



IPM PACKAGE NO. 1



INTEGRATED PEST MANAGEMENT PACKAGE

FOR

RICE



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

Grams : 'PROTECTION'



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FOREWARD

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

For successful implementation of IPM, gathering of the scattered information on various components of this eco-friendly approach in the form of package is basic necessity. In this direction, initial attempts were made in 1992 to harmonize the IPM Package of Practices of various crops. Subsequently, concerted efforts were made in 1998, 2001, 2002 and 2003 to update and develop IPM Package of Practices for agricultural and horticultural crops. Keeping in view the development of resistance and attainment of pest status by certain insects, updating of

P R E F A C E

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

With a view to provide technical knowledge to the extension functionaries and farmers in the States, first National Workshop on IPM for harmonization of Package of Practices was organized at National Plant Protection Training Institute (NPPTI), Hyderabad during June 29-30, 1992. Subsequently workshops were organized on April 15-17, 1998 and Nov. 5-6, 1998 at the Directorate of Plant Protection, Quarantine & Storage, Faridabad and IPM Package of Practices for 20 crops were finalized on rice, cotton, vegetables, pulses and oilseeds. In this series, two National Workshops on IPM have been conducted at NPPTI, Hyderabad and Dte. of PPQ&S, Faridabad during May 14-17, 2001 and February 20-22, 2002 respectively to update 20 available IPM Packages and developed 31 new IPM Packages especially for horticultural crops. Sixth and Seventh National Workshops held at Central Insecticides Laboratory, Faridabad on 4th-5th July, 2002 and 9th-10th January, 2003 respectively for 18 IPM Packages and Eighth National Workshop was held at NPPTI, Hyderabad on 28th-29th May, 2003 for 8 IPM Packages. In these Workshops, 77 IPM Package of Practices for cereal crops (Rice, Wheat, Maize, Sorghum, Millets), commercial crops (Cotton, Sugarcane, Tobacco, Tea, Betelvine, Saffron), pulse crops (Pigeonpea, Gram, Black gram/Green gram, Peas, Rajma), oilseeds (Groundnut, Soybean, Rapeseed/Mustard, Sesame, Olive, Safflower, Castor, Sunflower, Oilpalm), vegetables (Potato, Onion, Tomato, Brinjal, Okra, Chillies, Cruciferous vegetables, Leguminous vegetables, Cucurbitaceous vegetables, Broccoli, Spinach, Lablab bean, Garlic), fruits (Citrus, Banana, Apple, Mango, Guava, Grapes, Jackfruit, Pineapple, Sapota, Pomegranate, Litchi, Papaya, Apricot, Peach, Pear, Cherry, Walnut, Ber, Amla, Loquat, Strawberry, Watermelon, Fig, Phalsa, Persimmon, Custard apple, Raspberry, Kiwi, Passion fruit), spice and plantation crops (Small Cardamom, Large Cardamom, Black Pepper, Ginger, Coriander, Cumin, Fennel, Coconut, Cashew and Arecanut) have been finalized. Moreover, 9th National Workshop for Review/Upgradation of IPM Package of Rice, Cotton, Sugarcane, Coconut and Groundnut crops was held during 22nd -23rd Decembe, 2003 at CIL, Faridabad. Latest research developments, pest problems and their management practices have been incorporated in these IPM packages.

IPM technology manages the pest population in such a manner that economic loss is avoided and adverse side effects of chemical pesticides are minimized. The IPM packages encompass various management strategies for containing the pest and disease problems. Pest monitoring is one of the important components of IPM to take proper decision to manage any pest problem. It can be done through Agro-Ecosystem Analysis (AESAs), 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 the various Institutes of Indian Council of Agricultural Research, State Agricultural Universities, Central Directorate of Plant Protection, Pesticide Industries and State Departments of Agriculture/Horticulture will provide technical backup in the management of pests, diseases, weeds, nematodes and rodents in the agriculture and horticulture. These will also be useful in reducing the pesticide residues in agricultural commodities and would also help in the management of pests/diseases/weeds/nematodes which may get inadvertently introduced in the country.

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

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IPM PACKAGE FOR RICE

I. MAJOR PESTS

A. Pest of National Significance :

1. Insect pests :

- 1.1 Yellow stemborer (*Scirpopophaga insertulas*)
- 1.2 Brown planthopper (*Nilaparvata lugens*)
- 1.3 Gallmidge (*Orseolia oryzae*)
- 1.4 Leaf folder (*Cnaphalocrosis medinalis*)
- 1.5 White backed planthopper (*Sogatella furcifera*)

2. Diseases

- 2.1 Rice blast (*Pyricularia oryzae*)
- 2.2 Sheath blight (*Rhizoctonia solani*)
- 2.3 Bacterial leaf blight (*Xanthomonas campestris pv oryzae*)

3. Weeds

- 3.1 *Panicum* spp.
- 3.2 *Echinochloa* spp.
- 3.3 *Cyperus* spp.

