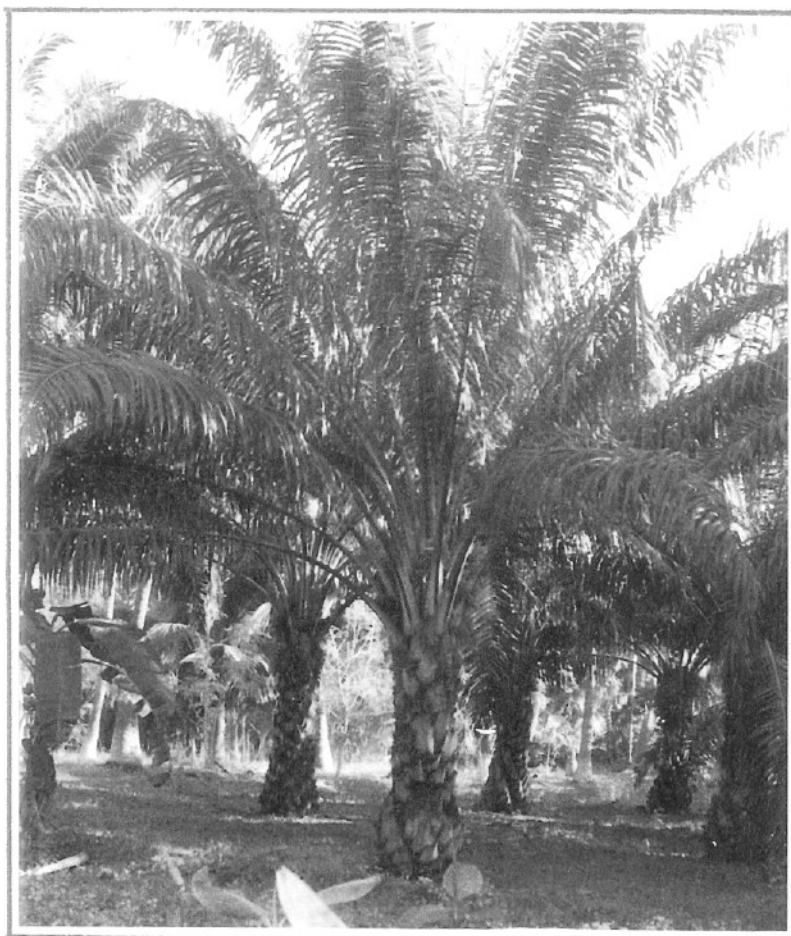




IPM PACKAGE NO. 45



INTEGRATED PEST MANAGEMENT PACKAGE FOR OIL PALM



**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 OILPALM

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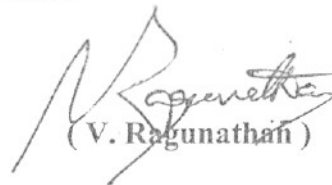
DR.V. RAGUNATHAN
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To the Government of India

FORWARD

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.

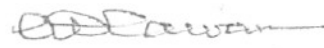
With a view to provide technical knowledge to the extension functionaries and farmers in the States, first National Workshop on IPM for harmonisation of Package of Practices was organized at National Plant Protection Training Institute (NPPTI), Hyderabad during June 29-30, 1992. Subsequently workshops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

ACKNOWLEDGEMENTS

The IPM Package of Practices for **Oilpalm** crop was discussed and finalised in the National Workshop on IPM held at National Plant Protection Training Institute (NPPTI), Hyderabad during May 14-17, 2001. The technical input received from the following experts is thankfully acknowledged.

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4. Dr. A.S. Sukumaran, Sr. Scientist, C.P.C.R.I. (ICAR), Kasargod.
5. Dr. B.J. Diwakar, Sr. Entomologist, NPPTI, Hyderabad
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4. Sh. K.W. Deshkar, PPO(E), Central IPM Centre, Goa.
5. Sh. N. Krishnaswamy, AD(E), Central IPM Centre, Trichy
6. Sh. Gyneshwar Banchor, SSA, Central IPM Centre, Emakulam.
7. Dr. A.M.K. Mohan Rao, Rodent Specialist, NPPTI, Hyderabad
8. Dr. G.V. Ranga Rao, Aventis Crop Science, Mumbai
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 4. Sh. R.S. Tomer, SSA, IPM Div., Dte of PPQS, Faridabad.
 5. Sh. Laxmi Chand, SSA, IPM Div., Dte of PPQS, Faridabad.
 6. Mohd. Abrar Alam, Stenographer, IPM Div., Dte of PPQS, Faridabad.
 7. Sh. N.K. Mishra, LDC, IPM Div., Dte of PPQS, Faridabad.

