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IPM PACKAGE NO. 20

INTEGRATED PEST MANAGEMENT PACKAGE

FOR LEGUMINOUS VEGETABLES

(PEAS, FRENCH BEAN, COWPEA, CLUSTER BEAN)

Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation
Directorate of Plant Protection, Quarantine & Storage
N.H. IV, Faridabad - 121 001
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IPM PACKAGE FOR LEGUMINOUS VEGETABLES

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FOREWARD

Integrated Pest management (IPM) approach has been globally accepted for achieving sustainability in agriculture. It has become more relevant due to a number of advantages like safety to environment, pesticide-free food commodities, low input based Crop Production Progamme etc. Though IPM approach has been taken up since 1981, its impact has not been felt until 1994. Human Resource Development has helped to sensitise extension functionaries and farmers about the usefulness of IPM.

For successful implementation of IPM, the scattered information on various components of this eco-friendly approach forms basic necessity. In this direction, initial attempts were made in 1992 to harmonise the IPM Package of Practices of various crops. Subsequently concerted efforts were made in 1998, 2001 and 2002 to update and develop IPM package of practices for agricultural and horticultural crops. Presently, IPM package of practices for 51 crops have been finalised to help the extension workers and farmers to manage the pests/ diseases and to minimise the over use/ misuse of chemical pesticides. Efforts have been made to incorporate the relevant available technical input provided by the scientists of ICAR Institutes/ SAUs and State Departments of Agriculture. However, suggestions for further improvement in future publication/ revision will be of immense help. Hopefully, these IPM Package of Practices will be useful for the Researchers, Plant Protection Workers and Farmers alike.

April 1, 2002

(V. Ragunathan)

PREFACE

In order to minimise the indiscriminate and injudicious use of chemical pesticides, INTEGRATED PEST MANAGEMENT (IPM) has been enshrined as cardinal principle of Plant Protection in the overall Crop Protection Programme under the National Agricultural Policy of the Govt. of India. IPM is an eco-friendly approach for managing pest and disease problems encompassing available methods and techniques of pest control such as cultural, mechanical, biological and chemical in a compatible and scientific manner. The greater emphasis has been given on biological control including use of biopesticides.

With a view to provide technical knowledge to the extension functionaries and farmers in the States, first National Workshop on IPM for harmonisation of Package of Practices was organized at National Plant Protection Training Institute (NPPTI), Hyderabad during June 29-30, 1992. Subsequently workshops were organized from April 15-17, 1998 and Nov. 5-6, 1998 at Directorate of Plant Protection, Quarantine & Storage, Faridabad and IPM package of practices for 20 crops were evolved on rice, cotton, vegetables, pulses, and oilseeds. In this series, two National Workshops on IPM have been conducted at NPPTI, Hyderabad and Dte. of PPQ&S, Faridabad during May 14-17, 2001 and Feb. 20-22, 2002 respectively to update 20 available IPM Packages and develop 31 new IPM Packages specially for Horticultural crops. In these workshops, 51 IPM Package of Practices for cereal crops (Rice, Wheat, Maize, Sorghum, Millets), commercial crops (Cotton, Sugarcane, Tobacco, Tea), pulse crops (Pigeonpea, Gram, Black gram/Green gram, Pea, Rajma), oilseeds (Groundnut, Soybean, Rapeseed/Mustard, Sesame, Safflower, Castor, Sunflower, Oilpalm), vegetables (Potato, Onion, Tomato, Brinjal, Okra, Chillies, Cruciferous vegetables, Leguminous vegetables, Cucurbitacious vegatables), fruit crops (Citrus, Banana, Apple, Mango, Guava, Grapes, Pineapple, Sapota, Pomegranate, Litchi), spice and plantation crops (Small Cardamom, Large Cardamom, Black Pepper, Ginger, Coriander, Cumin, Fennel, Coconut, Cashew and Arecanut) have been finalised.

IPM technology manages the pest population in such a manner that economic loss is avoided and adverse side effects of chemical pesticides are minimized. The IPM packages encompasses various management strategies for containing the pest and disease problems. Pest monitoring is also one of the important component of IPM to take proper decision to manage any pest problem. It can be done through Agro-Ecosystem Analysis (AESA), field scouting, light, pheromone, sticky/yellow pan traps. The economic threshold levels (ETL) of important pests and diseases are also given in the packages to take appropriate control measures when pest population crosses ETL.

