



IPM PACKAGE NO. 11



# **INTEGRATED PEST MANAGEMENT PACKAGE**

## **FOR RAPESEED/MUSTARD**



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 RAPESEED/MUSTARD

## Contents

<b>SUBJECT</b>	<b>Page No.</b>
<b>Foreward</b>	<b>i</b>
<b>Preface</b>	<b>ii</b>
<b>Acknowledgements</b>	<b>iii</b>
<b>I. MAJOR PESTS</b>	
A. Pests of National Significance	1
B. Pests of Regional Significance	1
<b>II. PEST MONITORING</b>	
1. Rapid Roving Survey	2
2. Field scouting	2
3. Agro-eco System Analysis	2
4. Economic threshold levels (ETL)	3
<b>III. IPM STRATEGIES</b>	
A. Cultural practices.	3
B. Mechanical practices	3
C. Biological control practices	4
D. Chemical control practices	4
E. Nematode management	5
F. Weed management	5
<b>IV. CROP STAGE/PEST-WISE IPM PRACTICES</b>	<b>6-8</b>
<b>V. DO'S AND DON'TS IN RAPESEED-MUSTARD IPM</b>	<b>9</b>
<b>VI. POTENTIAL NATURAL ENEMIES OF MUSTARD</b>	<b>10</b>
<b>VII. SAFETY PARAMETERS</b>	<b>11-13</b>
<b>ANNEXURES - I &amp; II</b>	<b>14-19</b>



Government of India  
Ministry of Agriculture  
(Department of Agriculture & Cooperation)

**DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE**  
NH IV, FARIDABAD - 121 001 (Haryana)

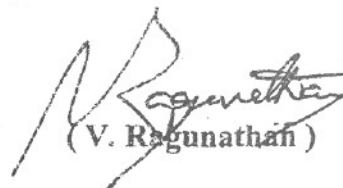
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To the Government of India

**FOR EWARD**

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 **Rapeseed/Mustard** 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.

- I. Chairman, Technical Session : Dr. A.D. Pawar, Director (IPM), Dte of PPQS, Faridabad
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2. Dr. Satyajit Roy, Sr. Scientist, CTRI (ICAR), Rajahmundry  
3. Dr. V. Nandagopal, Sr. Scientist, NRC for Grounut (ICAR), Junagarh  
4. Dr. N.S. Rao, Sr. Scientist (Ent), PDBC (ICAR), Bangalore  
5. Dr. S.D. Sawant, Sr. Scientist, NRC for Grapes (ICAR), Pune  
6. Dr. R.K. Sharma, Sr. Scientist, Dte of Maize Research (ICAR), New Delhi  
7. Dr. C. Chattopadhyay, Sr. Scientist, NRC for Rapeseed/Mustard, Bharatpur  
8. Dr. A.M. K. Mohan Rao, Rodent Specialist, NPPTI, Hyderabad  
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14. Sh. C. Elangovan, PPO (PP), Central IPM Centre, Trichirapalli  
15. Sh. A.K. Rai, PPO(E), Central IPM Centre, Indore  
16. Sh. M. Parry, SSA, Central IPM Centre, Srinagar (J&K)  
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18. Dr. R.B.L. Bhaskar, Jt. Director (Bio.), Dte of PPQS, Faridabad  
19. Dr. Brajendra Singh, Entomologist, Dte of PPQS, Faridabad  
20. Dr. B.S. Phogat, Agronomist (H), Dte of PPQS, Faridabad  
21. Dr. Jasvir Singh, AD(E), Dte of PPQS, Faridabad
- V. Technical input
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  2. Sh. K.S. Sharma, SSA, IPM Div., Dte of PPQS, Faridabad.
  3. Sh. Yogesh Kumar, SSA, IPM Div., Dte of PPQS, Faridabad.
  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 RAPESEED/ MUSTARD