IPM PACKAGE FOR OIL PALM

Oil palm (*Elaeis guineensis* Jacq) is the important edible oil producing crop and it is traditionally grown in areas with high rainfall and humidity and as such India has very little of such area but has a vast stretch of land with varied agro-climatic conditions and vast underground water potential, which can be used for oil palm cultivation, if irrigation is resorted to. The working group constituted by the Govt. of India in 1986 have identified 7.96 lakh ha. in eleven states. Andhra Pradesh and Karnataka have vast potential compared to other states.

The National Research Centre for Oil Palm established by the Indian Council of Agricultural Research at Pedavegi (Andhra Pradesh) is developing an appropriate technology for Oil Palm cultivation.

I. 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. 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.

II. PESTS OF OILPALM AND THEIR MANAGEMENT:

Most of the pests of coconut are found to attack oil palm. Management practices recommended for coconut may be followed.

1. Pests of Nursery :

a) Spindle bug

Symptoms: Necrotic lesions and dry ground patches on leaves spindle fails to open.

Control : Keep phorate (2g) filled perforated poly sachets in the leaf axil.

b) Tussock caterpillar

Symptoms : Defoliation of leaves.

Control : Handpicking of caterpillars. Cut and burn the damaged leaves. Spray monocrotophos (0.036%) or carbaryl (0.1%) if infestation is severe.

c) **Root grubs**

Symptoms : Sudden death of young plants.

Control : Fill the seedling bags with the soil free from root grub infestation. Apply 50 gms phorate per seedling while planting the sprouts.

d) **Termites**

Symptoms : Stunted growth of the plant.

Control : Destroy termite mounds(terrestrial & sub-terrestrial) and drench with chlorpyrifos (0.05%).

e) **Rodents:** Lesser bandicoot, *Bandicota bengalensis*

Symptoms: Destruction of the apical region.

Control: Anticoagulant baiting with bromadiolone(0.005%) may be given in suitable bait stations, preferably made of earthen pots.

f) **Wild boar:**

Symptoms : Destruction of the boll region.

Control : Wild boar scaring device may be kept.

2. **Pests of adult palms:**

i) **Major pests :**

a) **Rhinoceros beetle (*Oryctes rhinoceros L.*) :**

Symptoms: "V" shaped gaps in the leaf silhouette. Hole at the leaf base and chewed up fiber is seen at that place.

b) **Red palm weevil (*Rhynchophorus ferrugineus* Oliver) :**

Symptoms: Palm shows gradual wilting and drying. Presence of few holes and oozing of brown viscous liquid from these holes at the base of the palm. Grubs feeding inside the trunk make characteristic sound.

Control :

Removal of damaged and dead palms , rotten bunches from the orchard. Apply 'tar' to the wounds and cuts on stem portion to avoid the egg laying. Trap the adult beetles using log or pheromone baits. Maintain good sanitation in the orchard. Trunk injection with carbaryl 50%WP at 1% or endosulfan 35 EC at 0.1%.

c) Case Worm :

Symptoms:

Holes on the leaves. Occasional defoliation. Cone shape bags on under surface of the leaves.

Control:

Cut and burn badly infested leaves. Spray carbaryl (0.1%) on infested leaves. Root feeding of monocrotophos (mix 10 ml of insecticide in 10 ml of water) may be practiced if infestation is severe.

d) Birds :

Symptoms:

Bird feeding symptoms on mesocarp of fruits resulting in fruit and oil loss.

Control:

Cover the fruit bunches with wire mesh or coconut or oil palm leaves after 150 days of fruit set. Use bird scare devices.

e) Rodents : Lesser bandicoot, *Bandicota bengalensis*

Symptoms:

Damaged symptoms on the young fruits, Gnawing symptoms on exposed pericarp of the fruit. Damage to the boll region and killing the young palms.