These IPM packages developed with the technical inputs from experts from Indian Council of Agriculture Research, State Agricultural Universities, Central Directorate of Plant Protection, Pesticide Industries and State Departments of Agriculture/Horticulture will provide technical backup in the management of pests, diseases, weeds, nematodes and rodents in the Indian Agriculture and Horticulture. These will also be useful in reducing the pesticide residues in exportable agricultural commodities and would also help in the management of pests/diseases/weeds/nematodes which may get inadvertently introduced in the country.

IPM Package of Practices for Agricultural and Horticultural crops will be helpful to minimize the ill effects of chemical pesticides to promote the IPM for sustainable production. These packages will be useful for the researchers, extension workers and farmers alike who are engaged in the agricultural practices.

April 1, 2002

(A.D. Pawar)
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IPM PACKAGE FOR LEGUMINOUS VEGETABLES

(Peas, French bean, Cowpea, Cluster bean)

I. MAJOR PESTS

A. Pests of National Significance

1. Insect Pests

1.1 Aphids
1.2 Leaf miner
1.3 Pea pod borer
1.4 Pod borer
1.5 Bean fly
1.6 Flower thrips
1.7 Spider mite
1.8 Bean shoot borer
1.9 Leaf hopper
1.10 Cutworm

2. Diseases

2.1 Charcoal rot or Ashy stem blight.
2.2 Anthracnose
2.3 Bacterial blight
2.4 Powdery mildew
2.5 Mosaic Complex

3. Nematodes

3.1 Root knot nematode
3.2 Reniform nematode

4. Weeds

4.1 Lamb square (*Chenopodium album*)
4.2 Pimpernel (*Anagallis arvensis*)
4.3 Sweetclover (*Melilotus* spp.)

4.4 Fumitory (*Fumaria indica*)

4.5 Cornsparry (*Spergula arvensis*)

4.6 Blue grass (*Poa annua*)

4.8 Canary grass (*Phalaris minor*)

4.9 Rabbit foot grass (*Dactyloctenium aegyptium*)

B. Pests of Regional Significance

1. Insect Pests

1.1 Bean seed fly

1.2 Whitefly

1.3 Serpentine leaf miner

1.4 Blister beetle

2. Diseases

2.1 Haloblight

2.2 Ascochyta blight

2.3 Black root rot

2.4 Wilt complex

3. Nematode

3.1 Pigeon pea Cyst nematode

II. PEST MONITORING

A. Agro Eco System Analysis (AESA)

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 situations will help in appropriate decision on management practices.

1. Agro Eco System Analysis in vegetables

IPM is based on ecological interactions between the environment, plants, herbivores and their natural enemies. The maximum yield of the crop is determined by plants and their health. The health of the plant is determined by the environment and the herbivores. The herbivores are balanced by their natural enemies.

Agro-eco-system analysis (AESA) can be gainfully employed by a group of farmers for decision making in IPM. The basic components of AESA are:-

a) Plant health at different stages.
b) Compensation abilities of the plant.
c) Pest and defender population.
d) Soil condition, irrigation status etc.
e) Weather conditions
f) Past experience of the farmer in the situation.
g) Other investment opportunities.

The goal of the AESA activity is to analyse the field situation by observation, drawing and discussion. At the end of the activity the group should have made a decision about any action required for the field. The eco-system analysis is done weekly.

Time Required - 120 Minutes

Materials required - one note book, one large size paper, pencils and drawing crayons, polythene bags, plastic vials, rubber band and chloroform.

Procedure

Go to the field, leave the border side, select fifth plant in a row for observation. Move from the first to the second row and select the fifth plant from that position for second observation. Likewise select a total of ten plants. Observe each plant on the following parameters and record.

Insect-pest, disease and defenders count:

Count the larger pests and beneficial found on different branches and leaves of the plant. Start from the top of the plant and work downwards. Count the egg masses, larvae and adults of defoliators and workout defoliation percent. Count the flower and fruit feeding insects and assess the percentage of fruits affected by them. Count the branches that are affected by die-back or other shoot disease.