## **I. MAJOR PESTS**

### **A. Pests of National significance**

#### **1. Insect pests**

- 1.1 Mustard aphid
- 1.2 Painted bug
- 1.3 Mustard sawfly

#### **2. Diseases**

- 2.1 White rust
- 2.2 Alternaria blight

#### **3. Weeds**

- 3.1 Lamb square (*Chenopodium album*)
- 3.2 Wild onion (*Asphodelus spp.*)

## **B. Pests of Regional Significance**

### **1. Insect pests**

- 1.1 Hairy caterpillar (Punjab, Haryana, Rajasthan U.P. Bihar, M.P.)
- 1.2 Cabbage caterpillar (Punjab, Haryana, Rajasthan, U.P. Bihar, H.P., J & K, M.P.)
- 1.3 Green peach aphid (H.P, Punjab, Haryana, Rajasthan, U.P., Bihar, N.E. States, M.P. , Delhi)
- 1.4 Larger moth (Bihar, Orissa, M.P.)
- 1.5 Leaf miner (Punjab, Haryana, Delhi, Rajasthan, U.P., N. E. States, M.P.)

## ! Diseases

- 2.1 Sclerotinia stem rot (Haryana, M.P, U.P., H.P., Rajasthan, Jharkhand, Bihar)
- 2.2 Powdery mildew (Punjab, Gurjrat, Delhi, Rajasthan)
- 2.3 Downy mildew (J&K, Uttranchal, Bihar, West Bengal)
- 2.4 Club rot (West Bengal, Bihar, Orissa)

## 3 Weeds

- 3.3 Canary grass (*Phalens minor*)
- 3.4 Lathyrus (*Lathynus aphaes*)

## II. PEST MONITORING

The objective of pest monitoring is to detect the initial development of pest and disease and also the biocontrol potentials in the field situation.

1. **Rapid roving Survey (RRS) :** Survey routes should be identified with the beginning of the crop season in the pest and disease endemic areas to undertake Rapid Roving Surveys (RRS). Monitoring and Surveillance of almost all the important pests should be done regularly i.e. weekly in general and twice a week during flowering / pod formation stage. During survey the observations are to be made at every 10 kms distance in pre-selected routes. For mustard aphid, monitoring activities will have to be intensified from first week of January onwards. Record the incidence of pest, disease and defender populations in 80 – 100 randomly selected plants per ha.
2. **Field scouting :** Based on the observations of RRS, the farmers at village level are to be mobilized to undertake field scouting. During field scouting, farmers may record pest, disease and defenders population twice a week in their own fields as per Agro Eco-system Analysis (AESAs) approach. The State Department of Agriculture should make all possible efforts by using different media, mode and publicity to inform the farmers the need for field scouting in the specific crop areas having indication of pest or disease build-up.
3. **Agro Ecosystem Analysis (AESAs) :** AESA is an approach which can be gainfully employed by extension functionaries and farmers to analyse field situations with regard to pests, defenders, soil conditions, plant health, the influence of climatic factors and their inter-relationship

for growing healthy crop. Such a critical analysis of the field situation will help in taking appropriate decision on management practices.

1. Plant health at different stages (phenophases)
2. Built-in compensation abilities of the plants
3. Pest and defender population dynamics
4. Soil conditions and edaphic factors.
5. Climatic factors temperature, RH, rainfall, etc.
6. Farmers experience pest, diseases, weeds etc.

The details of the AESA are given in Annexure – I.

4. **Economic Threshold Levels (ETLs) :** To determine ETL of mustard aphid, observe 80 – 100 widely scattered plants in an ha. or per location or per spot, twice a week and then count the number of aphids (nymphs and adults ) or measure the colony size (in centimeter ) on 10 cm. terminal portion of the central shoot.

Pest	Economic Threshold Levels
Mustard aphid	10-60 aphids / 10 cm terminal portion of the central shoot or 0.5 – 1.0 cm colony size on terminal portion of the central shoot or 30-40 % aphid colonies or 30 – 40 % plants infested by the aphid colonies. (mother aphid with few young ones).

