



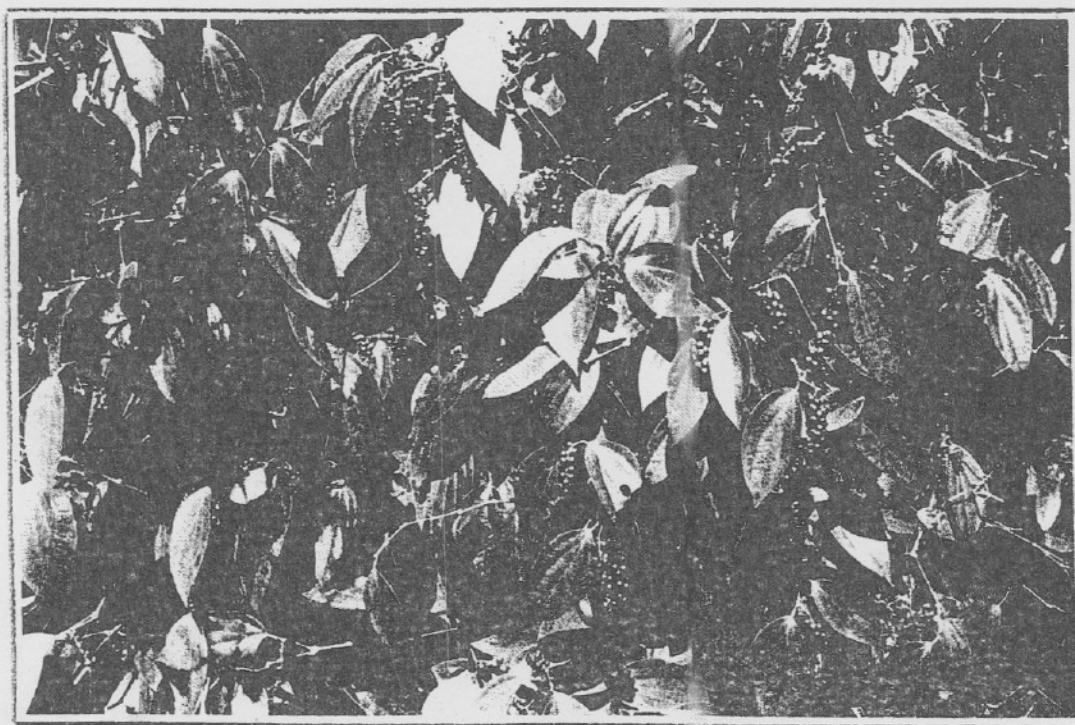
IPM PACKAGE NO. 40



# **INTEGRATED PEST MANAGEMENT PACKAGE**

FOR

# **BLACK PEPPER**



Government of India  
Ministry of Agriculture  
Department of Agriculture & Cooperation  
Directorate of Plant Protection, Quarantine & Storage  
N. H. IV, Faridabad - 121 001  
May, 2001

# IPM PACKAGE FOR BLACK PEPPER

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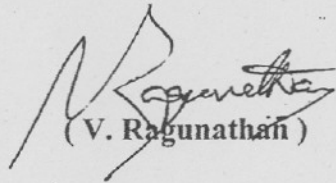
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**FOREWARD**

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.

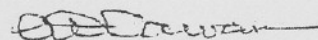
With a view to provide technical knowledge to the extension functionaries and farmers in the States, first National Workshop on IPM for harmonisation of Package of Practices was organized at National Plant Protection Training Institute (NPPTI), Hyderabad during June 29-30, 1992. Subsequently workshops 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.

April 1, 2002



(A.D. Pawar)  
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## IPM PACKAGE FOR BLACK PEPPER

Black Pepper, *Piper nigrum*, the King of spices is indigenous to the tropical forests of western ghats of south India. Kerala continues to enjoy near monopoly in area and production of pepper accounting for 97% in the country. Kerala produces 56,430 tonnes of pepper from 1,84,000 ha area.