Select three leaves from the sample plant, one taken from the top, one from the middle and one from the bottom of the plant. Pick or turn the leaf and count the number of sucking pests and predatory mites. Also record different leaf spot disease symptoms and count the number of spots. Estimate the percentage of leaf area affected.

Out of ten sample plants, assess the number of plants with virus symptoms. Like wise, for wilting symptoms. Pull wilting plants and observe symptoms on the roots (cut the roots to observe the colour of the vascular tissue).

Out of ten sample plants, note the number of plants with flowers/fruits to assess the percentage of plants flowering/fruiting.

Plant parameters : Measure the height of the plant, number of leaves and width of foliage etc.

Walk through the whole plot to assess other beneficial, pests or diseases, not observed earlier on the ten sample plants, which are occurring now; note the uniformity in growth of the plants. Make records of the soil condition, water situation and presence of weeds (observe the different kinds of weeds and severity).

Rats : Count number of plants affected by rats, also record number of live burrows in the plot.

Weather : Record last week's weather situation.

Find a shady place to sit as a group. Each group should sit together in a circle with pencils, crayons and data from each of the field activities and the drawing of the AESA of the previous week.

Make a drawing on the large piece of paper for each plot observed. The rules for drawing are as follows:-

Draw the plant with the correct number of branches, leaves, flowers, fruits and write the plant height and number of green and yellow leaves some where in the note book. If the plant is healthy, colour the plant green. If disease occurs, draw the disease. If the plant is yellow, colour it yellow. Draw dead or drying leaves in yellow. For weeds, draw the approximate density and size of weeds in relation to the size of the vegetable plant. Draw the kind of weeds in the field.

For pest population draw the different insects found in the fields on the right side of the plant, write the average number next to the insect. Also write the local name next to the insect. The data can be summarized in a table on the right side.

For natural enemy population, draw the insects and spiders as found in the field on the left side of the plant. Write the average number of natural enemies and their local names next to the drawing.

For rats, write the average number of fruits/heads attacked.

If the week was mostly sunny draw a sun. If the week was mostly sunny and cloudy together draw a sun but half covered with dark clouds. If the week was cloudy all the day for most of the week put just dark clouds.

If the fertilizer was applied, then draw a picture of a hand throwing N, P or K depending on the type of fertilizer used.

If pesticides were used in the field, show sprays with a nozzle and write the type of chemical out of the nozzle. If granules were broadcast, show a hand with the name of pesticide being broadcast.

Now discuss the field situation among the group and arrive at a conclusion for the management practices required for the field. The discussion may be centered around as detailed in Annexure-I.

2. PIT FALL TRAP

Due to nocturnal and hiding during day time many insect pests like greasy cutworm, *Agrotis ipsilon* can not be observed on plant in the vegetable fields during day time. Likewise many ground dwelling predators

like ground beetles which play a major role in regulating the population of lepidopterous pest like *Helicoverpa armigera, Spodopetra litura* can not be assessed properly by visual observations.

The pit fall trap method is effective in these situations. Pit fall trap is a simple plastic container (1 liter capacity) without lid. Container with half filled water with a few drops of teepol on water surface is buried in the field in such a way that the top surface is at level with that of soil surface. Observation should be made 48 to 72 hours after fixing the trap. Ten traps may be required per hectare of vegetable crop.

All host crops of the locality observed at each spot 20 plants at random. Record population potential of different biocontrol fauna. Record the major disease and their intensity.

B. Field Scouting

AESA requires skill and so only the trained farmers can undertake their exercise. However, other farmers also can do field scouting in their own fields at regular intervals to monitor the major pest situation. Sample field scouting on pest situation by the farmers helps to minimize pesticide usage to a large extent.

C. Pheromone traps

Pheromone traps with lures are commercially available for pests like Pod borer, Tobacco caterpillar. Install five traps with lures for each pests; keep the distance of 5 meters between the traps. Traps should be installed in the field in such a way that the position of lure is always 6" to 12" above the crop canopy. Replace the lures once in 15 position of lure is always 6" to 12" above the crop canopy. Replace the lures once in 15 to 25 days depending upon the weather conditions. The trapped moths should be collected and killed daily. ETL for Pod borer is 8 to 10 moths per day per trap.