### III. INTEGRATED PEST MANAGEMENT STRATEGIES

#### A. Cultural Practices

1. Deep summer ploughing, wherever possible
2. Destruction of plant debris of previous crops
3. Grow resistant / tolerant varieties.
4. Early sowing (upto 20<sup>th</sup> October) or optimally as recommended to a particular area of the crop to escape the mustard aphid and major disease damage.
5. Use recommended doses of fertilizers to ensure adequate vigour in plants.
6. Irrigate the crop in IV week after sowing to reduce the painted bug incidence, if present.
7. Arrange for proper drainage of water and follow clean cultivation.

#### B. Mechanical Practices

1. Collection and destruction of early instar (gregarious phase) larvae of cabbage caterpillar.
2. Collection and destruction of egg. masses and early instar larvae (gregarious phase) of hairy caterpillar.



3. Removing of aphid infested twigs in early stages.
4. Thrash the crop as early as possible and dispose the crop refuse.

### C. Biological Control Practices

Conserve the natural biocontrol agents namely Coccinellids, Chrysopids and Syrphids by selecting the safe insecticides (endosulfan safer for predators and pollinators) proper timings of spray (morning and evening hours) and by following the need based application of insecticides / fungicides depending upon the economic threshold levels or disease appearance.

### D. Chemical control practices

Pests/disease	Insecticide/ Fungicide	Dosages/ ha.
<b><u>Insect pests</u></b>		
Mustard sawfly and ] Painted bug ]	Endosulfan 35 EC Quanalphos 25 EC Malathion 50 EC	625 ml 625 ml 500 ml
Cabbage caterpillar and Hairy caterpillars	*Malathion 5% dust	25 kg
Mustard aphid	Oxydemeton methyl 25 EC ] Dimethoate 30 EC ] Endosulfan 35 EC ] Quinalphos 25 EC ] Formothion 25 EC ] Malathion 50 EC ] Phosphamidon 40%SL	625 – 1000 ml     150 – 250 ml

[Use any one of these insecticides in 200-312.5 litres of water per ha depending upon the crop stage, using a knapsack sprayer. Take up spraying in the afternoon to avoid mortality of pollinators ]

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

### Diseases

Alternaria blight ] Downy mildew ] White rust ]	Mancozeb 75% W.P. or Metalaxyl 8%+Mancozeb 64% WP	1500-2000gm/ha 2500 gm/ha
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E. **Nematode Management :**

There is no problem of nematode pests in these crops. However, mustard is an antagonistic crop or enemy crop of nematode. The root exudates of mustard are toxic to nematodes. The crop is recommended as an enemy crop for crop rotation purposes / inter-cropping with vegetables or pulses / for reduction of root – knot and reniform nematodes. No major nematode problems reported.

F. **Weed Management:**

Crop should be sown timely at proper moisture by using recommended seed rate, balanced doses of fertilizers for achieving optimum plant population and healthy crop stand which would be capable of competing with weeds at initial stages of crop growth.

Crop should be maintained weed free initially for 45 days after sowing by resorting two hand hoeing / weeding at 20 and 40 days after sowing.

#### IV. CROP STAGE/PEST – WISE IPM PRACTICES

Sl. No. (1)	Crop stage / Pest (2)	IPM component (3)	IPM practice (4)
1.	Pre sowing	Cultural practice	<ol style="list-style-type: none"> <li>1. Deep ploughing to expose the soil borne pathogens and hibernating stage of defoliators.</li> <li>2. Destruction of plant debris.</li> <li>3. Early sowing to avoid damage due to mustard-aphid, and major diseases.</li> <li>4. For club rot management, soil amendment with lime (@ 1 kg/m<sup>2</sup>) to raise soil P<sub>H</sub> to 7.2 or apply Neem cake @ 0.5 kg/m<sup>2</sup>.</li> </ol>
2.	Seed & seedling		
	Painted bug	Cultural practice	1. Irrigate the crop in IV week after sowing to reduce painted bug incidence.
		Chemical practice	2. Spray the crop with 1000 ml Malathion 50 EC or 625 ml Endosulfan 35 EC or Quinalphos 25 EC in 150 – 200 litres of water per ha.
			3. Methyl parathion 2% @ 25 kg/ha.
	Mustard saw fly	Chemical practice	- do -
	Hairy caterpillar	Mechanical practice	Collection and destruction of gregarious stage larvae twice a week.
	Alternaria, white rust and other seedling diseases	Chemical practice	Carbendazim @ 0.1% a.i. or Apron 35 SD @ 6 g/kg seed.
3.	Vegetative phase :		
	Mustard sawfly	Chemical practice	Spray the crop with 500 ml Malathion 50 EC or 625 ml Endosulfan 35 EC or Quinalphos 25 EC in 150 – 200 litre of water per ha.
	Cabbage caterpillar	Mechanical practice	Collection and destruction of the gregarious stage larvae.
		Chemical practice	Apply *Malathion 5% dust @ 25 kg.

