme 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. Ragunathan)

PREFACE

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, Cucurbitacious vegatables), 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.

April 1, 2002

(A.D. Pawar)
Director (IPM)

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III. Co-chairman, Technical Session : Dr. Bijender Singh, Entomologist Dte. of PPQ&S, Faridabad.

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8. Dr. D. Kanungo, Jt. Director, CIL, Dte of PPQS, Faridabad
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7. Sh. N.K. Mishra, LDC, IPM Div., Dte of PPQS, Faridabad.

IPM PACKAGE FOR GINGER

I. MAJOR PESTS:

A. Pests of National Significance:

1. Insect Pests:

1.1 Shoot borer (*Conogethes punctiferalis)*
1.2 Rhizome fly (*Mimegralla coeruliforns)*

2. Diseases:

2.1 Rhizome/soft rot (*Pythium spp.*)

2.2 Leaf spot *(Phyllosticta zingiberi*)

3. Weeds:

3.1 *Dactylactenium aegyptium*
3.2 *Trianthema portulacastrum*
3.3 *Panicum repens*

B. Pests of Regional/Minor Importance:

1. Insect Pests:

1.1 White grub (*Holotrichia setticolis)*
1.2 Skipper (*Udaspis folus*)
1.3 Scale (*Aspidiotus garlic)*

2. Diseases:

2.1 Bacterial wilt(*Pseudomonas solanacearum*)

2.2 Sheath blight/Leaf blight(*Rhizoctonia solani*)

2.3 Dry rot (*Fusarium oxysporium)*

II. PEST MONITORING:

The objective of pest monitoring is to monitor the initial development of pests and diseases in the field. 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. Therefore, for field scouting, farmers may be mobilized to observe the pest and disease occurrence at the intervals as stipulated under different developmental stage. The plant protection measures are required to be taken only when pests and diseases cross economic threshold level (ETL) as per results of field scouting.

III. INTEGRATED PEST MANAGEMENT STRATEGIES

A. Cultural Practices:

1. Deep ploughing of the fields.
2. Solarisation of beds for 20-30 days is beneficial in checking the multiplication of pests and diseases.
3. For seed material, big plumpy rhizomes free from any infection/infestation may be selected immediately after harvest.
4. The seed rhizomes may be put in shallow pit and mixed with well rotten cattle manure or compost mixed with *Trichoderma* (10gm compost inoculated with *Trichoderma)* planted at a spacing of 20-25 cm within and between the rows.
5. Balanced/recommended manure/fertilizers are to be applied as per soil testing report.
6. Mulching the ginger bed @10-12 tonnes of green leaves is essential. After 40th day and 90th day mulching with 5 tonnes of green leaves/ha, immediately after weeding and application of fertilizers to prevent washing of soil, conserve soil moisture, smothers weed growth and improve the physical properties of soil.
7. Cow dung slurry or liquid manure may be poured on the bed after each mulching to enhance microbial activities and nutrient availability.
8. Weeding is required just before fertilizer application and mulching. Two to three weeding are required depending on the intensity of weed growth.
9. Application of Neem Cake @ 2 tonnes/ha.
10. Proper drainage channels are to be provided in the inter rows to drain off stagnant water and also reduce soil inoculum.
11. Ginger should be rotated with other crops like Tapioca, chilly, paddy, gingilly, ragi, groundnut, maize and vegetables.
12. Growing tolerant varieties like Maran suas, Nadia, Narasapattnam, Venguna, Wynad local, W. Mannontody, Kuruppampady against rhizome rot.

B. Mechanical Practices:

1. Solarisation of bed at the time of land preparation is beneficial in checking the multiplication of pests and disease causing organisms.
2. Light traps will be useful in attracting and collecting the adult moths of shoot borer.
3. Provide adequate drainage system to avoid water stagnation to check soft rot or rhizome rot.
4. If soft rot/rhizome rot is noticed, the affected clumps are to be removed carefully along with the soil surrounding the rhizome (as it is a soil borne disease) to reduce the spread.
5. Collection of leaf roller larvae by locating the folded leaves is suggested if infestation is not wide spread.
6. Using healthy rhizomes for planting and early removal of dead plants and affected rhizomes reduces the infestation of rhizome fly.
7. Mechanical collection of white grub adults at dusk during emergence and destruction.

C. Biological Control Practices:

1. *Trichoderma* sp. may be applied at the time of planting and subsequently to prevent soft rot/ rhizome rot.
2. Use of *"Lantana camara"* and *"Vitex negundo"* as mulch may reduce the infestation of shoot borer.
3. Conserve the natural Bioagents such as lady bird beetles, spiders, chrysopids, trichogrammatids etc.
4. Release of *Trichogramma chilonis* @ 50,000 per ha. per week for lepidopterans.

D. Chemical Control Practices:

1. Spray Neem oil (0.5%) at fortnightly intervals, if shoot borer is noticed or spray dimethoate or quinalphos (0.05%).
2. Restricted use of Bordeaux mixture (1%) in disease prone area may be made to control soft rot/rhizome rot as spot application.
3. Spray carbaryl* (0.1%) to control leaf roller.
4. Dip the seed rhizome in quinalphos* (0.1%) twice before storage/sowing to get rid of rhizome scale.
5. Spraying of dimethoate* and quinalphos* is effective against rhizome fly.
6. Treatment of rhizome with metalaxyl* mz @ 4 gm per kg and soil drenching (spot application) with matalaxyl* mz for rhizome rot management.