D. Yellow Water Pan/Sticky Traps

Set up yellow pan/sticky traps for monitoring whitefly, thrips, etc @ 10 traps per hectare. Locally available empty yellow palmolive tins coated with grease/vaseline/castor oil on outer surface may also be used as yellow pan trap.

E. Nematodes

Root knot nematode causes diagnostic symptoms of gall formation and reniform causes dirty roots. Their presence can be detected by using "Trypan Blue" stain, solution in water, which turns nematode egg sac dark blue in colour, whereas roots stay uncoloured. The cyst nematode adult female cause "Pearly root disease" at 30 to 45 days crop stage. Examine roots held upside down with hand-lens.

F. Economic Threshold Levels (ETL)

The Economic Threshold Level (ETL) is an attempt to improve decision making practices by using partial economic analysis on the impact of the control practices such as spraying a pesticide. At the ETL the benefit of spraying is equal to the losses caused by the insects in the field. The farmers are advised to take up the appropriate measure, whenever the incidence crosses ETL. The ETL for some of the major pests are listed below :-

Pest	Economic Threshold Level (ETL)
Pod borers	One larva per plant or one damaged fruit per plant.
Leaf hoppers	3 Leaf hoppers/leaf.

III. IPM STRATEGIES FOR LEGUMES

A. Cultural Practices

1. Deep summer ploughing to expose resting stages of pests and soil borne nematodes.

2. Timely sowing of the crops to avoid peak infestation of pests.
3. Well timed irrigation to contain major foliar diseases.
4. Crop rotation with cereals; jowar/maize against pod borers of beans, it also helps in reducing *Epilachna* beetles and thrips. Nematode population also reduce by this rotation. Marigold may be used as an inter-crop.
5. Use higher seed rate in bean stem fly endemic areas.
6. Application of 200 kg.neem cake per ha helps in controlling root diseases, nematodes, bean stem fly etc.
7. Mixed and multiple cropping to reduce bean shoot borer and other pests. Marigold should be incorporated to reduce nematodes.
8. Use balanced doses of fertilizers to obtain optimum plant population and healthy crop stand, which would be capable of competing with weeds at initial stages of crop growth.
9. Removal of any crop residues is essential to prevent population build up of soil borne nematodes.

B. Mechanical Control

1. Roguing of affected plants particularly virus infected plants.
2. Hand collection and destruction of egg mass larvae and infected leaves.
3. Installation of Pheromone traps @ 5 / ha for monitoring of lepidopteran pests.
4. Field sanitation by resorting to timely hand hoeings/hand weedings.

C. Biological Control

(1) Conservation

a) Some parasitoids are very active in the field against serious pests of leguminous crop. *Eg. Trichogramma* sp., *Compoletis chloridae, Eriborus argenteopilosus, Hyposoter didynotor* on *H. armigera; Telenomus remus, C. blackburni, Eriborus* sp., *Cotesia colemani, Cotesia marginiventris,* against *S. litura ; Goniozus* sp., *Cotesia* sp., *Telenomus* sp., *Phaneraotoma* sp. are found active against *Maruca* sp.; *Elasmus* sp., *Tetrastichus ovulorum* against *Epilachna* sp.; conserve *Hemiptarsenus varicornis, Gonotoma* sp.,

Chrysonotomyia sp., on serpentine leaf miner; *Aphidius* sp., *Aphelinus* sp. on aphids; *Stethorus pauperculus* is active parasite on red spider mite.

(b) In addition to these parasitoids, general predators like Coccinellids, Syrphids, Spiders, Carabids, Staphylinids, Dragonfly, Damselfly, predatory miridbugs, predatory pentatomids nabid bug, reduvid bug. Anthocoridbug, Geocorid bug, predatory mite, predatory thrips also actively suppress the pest population. Since these natural enemies are highly prone for pesticides, avoiding unnecessary sprays are the best way to conserve them.

c) Nematodes like *Hexamermis* sp. Entomopathogenic fungi like *Nemuria releyi, Metarhizium anisopliae, Heterorhabditis* and *Steinernema* are active during rainy season against lepidopteran pests.

d) Erect bird perchers @ 50/ha to attract local predatory birds, which in turn feed on insect pests.