Sl. No. (1)	Crop stage / Pest (2)	IPM component (3)	IPM practice (4)
			per ha.
	Alternaria Blight	Chemical practice	i) Spray with Metalaxyl 8%+Mancozeb 64% WP 25gm/ha at situation of disease. ii) Spray the crop with Mancozeb 75% W.P. @ 1500-2000 gm/ha at the appearance of disease.
	Downy mildew	Chemical practice	- do -
	White rust	Chemical practice	- do -
	Powdery mildew	Chemical practice	Spray with wettable Sulphur @ 0.3%

#### 4. Flowering phase

Mustard aphid	Mechanical practice	Destroy aphid infesting twigs at the initial stage of appearance
	Chemical practice	Spray the crop with one of the following insecticide: Oxydemeton methyl, Dimethoate, Endosulfan, Quninalphos, Malathion @ 625 – 1000 ml per ha.
Hairy caterpillar	Mechanical practice	Collection and destruction of gregarious phase larvae.
Cabbage caterpillar	Chemical practice	Apply *Malathion 5% dust @ 25 kg/ha.
Alternaria blight	Chemical practice	Sprary the crop with Mancozeb 75% W.P. @ 1500-2000gm/ha.
White Rust	Chemical practice	- do -
Downy mildew	Chemical practice	- do -
Sclerotinia rot	Chemical practice	Spray with Carbendazim @ 0.1% a.i. at 50 and 70 days after sowing.

#### 5. Pod formation stage :

Mustard aphid	Chemical practice	Spray the crop with any one of the insecticides given under flowering
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Sl. No.	Crop stage / Pest	IPM component	IPM practice
(1)	(2)	(3)	(4)
			phase.
	Cabbage caterpillar	Mechanical practice	Collection and destruction of gregarious stage larvae.
		Chemical practice	Apply *Malathion 5% dust @ 25 kg per ha.
	Alternaria blight	Chemical practice	Spray the crop with Mancozeb 75% W.P. @ 1500-2000 gm/ha.

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

## V. DO'S AND DON'TS IN RAPESEED – MUSTARD IPM

Sl. No.	DO's	Don'ts
1.	Deep ploughing expose the weeds, soil borne pathogens and hibernating larvae of defoliators.	Do not plant or irrigate the fields immediately after ploughing.
2.	Grow commonly recommended varieties.	Do not grow varieties not suitable for the season or the region.
3.	Prefer to sow the crop early i.e. upto 20 <sup>th</sup> October.	Avoid late sowing of the crop as it may lead to reduced yields and high incidence of aphids and diseases.
4.	Sow in the crop in rows at optimum depths under proper moisture conditions for better establishment.	Do not sow seeds beyond 5 cm depth and under improper moisture conditions.
5.	Use fertilizers as per the soil test recommendations.	Avoid imbalance use of fertilizers.
6.	Take decision on management practices based on AESA, ETL pest defender (P.D.) ratio only.	Do not apply chemical pesticides on calendar basis.
7.	Use only the recommended chemical pesticides.	Do not use mixtures of chemical pesticides.
8.	Use the recommended doses of pesticides and the quantity of water for spraying.	Avoid indiscriminate use of pesticides and wrong sprayers.
9.	Spray the crop in morning or evening hours to avoid direct hit to the natural enemies and bee pollinators.	Do not spray the crop during noon hours as honey bees visit the crop in maximum numbers during this period.
10.	Use safer insecticides like Malathion/ Endosulfan.	Do not use insecticides highly toxic to parasites and predators.
11.	Use Malathion 50 EC on the crop meant for saag purpose and follow the waiting period of 8 days.	On a crop meant for saag., do not spray any insecticide other than Malathion and not pluck the Saag from the sprayed field before the waiting period.