### I. MAJOR PESTS:

#### A. Pests of National Significance:

##### 1. Insect Pests:

- 1.1. Pollu Beetle (*Longitarsus nigripennis*)
- 1.2. Top shoot borer (*Cydia hermidoxa*)
- 1.3. Leaf gall thrips (*Liothrips karnyi*)

##### 2. Diseases:

- 2.1. Phytophthora foot rot or quick wilt (*Phytophthora capsici*, *Phytophthora palmivora*)
- 2.2. Slow decline (slow wilt) may be nematodes and also soil borne fungi like *Fusarium* sp, *Rhizoctonia* sp, *Pythium* sp.
- 2.3. Pollu disease (*Colletotrichum gloeosporioides*)

##### 3. Nematodes:

- 3.1. Burrowing nematode (*Radopholus similis*)
- 3.2. Root knot nematode (*Meloidogyne incognita*)

#### B. Pests of Minor Significance:

##### 1. Insect Pests:

- 1.1. Scale insects (*Lepidosaphes piperis* and *Aspidiotus destructor*)
- 1.2. Soft scale (*Lecanium marsupiale* (?))
- 1.3. Mealy bug (*Pseudococcus virgatus* CKIL.)

##### 2. Diseases:

- 2.1. Stunted disease (suspected to be MLO s.)
- 2.2. Phyllody disease (may be MLO s.)
- 2.3. Basal wilt (*Sclerotium rolfsii*) in nurseries

### 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

#### 1. Cultural Practices:

1. Planting material must be collected from disease free garden or nursery raised preferably in fumigated soil.
2. Well drained level land and hill slopes are suitable for growing pepper, slopes facing south and south western side should be avoided and north and north eastern slopes should be preferred.
3. Cultivate varieties such as Narayankodi, Kalluvally, Uthirankotta and Balancotta which are tolerant to quick wilt.
4. Follow recommended spacing of 3m X 3m in plain and 2m X 4m on sloppy lands.
5. Press the soil around the cutting to form a small mound slopping outward and away from cuttings to prevent water stagnation around the plants.
6. Adequate mulch with green leaf, saw dust or coir dust or organic matter should be given towards the end of north-east monsoon.
7. Injury to root system to be avoided at any cost.
8. About 10kg of well rotten cattle manure or compost is to be given in April-May in order to support antagonistic fungi.
9. Fertilizer-as per recommendation of soil testing.
10. Growing cover crops like *Calapogonium muconoides*, *Mimosa invisa* are also recommended under west-coast condition to provide an effective soil cover to prevent soil erosion as well as spread of soil borne pathogens in rainy season and for thick organic mulch during summer.

#### 2. Mechanical practices:

1. Racking the soil near the base of vines may effectively reduce the grub of Pollu beetle.
2. In nursery leaf rot and blight of rooted cuttings (*Rhizoctonia solani*) and basal wilt (*Sclerotium rolfsii*), may be controlled by observing strict phytosanitary measures, the affected cutting along with the defoliated leaves should be removed from nursery manually and destroyed.
3. All infected/ dead vines along with root system are to be removed and burnt.
4. The runner shoots are to be pruned off or tie back to vines before the on set of monsoon to avoid infection of quick wilt disease.

#### 4. Bio-control Practices:

1. Root knot nematode can be effectively managed by the application of bacterial suspension of  $1.2 \times 10^8$  cells of *Bacillus macerans* or *B.circulans* prior to planting of vines or just before the monsoon period in established plants.
2. Apply one kg lime and two kg neem cake/ standard/ year as pre-monsoon dose. The application of neem cake should be four week after lime application.
3. Conserve the natural enemies such as anthocorids, spiders, lady bird beetles, chrysopids etc.

5. **Chemical control:**

1. Spray any one of the insecticides namely endosulfan, quinalphos, monocrotophos\*, dimethoate\* @ 0.05% for controlling Pollu beetle.
2. Spray endosulfan 0.05% to control top shoot borer.
3. Spray quinalphos 0.05% to control soft-scale
4. Spray monocrotophos\* 0.05% to control leaf gall thrips.
5. Spray dimethoate\* 0.05% to control scale insects.
6. Foliar spray with 1% Bordeaux mixture against pollu disease.
7. The plant cuttings be given a spray with 0.1% carbendazim\* or 0.2% copper oxychloride to check basal wilt in nursery.
8. Foliage spray with 1% Bordeaux mixture, drenching of base with 0.2% copper oxychloride @ 5lit/ vine and painting of stem with Bordeaux paste may prevent the Phytophthora foot rot or foliar spray as well as soil drenching with metalaxyl mz @ 0.4% is also very effective.
9. Apply 30gm of phorate\* or 100gm of carbofuran\* per vine twice a year to control plant parasitic nematode.
10. Treat the planting pit with phorate\* @ 15gm or carbofuran\* @ 50gm at the time of planting to protect the vines from plant parasitic nematode.