2. Augmentation

a) Seed treatment with *Trichoderma viride* @ 2 g per 100 g seed to contain soil borne fungal infection.

b) Release spotted spider mite *Phytoesilus persimilis* @ 5 adults per plant against red spider mite.

c) Release or *Chrysoperla carnea* @ 2 grubs per plant 2 times at weekly interval against soft bodied insects.

d) Spray *adisura attinsoni* NPV 250 LE (6 x 10^9 PIB/LE) / ha which also takes care of pod borer due to cross - infectivity.

e) Spray SINPV 250 LE (6 x 10^9 PIB/LE)/ha against tobacco cutworm.

f) Release *Chelonus blackburni* @ 15000/ha for 3 times at weekly interval.

g) Release *T. chilonis* @ 50,000/ha at pre flowering and to be continued for 5 times at an interval of 7 days.

D. Chemical Control

1. Spray 5 percent NSKE 30 days after sowing and same should be repeated for 2 times at 10 days interval of seedling stage.

2. Soil application of phorate / carbofuran Gr. at 20 kg/ha may be followed before sowing of summer crops for protection against thrips and for Kharif crop, for protection against Stem fly and Jassids.

3. Spray wettable Sulphur 80% @ 3.13 kg/ha diluted in 750 to 1000 lt. water to control powdery mildew.

4. Alachlor (10 G) @ 2.5 kg/ha as pre-emergence herbicide recommended for weed management.

5. For nematode mangement, the seed treatment with carbofuron/carbosulfan (25 ST) @ 3 per cent (W/W) reduces the root knot, cyst and reniform nematode problem.

IV. CROP STAGE-WISE IPM PRACTICES

Stage 1	Pest 2	Practice 3
1. Pre-sowing	Resting stage of pests, nematodes	Deep summer ploughing Application of neem-cake @ 200 kg per ha.
	Soil borne pathogen nematodes	Crop rotation with maize and other coarse cereals.
2. Seed-Seedling	Weeds	Apply Alachlor (10G) @ 2.5 kg/ha as pre-emergence. Optimum spacing ; timely planting and balanced dose of fertilizer.
	Stem fly	Higher seed rate in endemic areas. Roguing of affected plants. Spray 5% NSKE. Spray endosulfan @ 0.07% when the initial puncher marks are noticed and spray again when 5 petioles are mined per 10 unifoliate leaves. Apply Carbofuran @ 30 kg/ha in endemic area.
	Nematodes	Seed treatment with Carbofuran/ Carbosulfan 3% (W/W).
3. Vegetative	Red spider mites	Removal of alternate hosts and destruction of affected plants. Release *Phytoseiulus persionilis* @ 5 grubs per plant. Spray Dicofol @ 0.05%.
	Nematodes	Removal of weeds which act as alternate hosts.

Stage 1		Pest 2	Practice 3
		Weeds	Maintain weed free field for 4-6 weeks after planting by hand hoeing.
		Bean shoot borer (Maruca)	Mixed and multiple cropping are found to be effective. Spray *B. thuringiensis var kurstake* @ 500g/ ha. Spray should be done during late evening hours as the pest is active at 1800 hours to 0600 hours.
		Jassids	Release *Chrysoperla carnea* @ 2 grubs per plant.
		Leaf spot	Spray Mancozeb 75% WP @1500-2000g per ha.
4.	Reproductive	Anthracnose	Destruction of affected plants.
		Maruca testulalis	Hand collection and destruction of larvae.
		Pod borer *A. atkinsoni*	Installation of pheromone traps @ 5 per hectare. Release of *T. brasiliensis* @ 50,000/ha 4 to 6 times within weekly interval. Spray NPV, 250 LE+ fungus *Vairimorpha sp* (6 x 10^9 PIB/ LE) during evening hours and repeat it after 10 days.
		S. litura	Release of *T. remus* @ 50,000/ha three times within weekly interval. Release of *C. blackburni* @ 15000/ha two times within weekly interval. Spray SINPV 25 LE/ha two times from pod development stage. Spray *B. thuringiensis* 500g/ha for lepidopteran pests. Spray Endosulfan 525-650 g ai/ha.