## VI. POTENTIAL NATURAL ENEMIES OF MUSTARD

**Chrysoperla** Green lacewing adults are delicate, light green insects with net like wings. The eggs are stalked. Its grubs possess sickle shaped mouth parts, wander on plants in search of soft bodied insects and prey voraciously on them.

**Lady bird beetle** The lady bird beetles are predatory. The eggs are yellowish, cigar shaped, larvae blackish fast moving, pupa are also blackish and is resting stage. The adults are small in size, yellowish in colour and having black spots on fore wings. The adults and grub feed on aphids.

**Syrphid fly** The maggots are greenish in colour having sharp mouth parts which feed on aphids. The adult does not feed. These (adults) are also called hover flies and look like a house-fly.

*Ischiodan scutellans* (predator) alongwith *Verticillium lacanii* (fungus) ( $1 \times 10^5$ ) release 10 days after appearance of mustard aphids. 2<sup>nd</sup> release after 10 days of first release. 3<sup>rd</sup> release if necessary.

500 to 750 pupae/ha as augmentative release.

## 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>	
<b>ORGANOPHOSPHATE PESTICIDES</b>								
2.	Quinalphos	Highly toxic	Yellow	Class II – Moderately Hazardous		Mild – anorexia, headache, dizziness, weakness, anxiety, tremors of tongue and eyelids, miosis,	For extreme symptoms of O.P poisoning, injection of atropine (2-4 mg., for adults, 0.5-1.0 mg for children) is recommended,	
3.	Dimethoate	-do-	-do-	-do-				



4.	Phosphamidon	Extremely toxic	Bright red	Class I b - Highly hazardous	impairment of visual acuity.	repeated at 5-10 minute intervals until signs of atropinization occur.
5.	Malathion	Moderately toxic	Blue	Class III - Slightly 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;
6.	Oxydemeton methyl	Highly toxic	Yellow	Class II - Moderately hazardous	Severe - diarrhoea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.	- 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.
7.	Formothion	-do-	-do-	-do-		
8.	Methyl parathion	Extremely toxic	Bright red	Class I b - Highly 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 or phenothiazines.

							Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.	
FUNGICIDES								
9.	Mancozeb	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.	
10.	Carbendazim	Slightly toxic	-do-	-do-				
11.	Sulphur	-do-	-do-	-do-				

AGRO ECO SYSTEM ANALYSIS (AES A)

Agro Eco system Analysis (AES A) approach :

The state Department of Agriculture should make all possible efforts by using different media, mode and publicity to inform the farmers the need for field scouting in the specific crop areas having indication of pest or disease build – up.

Agro Ecosystem analysis (AES A) :

AESA is an approach which can be gainfully employed by extension functionaries and farmers to analyse field situations with regard of pests, defenders, soil conditions, plant health, the influence of climatic factors and their inter – relationship for growing healthy crop. Such a critical analysis of the field situations will help in taking appropriate decision on management practices.

The basic components of AES A are :

1. Plant health at different stages (phenophases)
2. Built – in compensation abilities of the plants.
3. Pest and defender population dynamics.
4. Soil conditions and edaphic factors
5. Climatic factors temperature, RH, rainfall, etc.
6. Farmers experience pest, diseases, weeds etc.