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



## IV. CROP STAGE WISE IPM PRACTICES

Crop stage/ pest	IPM component	IPM practices
<b>A. Pre-sowing /Nursery :</b>		
Basal wilt	Cultural practice	1.Planting materials must be collected from disease free gardens and nurseries raised preferably in fumigated soil.
	Mechanical Practice	1. The affected cutting along with defoliated leaves should be removed from the nursery and destroyed.
	Chemical practice	1.All the cuttings may be given a spray with 0.1% carbendazim* or 0.2% copper oxychloride to check the disease incidence.
Plant Parasitic nematode viz:-Root knot nematode ( <i>Meloidogyne incognita</i> ) Burrowing nematode ( <i>Radopholus similis</i> )	Chemical practice	1.Fumigate the soil mixture of nursery with Methyl Bromide @500 gm/100cu.ft of soil under polythene cover for 24-48 hours. 2.Treat the planting pit with phorate @15gm or carbofuran* @50gm at the time of planting.
Leaf gall thrips ( <i>Liothrips karnyi</i> )	Chemical practice	1.Spraying of monocrotophos* 0.05% is effective.
<b>B. Planting stage</b>	Cultural practice	1.Follow the spacing recommended 3m X 3m in plain lands and 2m X 4m. in slope lands.
<b>C. Vegetative phase</b>	Cultural practice	1.Hand weeding around the plants is to be done according to necessity. 2.Adequate mulch with green leaf or organic matter should be given towards the end of north-east monsoon. 3.Recommended dose of fertilizers is to be applied. Care should be taken to avoid direct contact of fertilizers with the roots of pepper 4.Water logging is to be avoided.
Phytophthora foot rot (Quick Wilt)	Cultural practice	1.Removal and destruction of dead vines along with root system from the garden is essential as it reduces the build up of inoculum.

		<p>2. Adequate drainage should be provided to avoid water stagnation.</p> <p>3. Injury to root system to be avoided due to cultural practice.</p> <p>4. The freshly emerging runner shoots should not be allowed to trail on the ground. They must either be tied back to the standard or pruned off.</p>
	Chemical practice	<p>1. Pre-monsoon spray with 1% Bordeaux mixture.</p> <p>2. The base must be drenched with 0.2% copper oxychloride @ 5lit./vine.</p> <p>3. Bordeaux paste has to be applied to the stem at the base up to a height of 30-40cm.</p> <p>4. Since Bordeaux mixture application is to be given during the monsoon, a sticker may be added.</p>
Slow wilt.	Cultural practice	<p>1. Nematode free root cutting raised in fumigated nursery mixture should be used for fresh planting.</p> <p>2. Remove the severely affected vines which are beyond recovery.</p>
	Chemical practice	<p>1. Apply phorate* @30gm or carbofuran* @100gm/vine twice a year. First application during May/June with the onset of south west monsoon and second application during Sept./Oct.</p> <p>2. Rake the soil in the basin of vine lightly without causing damage to the root system, spread nematicide uniformly in the basin and cover it with soil immediately.</p>
	Biological practices	<p>1. By application of <i>Bacillus macerans</i> or <i>B. circulans</i> (<math>1.2 \times 10^8</math> cells) prior to planting vines or just before the monsoon in established plants to manage the nematode infestation effectively.</p>
Polhu beetle, ( <i>Longitarsus nigripennis</i> )	Chemical practice	<p>1. Spray any of the following insecticides namely endosulfan, quinalphos, dimethoate* or monocrotophos* @ 0.05% concentration during June-July and Sept.-Oct.</p>

