IPM PACKAGE NO. 68

INTEGRATED PEST MANAGEMENT PACKAGE

FOR

GARLIC

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 GARLIC

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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.

Chandurkar
14/8/03
(P. S. CHANDURKAR)

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PREFACE

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, Cucurbitacious 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.

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(ii) Co-Chairman Tech. Session	Dr. Raj Singh, JD(Bio) Dte. of P.P.Q. & S., Faridabad
(iii) Coordinator- Tech. Session	Sh. K.K. Singh, Asstt. Director (Ent) Dte. of P.P.Q. & S., Faridabad
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IPM PACKAGE FOR GARLIC

I MAJOR PESTS :-

(A) Pests of National Significance

(1) Insect Pests

(i)	Thrips	(*Thrips spp.)*
(ii)	Cutworms	(*Agrotis spp.)*
(iii)	Tobacco caterpillar	(*Spodoptera spp.)*

(2) Diseases

(i) Purple blotch
(ii) Stemphillium blight
(iii) Smut
(iv) Charcoal rot
(v) Damping off
(vi) Bacterial soft rot
(vii) Leaf blight

(3) Nematode

(i) Root-knot nematode

(4) Weeds

(a) Monocot weeds

1. Canary grass (*Phalaris minor*)
2. Burmuda grass (*Cynodon dactylon)*
3. Nut grass (*Cyperus rotundus*)
4. Darnel (*Lolium temulentum*)

(b) Dicot weeds

1. Fathen/ lambs quarter (*Chenopodium album)*
2. Sweet clover (*Melilotus indica)*
3. Pimpernel (*Anagallis arvensis)*
4. Swine grass (*Coronopus didymus)*
5. Wild onion (*Asphodelus tenuifolius)*

(B) Pests of Regional significance

(1) Insect Pests

(i) Aphid
(ii) Leaf caterpillars

(2) Diseases

(i) Rust
(ii) Downy mildew

II PEST M ONITORING

1. Agro Eco System Analysis (AESA)

AESA is an approach, which can be gainfully employed by extension functionaries and farmers to analyse field situations for pests, defenders, soil conditions, plant health, the influence of climatic factors and their relationship for growing healthy crop. A critical analysis of the field situations will help or enhance in decision making skill for implementation of 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.

2. Field scouting

AESA requires skill and the trained farmers can able to undertake exercises. However, remaining farmers can do field scouting in their own fields at regular intervals to monitor the major pest situation. It helps to reduce pesticide usage to a large extent.

(i) Thrips are usually a problem at the bulb formation stage. At this stage, thrips can be monitored by selecting 10 plants. By splitting the leaf sheath and using the 10 lens, thrips can be observed. Also look for thrips damaged streaks on the leaves.

(ii) Damaged by Cutworms usually occurs at the seedling stage. The young seedlings are cut at night. Larvae hides underneath the soils. Rarely damage by the tobacco caterpillar can be observed wherein the larvae of the pest enter the leaf sheath and

feeds inside. Such leaves turn white, on splitting the leaf sheath, caterpillars can be observed alongwith the contaminated excreta.

(iii) For disease monitoring, select 15 plants at random and observe for the yellow or purple blotches on the leaf surface. It is necessary to observe the rain fall and humidity pattern as this has bearing on the further spread of purple blotches.

3. Yellow pan/sticky traps

Set up yellow pan/sticky traps for monitoring thrips @ 10 traps per ha. Locally available empty yellow tins coated with grease/castor oil outer surface may also be used as yellow pan traps.

4. Economic Threshold Level (ETL)

S.No.	Pest	Stage of the crop	Economic Threshold Level
1.	Thrips	Vegetative growth	8-10 nymphs and adults per leaf
2.	Tobacco caterpillar	Vegetative growth	1 larva plant or 5% affected plants.
3.	Downey mildew	Vegetative growth	5-10% infested leaf area
4.	Leaf blight	Vegetative growth	5-10% infested leaf area.

III. INTEGRATED PEST MANAGEMENT STRATEGIES

A. Cultural Practices

(i) Procure bulbs from smut free areas for planting or it is better to sow seeds and not bulbs.

(ii) Crop seedlings should be timely planted in well prepared field at recommended spacing by using balanced dose of fertilizers for having optimum plant growth and healthy crop stands would be capable of competing with weeds at the initial stages of the crop growth.

B. Mechanical Control:

(i) Get sprinkling of water through Jet nozzles to prevent thrips multiplication.

(ii) Crop should be maintained weed free for 4 to 6 weeks after planting by timely hoeing.

(iii) Use of light traps is effective in monitoring and management of tobacco worm.

(iv) Set up yellow pan/sticky traps for monitoring and suppression of thrips population.

C. Biological Control:

1. Conservation:

General predators like Coccinellids, Syrphids, Dragon fly, Damsel fly and predatory bugs actively suppress the pests population. Application of unnecessary broad spectrum pesticides should be avoided which is the best way to preserve them and protecting them from harmful effects.

2. Augmentation:

Release *Chysoperla carnea* @ 2 larvae plant against thrips, *Telenomus ramus* @ 100000 parasitoids/ha against tobacco caterpillar . (ii) Spray SlNPV @ $3x10^{12}$ POBs/ha for tobacco caterpillars.

3. Biopesticides:

(i) Spray of 5% NSKE against thrips during vegetative stage yields better crop growth.

(ii) Wherever possible spray NPV for the control of Tobacco worm . BT can also be use as an alternative to NPV. Use of *Trichogramma* and others bioagents must be encouraged for the control of caterpillars.

D. Chemical control:

(i) Chemical pesticides should be used on need basis as a last resort only when pest population intensity crossed economic threshold level. The safer pesticides should be applied judiciously.

(ii) Do not take chemical control for thrips if the weather pattern is associated with rain fall. Thrips are a problem during hot dry weather and damage will be more under water stress. Enough irrigation and one or two prophylactic sprays at 60 to 75 days after planting is adequate. However, ensure that the nursery is free of thrips and other caterpillars.

(iii) Spray of sulphate potash @ 1 g/litre at bulb formation stage imparts resistance against various pests.

IV. CROPS STAGE WISE IPM PRACTICES:

STAGE	PEST	PRACTICES
1. Pre-sowing	Resting stages of pests in harvested fields.	Deep summer ploughing.
2. Seed/Seedling	Smut, Weeds	Get smut free bulbs. Timely planting and maintain required population density in keeping weed free field.
3. Vegetative	Thrips, Mites	Conserve the predators. Release *Chrysopids* against thrips @ 2 per plant.
	Leaf caterpillar	Hand picking of caterpillars. Removal of alternate hosts.
	Leaf blight	Grow resistant variety. Removal of alternate hosts.
	Tobacco worm	Hand collection of different stages of insects. Release of *Trichogramma chilonis* @ 50,000 per ha at weekly intervals for 4 times.
4. Bulb development	Smut	Plant red skinned onions.

V. DO'S AND DON'TS IN GARLIC IPM

Do's	Don't's
1. Select red skinned variety.	Reject whitish varieties for plantation as it is prone to attack by pests.
2. Obtain smut free bulbs.	Don't plant smutted bulbs.
3. Try to monitor the field regularly.	Don't resort for indiscriminate pesticide sprays.
4. Encourage practice for biocontrol	Discourage improper management based use of fertilizers and irrigation.

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