V. DO'S AND DONT'S IN IPM OF VEGETABLES

	Do's	Don'ts
1.	Deep ploughing is to done on bright sunny days during the months of May and June. The field should be kept exposed to sun light atleast for 2 to 3 weeks.	Do not plank or irrigate the field after ploughing atleast for 2-3 weeks, to allow desiccation of weed's bulbs and/or rhizomes of perennial weeds.
2.	Grow only recommended varieties.	Do not grow varieties not suitable for the season or the region.
3.	Timely early sowing.	Avoid late sowing as this may lead to reduced yield and incidence of white grubs and diseases.
4.	Always treat the seeds with approved chemicals/bio-products for the control of seed borne diseases/pests.	Do not use seeds without seed treatment with biocides/ chemicals.
5.	Sow in rows at optimum depths under proper moisture conditions for better establishment.	Do not sow seeds beyond 5 - 7 cm. depth.
6.	Pre-emergence herbicides should be applied immediately after sowing before the emergence of weeds and crop.	Pre-emergence herbicides should not be applied after emergence of crop or weeds as they cannot control the germinated weeds as well as they may cause phytotoxicity to the crop.
7.	Herbicides like Fluchloralin should be incorporated into the soil immediately after spraying, to avoid its photo degradation.	Soil incorporation of Fluchloralin should not be delayed or avoided for achieving effective weed control.

8.	Apply only recommended herbicides at recommended dose, proper time as appropriate spray solution with flatfan or flat jet nozzles.	Pre-emergence as well as soil incorporated herbicides should not be applied in dry soils. Do not apply herbicides alongwith irrigation Water or by mixing with soil, sand or urea.
9.	Maintain optimum and healthy crop stand which would be capable of competing with Weeds at a critical stage of crop weed Competetion.	Crops should not be exposed moisture deficit stress at their crititcal growth stage.
10.	Use NPK fertilizers as per the soil test recommendations.	Avoid imbalanced use of fertilizers.
11.	Use micronutrient mixture after sowing as top dressing separately.	Do not mix micronutrients with fertilizers and incorporate into the soil.
12.	Conduct AESA weekly in the morning preferably before 9 a.m. Take decision on, management practice based on AESA, ETL and PD ratio only.	Do not apply chemical pesticides on calendar basis.
13.	Install pheromone traps at appropriate period.	Do not store the pheromone lures at normal room temperature (keep them in refrigerator).
14.	Release parasites only after noticing adult moth catches in the pheromone trap or as per field observation.	Do not apply chemical pesticides within seven days of release of parasites.

15.	Apply HaNPV, SINPV at recommended dose when a large number of egg masses and early instar larvae are noticed. Apply NPV only in the evening hour's after 5 p.m.	Do not use the same sprayer for application of chemical pesticides and biocides.
16.	In case of pests which are active during night like *Spodoptera* spray recommended Biocides/chemicals at the time of their appearance in the night.	Do not apply pesticides/biocides when it is not absolutely required.
17.	Spray pesticides thoroughly to treat the under surface of the leaves particularly for mites.	Do not spray pesticides at midday since, most of the insects are not active during this period.
18.	Apply short persistent pesticides to avoid pesticide residue in the soil and produce.	Do not apply pesticides during preceding seven days before harvest.
19.	Follow the recommended procedure of trap technology like in tomato and Cole crops.	Do not apply long persistent pesticide on trap crop, otherwise it may not attract the pests and natural enemies.

CROP: LEGUMINOUS VEGETABLES

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	Remove the person from the contaminated environment. In case of (a) Skin contact – Remove all contaminated clothings and immediately wash with lot of water and soap; (b) Eye contamination – Wash the eyes with plenty of cool and clean water; (c) Inhalation – Carry the person to the open fresh air, loosen the clothings around neck and chest, and (d) Ingestion – If the victim is fully conscious, induce vomiting by tickling back of the throat. Do not administer milk, alcohol and fatty substances. In case the person is unconscious make sure the breathing passage is kept clear without any obstruction. Victim's head should be little lowered and face should be turned to one side in the lying down position. In case of breathing difficulty, give mouth to mouth or mouth to nose breathing. Medical aid: Take the patient to the docotr/Primary Health Centre immediately along with the original container, leaflet and label.	Nausea, vomiting, restlessness, tremor, apprehension, convulsions, coma, respiratory failure and death	- 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) intra-venously every four hours.	
2.	Dicofol	Moderately toxic	Blue	Class III – Slightly hazardous				
ORGANOPHOSPHATE PESTICIDES								
3.	Phorate	Extremely toxic	Bright red	Class I a – Extremely 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,	