Control:

Follow integrated management practices using all the possible measures of control. Baiting with Bromadiolone(0.005%) in baits given in the suitable bait stations , use of bamboo snap trap etc. Cover the base portion of the plant with wire mesh while planting.

ii) Minor pests :

a) Scales and mealy bugs :

Symptoms:

Yellowing of unfolding leaves. Stunted growth infests on fruit bunches.

Control:

Naturally suppressed by bio-agents. If need we spray any systemic insecticide like phosphamidon or dimethoate (0.03%).

b) Termites :

Symptoms:

Feeding symptoms on the spear leaves, male inflorescence and fruit bunches.

Control:

Give copious irrigation. Apply quinolphos (0.06%) or chlorpyrifos (0.05%) in the basins if infestation is severe. Find the termite nests/ mound and destroy.

IV. IPM APPROACH TO MANAGE OILPALM PESTS

Integrated approach using all the possible methods of control is the only possible way to manage the pest effectively. These methods are :

1. Prophylactic :

Leaf axil filling with insecticide-sand mixture is recommended as a prophylactic method to prevent the pest entry. Granular insecticides like Sevidol (8G) or Phorate (10G) mixed with fine sand at the ratio of 1:10 can give best results. This mixture should be applied in the leaf axil during April-May, September-October and December-January.

2. Baiting:

Trapping the weevils using fermented castor cake is the best method to control this pest . For this purpose fermented castor cake (one part of castor cake mixed with 2 parts of rice water and kept for fermentation for 3-4 days) should be kept in wide mouthed pots at different places in the orchards. Fresh castor seeds can also be used for this purpose. These seeds should be roasted slightly and made it as paste before going for fermentation. Adults beetles are attracted to this solution which should be removed everyday which otherwise they decompose and give unbearable smell. The solution should be changed once in a week.

3. Sanitational :

Destruction of all possible breeding sites of above mentioned and keeping the plantations and surroundings in a clean condition are essential to keep the pest away from using a breeding site.

The decaying heaps of cattle dung, compose pits and other breeding sites should be treated with insecticides like carbaryl 85% WP (0.01 %) or BHC 50 WP (0.1 %) at regular interval which will control the immature stages of the pest.

Fully decomposed Farm Yard Manure (FYM) and compost should only be applied to the plants which otherwise the pest will migrate alongwith unrotten FYM and attack the palms.

4. Mechanical :

Extraction and killing of the beetle from the crowns of infested palms with hooked pointed metal rod of 0.5 m length having a hook at one end and ring or handle at the

base. This can be effectively used in case of young palms. After extraction the hole should be filled with sand.

5. Biological :

Biological control agents of the pest namely, *Metarrhizium anisopliae* and *Baculovirus oryctae* are found to be the most predominant in controlling the pest. Of these two, the virus *Baculovirus oryctae* is found to be highly effective in suppressing the infestation. All the instars of the beetle including grub and adult are susceptible to the disease. The infected grub become lethargic and cease feeding. Disease infected adults don't show any external symptoms. They are virus reservoirs spreading the ineffective virus into the insects natural habits and thereby the fresh ones could also get the disease.

Application of entomopathogen *Metarrhizium anisopliae* to the breeding sites is very effective for the control of larval stages of the pest.

6. Phermone trapping :

Adults beetles of Rhinoceros can be trapped by using Phermone material called Orycta phermone.

7. Chemical:

Chemical control measures can be applied against grubs.

IV. DISEASES OF OIL PALM AND THEIR MANAGEMENT:

So far it is observed that only a few diseases are prevalent on oil palm in India. Among which, the important ones are mentioned below:

a) Stem wet root :-

Symptoms:

- ◆ Sudden death of spear leaves including the young expanded fronds surrounding the spear.
- ◆ Remaining fronds show yellowish discolouration and then rapidly wither and die.
- ◆ Sometimes the older leaves die first and the symptoms progress to the younger fronds.