*Not as per the approved usage under Insecticides Act, 1968.

IV. CROP STAGE-WISE IPM PRACTICES:

CROP STAGE/PEST	IPM COMPONENT	IPM PRACTICE
1. Pre-sowing	Cultural practice	1.Deep ploughing. 2. Adopt crop rotation.
	Mechanical practice	1. Solarisation of bed may be done to reduce various pests/ diseases.
2. Seedling stage	Cultural practice	1. Carefully preserved seed rhizomes free from infection/ infestation may be put in shallow pits mixed with compost /cattle manure inoculated with *Trichoderma*, during first fortnight of May with the receipt of monsoon shower .(under irrigated condition in Feb / March) 2. Mulching ginger bed is essential. Cow dung slurry or liquid manure may be added after each mulch to enhance microbial activity. 3. Proper drainage channel are to be provided between the rows to avoid water stagnation and reduce rhizome rot.

Rhizome scale Bacterial wilt	Chemical practices	1. Dip the seed rhizomes in quinalphos* (0.1%) twice prior to storage/sowing. 2. Treat the seed rhizomes with 100-200 ppm streptomycine* for 30 minutes.
3. VEGETATIVE PHASE Shoot borer	Cultural practice	1. Install light trap to catch adult months.
	Biological practice	1. Use of "*Lantana camara*" and "*Vitex negundo*" as mulch may reduce the infestation of shoot borers.
	Chemical practice	1. Spray Neem oil (0.5%) at fortnightly intervals or spray dimethoate* or quinalphos* at 0.05%
Soft rot/rhizomes rot	Cultural practice	1. Select sites having proper drainage. 2. Select seed rhizomes from disease free areas. 3. Dig out the affected plants along with soil surrounding rhizome.
	Biological practice	1. *Trichoderma* may be applied at the time of planting and subsequently.
	Chemical practice	1. Treat the seed rhizomes before planting with

		metalaxyl* mz @ 4 gm /kg. 2. After digging out the infected plant drench the beds with chestnut compound or 1% Bordeaux mixture.
Rhizom rot	Chemical practice	1. Thiram @ 25-30 g/kg of seeds may be treated.
Leaf roller	Chemical practice	1. Spray Carbaryl 0.1%
Rhizome fly	Chemical practice	1. Dimethoate* or monocrotophos* are effective.
Weed	Mechanical practice	1. Remove weeds by hand weeding before each mulching. Repeat weeding according to weed growth during the fifth and sixth months after planting.
Preservation of seed rhizomes	Cultural practice	1. Store the rhizomes free from infection /infestation in pits, dug under shade, the floor of which is lined with sand or saw dust. 2. It is advisable to spread layers of leaves of *Glycosmis pentaphylla* (panai) cover the pits with coconut fronds.

* Not as per the approved usage under the Insecticides Act, 1968.

V. DO'S AND DONT'S IN GINGER IPM

DO'S	DON'TS
1. Grow only recommended varieties.	1. Don't grow verities not suitable for the season/region.
2. It should be ensured that the seed rhizomes are free from any infection/infestation. Biocides, like *Trichoderma* can be used while planting the seed rhizomes.	2. Don't treat the seed rhizomes with any chemicals.
3. Remove weeds by hand weeding before each mulch and fertilizer application.	3. Don't forget weeding before mulching and fertilizer application.
4. Use fertilizers as per soil test recommendation.	4. Don't mix micronutrients with fertilizers and incorporate in soil.
5. Proper drainage facilities must be provided to drain off stagnant water.	5. Don't allow water to be stagnant.
6. Conduct AESA weekly /monthly in the morning preferably before 9 a.m. for taking decision on management practice.	6. Don't apply chemical pesticides on calendar basis.
7. Install light traps for collecting and monitoring shoot borer adult moths.	8. Don't apply any insecticides before monitoring the pests situation.

CROP: GINGER

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. 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.	Mild – anorexia, headache, dizziness, weakness, anxiety, tremors of tongue and eyelids, miosis, impairment of visual acuity. Moderate- nausea, salivation, lacrimation, abdominal cramp, vomiting, sweating, slow pulse, muscular tremors, miosis. Severe – diarrhoea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.	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. 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.	
2.	Monocrotophos	Extremely toxic	Bright red	Class I b – Highly hazardous				
3.	Dimethoate	Highly toxic	Yellow	Class II – Moderately hazardous				

							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. Avoid morphine, theophyllin, aminophyllin, barbiturates ofr phenothiazines. Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.	
CARBAMATES								
4.	Carbaryl	Highly toxic	Yellow	Class II – Moderately 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. - 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 was with soap and water (eyes – wash with isotonic saline). Wear rubber gloves while washing contact	

							area. - Oxygen - Morphine, if needed. Avoid theophyllin and aminophyllin or barbiturates. 2-PAM and other oximes are not harmful and in fact contra indicated for routine usatge. Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.	
FUNGICIDES								
5.	Metalaxyl	Moderately toxic	Blue	Class III – Slightly hazardous		Headache, palpitation, nausea, vomiting, flushed face, irritation of nose, throat eyes and skin etc.,	No specific antidote. Treatment is essentially symptomatic.	
6.	Thiram	Moderately toxic	Blue	-do-				

ANNEXURE -I

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 olyethylene 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 burried deep into soil away from water source.
3. Never re-use empty pesticide container for any purpose.