						impairment of visual acuity. Moderate- nausea, salivation, lacrimation, abdominal cramp, vomiting, sweating, slow pulse, muscular tremors, miosis. Severe – diarrhoea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.	repeated at 5-10 minute intervals until signs of atropinization occur. Speed is imperative - Atropine injection – 1 to 4 mg. Repeat 2 mg. when toxic symptoms begin to recur (15-16 minute intervals), Excessive salivation – good sign, more atropine needed; - Keep airways open, Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed. - For ingestion lavage stomach with 5% sodium bicarbonate, if not vomiting. For skin contact, wash with soap and water (eyes- wash with isotonic saline). Wear rubber gloves while washing contact areas. In addition to atropine give 2-PAM (2-pyridine aldoxime methiodide). 1 g and 0.25 g for infants intravenously at a slow rate over a period of 5 minutes and administer again periodically as indicated. More than one injection may be required. Avoid morphine, theophyllin, aminophyllin, barbiturates ofr phenothiazines.	

							Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.	
CARBAMATES								
4.	Carbofuran	Extremely toxic	Red	Class I b – Highly hazardous		Constriction of pupils, salivation, profuse sweating, lassitude, muscle incoordination, nausea, vomiting, diarrhoea, epigastric pain, tightness in chest.	- Atropine injection 1 to 4 mg. Repeat 2 mg when toxic symptoms begin to recur (15-60 minute intervals). Excessive salivation – good sign, more atropine needed. - Keep airway open. Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed. - For ingestion, lavage stomach with 5% sodium bicarbonate, if not vomiting. For skin contact was with soap and water (eyes – wash with isotonic saline). Wear rubber gloves while washing contact area. - Oxygen - Morphine, if needed. Avoid theophyllin and aminophyllin or barbiturates. 2-PAM and other oximes are not harmful and in fact contra indicated for routine usatge. Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.	

FUNGICIDES								
5.	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.	
6.	Wettable sulphur	Slightly toxic	Green	-do-				
7.	Tridemorph	Moderately toxic	Blue	Class II – Moderately hazardous				
HERBICIDES								
8.	Alachlor	Moderately toxic	Blue	Class III – Slightly hazardous		Headache, palpitation, nausea, vomiting, flushed face, irritation of nose, throat eyes and skin etc.,	No specific antidote. Treatment is essentially symptomatic.	

VI. ECO - SYSTEM ANALYSIS

Steps	What to observe	What to ask ? Discuss	Actions
1.	Weather	Rain/dry? Trends in weather dry/wet season, effects on crop	Do we need to water ? Preparation of beds? Disease management.
2.	Crop condition	Age of crop, seedling/vegtable growth/flowering fruiting/colour of leaves, leaf spots ? Die back ? Diseases ?	Need fertilizer ? Need watering ? Fungicides ? Special topic ?
3.	Field condition	Soil structure hard/wet ? Weeds present ?	Hand weeding ? Soil aeration
4.	Herbivores	What herbivores ? Population ? Damaging ?	Insect zoo Special topic
5.	Natural enemies (and neutrals)	What natural enemies ? Population ? Damaging ?	Insect zoo Special topic
6.	Activities in neighbours fields	Do neighbours spray ? what was sprayed?	Compare with FP Plot
7.	Decisions made last week	Was the decision made effective? Do we need to do similar Action?	Insect Zoo Special topic

Annexure-II

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 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 sunlight 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 of 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 polythene bags as hand gloves, handkerchiefs or piece of clean cloth as mask and a cap or towel to cover the head (Do not use polythene 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 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 polythene 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 solid away from water source.
3. Never re-use empty pesticide container for any purpose.

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