Top shoot borer	Chemical practice	1. Spraying of endosulfan 0.05% is effective.
Leaf gall thrips Scale insects Soft scale	Chemical practice	As suggested under chemical control.
Spike formation/ flowering stage		
Polu disease.	Chemical practice	1. As suggested under chemical control. 2. Wherever Phytophthora foot rot control is undertaken separate control measure for Polu disease is not necessary.
Phyllody disease/Stunted disease.	Cultural practices	1. The eradication of affected vines from the garden is an immediate step to be adopted.
Polu beetle	Chemical practices	1. Same as shown in vegetative phase.
Berry formation stage		
Polu disease	Chemical practices	1. Same as shown in vegetative phase.
Phyllody/ Stunted disease	Cultural	1. Same as shown in flowering phase.
Foot rot (Quick wilt)	Cultural/Chemical	1. Same as shown in vegetative phase.
Polu beetle	Chemical	1. Same as shown in vegetative phase.
Scale insects	Chemical	1. Same as shown in vegetative phase.

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

**V. DO'S AND DONT'S IN BLACK PEPPER IPM.**

<b>Do's</b>	<b>Don'ts</b>
1. Grow only recommended varieties	1. Don't grow variety not suitable for season or region.
2. Collect the planting material from disease and nematode free nursery	2. Don't use any disease infected planting materials.
3. Use fertilizers as per soil test recommendation.	3. Avoid imbalance use of fertilizers.
4. Light and frequent water is recommended in the nursery.	4. Avoid water logging.
5. Conduct AESA on weekly intervals in the morning preferably before 9am. for proper management of pest/disease	5. Don't apply chemical pesticide on calendar basis.
6. Mulch the basin of pepper vines during summer for effective soil cover to protect soil erosion and spread of pathogen in rainy season and for leaving a thick organic mulch in summer.	6. Don't allow soil erosion in rainy season.
7. Runner shoots should be tied back to vines or pruned off before the onset of monsoon.	7. Don't injure the root system while undertaking cultural practices.

CROP: Black Pepper

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)
<b>INSECTICIDES</b>								
<b>ORGANOCHLORINE PESTICIDES</b>								
1.	Endosulfan	Highly toxic	Yellow	Class II - Moderately Hazardous	<p>Remove the person from the contaminated environment.</p> <p>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.</p> <p>Medical aid: Take the patient to the docotr/Primary Health Centre immediately along with the original container, leaflet and label.</p>	Nausea, vomiting, restlessness, tremor, apprehension, convulsions, coma, respiratory failure and death	<ul style="list-style-type: none"> <li>- Gastric lavage with 2-4 L. tap water - Catharsis with 30 gm. (10 oz) sodium sulphate in one cup of water</li> <li>- Barbiturates in appropriate dosages repeated as necessary for restlessness or convulsions</li> <li>- Watch breathing closely, aspirate, oxygen and/or artificial respiration, if needed.</li> <li>- Avoid oils, oil laxatives and epinephrine (Adrenalin) - do not give stimulants.</li> <li>- Give calcium gluconate (10% in 10 ml. Ampules) intravenously every four hours.</li> </ul>	

ORGANOPHOSPHATE PESTICIDES

2.	Quinalphos	Highly toxic	Yellow	Class II - Moderately Hazardous		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.
3.	Monocroto phos	Extremely toxic	Bright red	Class I b - Highly hazardous			
4.	Dimethoate	Highly toxic	Yellow	Class II - Moderately hazardous		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.
5.	Phorate	Extremely toxic	Bright red	Class I a - Extremely Hazardous		Severe - diarrhoea, pinpoint and non- reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.	In addition to atropine give 2-PAM (2-pyridine aldoxime methiodide). 1 g and 0.25 g for infants

							<p>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							
6.	Carbofuran	Extremely toxic	Red	Class I b - Highly 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"> <li>- 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.</li> <li>- Keep airway open. Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed.</li> <li>- 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</li> </ul>

							<p>area.</p> <ul style="list-style-type: none"> <li>- Oxygen</li> <li>- Morphine, if needed.</li> </ul> <p>Avoid theophyllin and aminophyllin or barbiturates. 2-PAM and other oximes are not harmful and in fact contra indicated for routine usatge.</p> <p>Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.</p>
FUNGICIDES*							
7.	Carbendazim	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.
8.	Copper oxychloride		Blue	Class III - Slightly hazardous			
9.	Metalaxyl	Moderately toxic	-do-	-do-			
10.	Bordeaux mixture						



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

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