Control:

- Improvement in agronomic practices, providing drainage, avoid flooding of the field, etc.
- In order to prevent the spread of the disease, palms died due to the disease should be excavated and burnt.
- Early detection of the disease and trunk surgery can save the palm

Early detection of diseased palms:

The proper diagnosis of the disease affected palms can be made by hitting the palm with a wooden implement which gives a dull sound indicates an underneath a soft area. For further confirmation of the disease, a sharp iron rod may be pierced into the stem base, which gives out some liquid. If the liquid is of putrefied smell, the palm should be treated immediately by trunk surgery.

Trunk surgery:

Trunk surgery is done by excision of all affected fibrous tissues from inside the trunk. For excision of the diseased fibrous mass a sharp harvesting chisel will be quite useful. First the outer stem tissues and front butts should be chiseled. The inner most disease tissues including yellowish lesions which are generally seen along with the border of healthy and diseased tissues are also should be removed. Since the rotten tissues are in irregular direction the excision is time consuming. It should be done with great care and patience and removal of healthy tissues should be avoided. When the surgery is completed a protective covering with carbendazim (1%) + monocrotophos (1ml) paste followed by coat tar should be given to prevent the wound invading micro-organisms and insects.

Since it is not possible to remove all the diseased tissues from the very bottom of palm in the first attempt, resurgence of infection is quite possible and re-treatment is essential after three months of first treatment.

b) Bud rot disease :-

Symptoms:

- ◆ Yellowing of the spear leaves which subsequently turns to brown. affected spear bends at the base and seen hanging down in the crown.
- ◆ The basal tissues of the spear completely gets rotted as a result it collapses and can easily be pulled out.
- ◆ The rotten tissues emit offensive odour.
- ◆ Continuous and un-checked rotting leads to total destruction of meristem and ultimately death of the palm.
- ◆ Often the disease become rampant during the monsoon when the inoculum build up reaches high.
- ◆ Palms of all ages are prone to this disease.

Disease management:

- It is possible to cure very effectively, if the disease is detected in the early stages, i. e.; when the spindle starts showing symptoms of withering, yellowing and dropping down.
- The affected spear should be pulled out along with the decayed tissues. The affected tissues in the crown should be removed and drenched with fungicide solution, like carbendazim or thiram (0.1%).

- For treating advanced stage disease affected palms, first of all, the leaves surrounding the spear should be cut and the effected tissues of the meristem should be removed layer by layer till the fresh tissues are seen.
- Once the affected tissues are completely removed the exposed tissues of the apical bud should be cleaned and smeared with 1% carbendazim solution. The exposed portion should be covered with dried leaves or perforated polythene sheet.

Prophylactic Check :

- Where the beetle amage is predominantly high, it should be checked by keeping 10 g of phorate granules in perforated polythene sheet.

c) Basal Stem Rot (*Ganoderma*):-

Generally the disease incidence can be expected in the coastal estates where the old coconut plantations are already affected by the disease and soils are infected with the pathogen.

Symptoms:

- ◆ Withering, yellowing and orange discolouration of the leaves followed by necrosis on one side of fronds.
- ◆ Desiccated fronds drop or break at some point along the rachis.
- ◆ Appearance of light brown lesions/rotting of the bole at the stem base is characteristic symptom at the advanced stage of the disease.
- ◆ The infected palms appear suffering with malnutrition.
- ◆ The disease produces dry rot of internal tissues at the base of trunk.
- ◆ The roots become friable and disintegrate easily.
- ◆ The internal tissues turn into dry and powdery mass.

Control of the disease:

- There is a little hope of saving the affected palms as by the time symptoms are visible more than 50% of the basal stem tissues get affected. However, the disease progress can be checked by.
- Field sanitation : Removal and destruction of the dead and diseased palms in order to prevent the spread of the disease.
- Isolation of the diseased palms : The palms in the early or middle stages of the disease should be isolated from the neighbouring palms by taking drenches of 1m deep and 30 cm wide.
- Affected palm should be given 5 kg. of neem cake/year.
- The disease affected and apparently healthy palms should be treated with 10ml Calixin (tridemorph) or 10g Aureofungin sol (in 100ml of water) per palm through root feeding.