The methodology of AES A is as under :-

A. Field observation :

- a) Enter the field at least to ft. away from the bund. Select a site with a dimension of 1 sq. mt. randomly.
- b) Record the visual observations in following sequence :-
  - i) Flying insects (both pests & defenders)
  - ii) Close observation on pests and defenders which remain on the plants.
  - iii) Record disease and its intensity
  - iv) Record insect damage in percentage or population/plant.
- c) Record parameters like number of leaves, branches, plant height and reproductive parts of the selected plants which should be flagged for making observation in the following weeks.
- d) Record the types of weeds, their size and population density in relation to crop plant.
- e) Record soil conditions viz. Flooded, wet or dry.
- f) Observe rodent live burrows.
- g) Repeat the step (a) to (f) in four sites randomly selected.

- h) Record the climatic factors viz. Sunny, partially sunny cloudy, rainy etc. for the preceding week.

**B. Drawing :**

First draw the plant with actual number of branches/leaves etc. at the centre on a chart. Then draw pests on left side and defender on the right side. Indicate the soil condition, weed population, rodent damage etc. Give natural colours to all the drawing, for instance, draw healthy plant with green colour, diseased plant/leaves with yellow colour. While drawing the pests and the defenders on the chart care should be taken to draw them at appropriate part of the plant, where they are seen at the time of observation. The common name of pest and defenders and their population count should also be given along with diagram. The weather factor should be reflected in the chart by drawing the diagram of sun just above the plant if the attribute is sunny. If cloudy, the clouds may be drawn in place of sun. In the case of partially sunny, the diagram of sun may be half masked with clouds.

**C. Group discussion and decision making :**

The observations recorded in the previous and current charts should be discussed among the farmers by raising questions relating to change in pest and defender population in relation to crop stages, soil condition, weather factors such as rainy, cloudy or sunny, etc. The group may evolve a strategy based upon weekly AESA, ETL and corresponding change in P:D ratio and take judicious decision for specific pest management practices.

**D. Strategy for decision making : (Examples)**

Some of the defenders like lady beetles, *Chrysoperla*, *Syrphids*, etc. play useful role in arriving at P:D ratio.

**AESA BY EXTENSION FUNCTIONARIES :**

The extension functionaries during their regular visit to the village mobilise the farmer, conduct AESA and critically analyse the various factors such as the pest population vis-à-vis defender population and their role in natural suppression of the pest, the influence of prevailing weather condition / soil conditions on the likely build up of defender/pest population. They may also take the decision based on the AESA, which IPM components like release of defenders, application of safe pesticides are to be used for specific pest situation. Such an exercise may be repeated by the extension functionaries during every visit to the village and motivate the farmers to adopt AESA in their fields.

**AESA BY FARMERS :**

After a brief exposure during IPM demonstrations/field trainings, farmers can practice AESA in their own fields. Wherever trained farmers are available

their experiences could be utilized in training their fellow farmers in their own villages. Thus a large group of farmers could be made proficiently competent in undertaking weekly AESA thereby empowering themselves in decision making on any specific pest situations. Farmers – to – farmers training approach will go a long way in practicing IPM on a large area on sustainable basis.

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BASIC PRECATUTIONS IN PESTICIDE USAGE

**A. Purchase:**

1. Purchase only JUST required quantity e.g. 100, 250, 500 or 1000 g/l. 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 house premises.
2. Keep only in original container with intact seal.
3. Do not transfer pesticides to other containers.
4. Never keep them together with food or feed/fodder
5. Keep away from 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 polythin bags as hand gloves, hand kerchiefs or piece of clean cloth as mask and a cap or towel to cover the head (Do not use poythin bag contaminated with pesticides)
5. Read the label on the container before preparing spray solution.
6. Prepare spray solution as per requirement on.
7. Do not mix granules with water.
8. Concentrated pesticides must not fall on hands etc. while opening scaled containers. Do not smell the pesticides.
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 polytheen 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 buckets 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 sou.ce.
3. Never re-use empty pesticide container for any purpose.

# WARNINGS

1. Consult expert of the field of Plant Protection before use of any pesticide, regarding doses and time of applications.
2. Don't use pesticides in wrong way.
3. Select pesticides wise fully.
4. Use pesticides judiciously on need based manner.
5. Don't use green leaves as food after spray of pesticides.