- The suspected disease palms should be uprooted and destroyed immediately as soon as they are noticed.

d) Bunch rot :-

Bunch rot disease is one of the important diseases affecting the fresh fruit bunches thus causing direct economic loss.

Symptoms:

- ◆ During the early stages of infection, strands of mycelium can be seen spreading over the bunch surface.
- ◆ Mycelium development is profused particularly at the back of the bunch.
- ◆ In the later stage the mycelium grows over the fruit surface and penetrates into the mesocarp.
- ◆ The infected bunch becomes completely rotten and unfit for harvest.
- ◆ Cause
- ◆ Diseased bunches left on palms itself spread the disease from one bunch to other

Control:

- **Sanitation :** Before on-set of monsoon, crown cleaning by mans of removing the dead inflorescences, bunch stalks, aborted bunches, etc.; will help in reducing the inoculum buildup and harbouring of pathogen.
- **Chemical control :** To check the spread of the disease and to eradicate the inoculum of the fungus, crowns of the infected palms should be thoroughly cleaned and sprayed with 0.1% carbendazim solution.

Note: There is no insecticide approved under the Insecticides Act, 1968 for this crop.

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								
ORGANOCHLORINE PESTICIDES								
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"> - Gastric lavage with 2-4 L. tap water - Catharsis with 30 gm. (10 oz) sodium sulphate in one cup of water - Barbiturates in appropriate dosages repeated as necessary for restlessness or convulsions - Watch breathing closely, aspirate, oxygen and/or artificial respiration, if needed. - Avoid oils, oil laxatives and epinephrine (Adrenalin) - do not give stimulants. - Give calcium gluconate (10% in 10 ml. Ampules) intravenously every four hours. 	
ORGANOPHOSPHATE PESTICIDES								
2.	Phorate	Extremely toxic	Red	Class Ia - Extremely Hazardous		Mild - anorexia, headache, weakness, dizziness, anxiety,	For extreme symptoms of O.P poisoning, injection of atropine (2-4 mg., for	

3.	Monocrotophos	Extremely toxic	Bright red	Class I b - Highly hazardous	tremors of tongue and eyelids, miosis, impairment of visual acuity.	adults, 0.5-1.0 mg for children) is recommended, repeated at 5-10 minute intervals until signs of atropinization occur.
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;
5.	Chlorpyrifos	Highly toxic	Yellow	Class II - Moderately Hazardous		- Keep airways open, Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed.
6.	Phosphamidon	Extremely toxic	Red	Class Ia - Extremely hazardous	Severe - diarrhoea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.	- 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.
7.	Quinalphos	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,

							<p>theophyllin, aminophyllin, barbiturates ofr phenothiazines.</p> <p>Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.</p>
CARBAMATES							
8.	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 was with soap and water (eyes - wash with isotonic saline). Wear rubber gloves while washing contact 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 usatge.</p>

							Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.
FUNGICIDES							
9.	Tridemorph	Moderately toxic	Blue	Class II - Moderately hazardous		Headache, palpitation, nausea, vomiting, flushed face, irritation of nose, throat eyes and skin etc.,	No specific antidote. Treatment is essentially symptomatic.
10.	Carbendazim	Slightly toxic	Green	Table 5 - Unlikely to present acute hazard in normal use.			
11.	Tridemorph	Moderately toxic	Blue	Class II - Moderately hazardous			
RODENTICIDES							
12.	Bromodiolone	Extremely toxic	Bright red	Class I a - Extremely hazardous		Bleeding from nose, gums and into conjunctiva, urine and stool & cornea Possible polar and petechial rash, late-massive echymoses or hematoma of skin, joints, brain hemorrhage	- Give Vitamin K1 15-25 mg for adults; 5-10 mg. for children orally; - Transfuse with fresh blood if bleeding is severe or until anemia is corrected. - Iron (Ferro sulfate) by mouth for correction of secondary anemia, 0.3 gm t.i.d.
OTHERS							
13.	Aureofungin	Moderately toxic	Blue	Class II - Moderately hazardous		Headache, palpitation, nausea, vomiting, flushed face, irritation of nose, throat eyes and skin etc.,	No specific antidote. Treatment is essentially symptomatic.

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 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.