4. Rodents

- 4.1 Smaller bandicoot (*Bandicota bengalensis*)
- 4.2 Soft furred field rat (*Millardia meltada*)
- 4.3 Field mice (*Mus* spp.)

B. Pest of regional significance :

1. Insect-Pests

- 1.1 Gundhi bug (*Leptocorisa varicornis*) - Mainly in upland rice in Bihar, Madhya Pradesh, Orissa, Uttar Pradesh and West Bengal.

- 1.2 Rice hispa (*Dicladispa armigera*) - Bihar, West Bengal, Assam, Orissa, Meghalaya, Mizoram, Tripura, Punjab, Himachal Pradesh, Uttar Pradesh and Uttaranchal.
- 1.3 Green leafhopper (*Nephotettix sp.*) - Bihar, West Bengal, Assam, Orissa, Madhya Pradesh, Andhra Pradesh, Tamil Nadu and Punjab.
- 1.4 Climbing cutworm/Rice Ear Cutting Caterpillar/Armyworm (*Mythimna separata*) - In coastal rice growing areas, Haryana, Punjab and Uttar Pradesh.
- 1.5 Caseworm (*Nymphula depunctalis*) - In low lying and water logged areas.
- 1.6 Swarming caterpillar (*Spodoptera mauritia*) – Punjab, Orissa, West Bengal.
- 1.7 Thrips (*Baliothrips biformis*) - In upland rice in Orissa, Andhra Pradesh, Madhya Pradesh, Punjab, Haryana, Assam, Tamil Nadu.
- 1.8 Termite (*Odontotermes spp.*) - In rainfed upland areas, irrigated rice-wheat system.
- 1.9 Mealy bug (*Ripersia oryzae*) - In upland rice in Uttar Pradesh, Bihar, West Bengal, Orissa, Madhya Pradesh, Tamil Nadu, Kerala, Pondicherry, Karnataka.
- 1.10 Root weevil (*Echinochemus oryzae*) – Haryana, Punjab, Tamil Nadu.
- 1.11 Mites (*Oligonychus oryzae*) – Andhra Pradesh, Orissa.

2. Diseases

- 2.1 Sheath rot (*Sarocladium oryzae*)
- 2.2 Rice Tungro Virus.
- 2.3 Brown spot (*Helminthosporium oryzae*) - In upland and ill drained low land.
- 2.4 False smut (*Ustilaginoidea virens*)
- 2.5 Udbatta (*Ephelis oryzae*) - In Karnataka, Orissa.
- 2.6 Bacterial leaf streak (*Xanthomonas translucens* f. sp. *oryzicola*)
- 2.7 Grassy stunt virus - in Kerala.

3. Weeds

- 3.1 *Commelina bengalensis*

3.2 *Eclipta alba*

3.3 *Ischaemum rugosum*

3.4 *Eleusine indica*

3.5 *Amaranthus spinosus*

3.6 *Monochrea vaginalis*

3.7 *Digitaria sanguinalis*

3.8 *Fimbristylis littoralis*

4. **Rodents:** Indian gerbil (*Tatera indica*) - upland rice.

5. **Nematodes:**

5.1 Root knot nematode (*Meloidogyne graminicola*) - West Bengal, Assam, Orissa & Tripura, Eastern Uttar Pradesh, Karnataka, Himachal Pradesh.

5.2 Whitetip nematode (*Aphelelchooides besseyi*)

5.3 Ufra (*Ditylenchus angustus*) - West Bengal and Assam.

5.4 Rice root nematode (*Hirschmanniella oryzae*)

5.5 Cyst nematode (*Heterodera oryzae*) - in Kerala only.

5.6 Root lesion nematode (*Pretylenechus indicus*) – Upland Orissa.

II. PEST MONITORING:

A. Agro Eco System Analysis (AESAs)

1. 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 interrelationship 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 AESA are :-

1. Plant health at different stages.
2. Built-in-compensation abilities of the plants.
3. Pest and defender population dynamics.
4. Soil conditions.

5. Climatic factors.
6. Farmers past experience.

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

B. Survey/Field Scouting

The objective of surveys through roving surveys is to monitor the initial development of pest and diseases in endemic areas. Therefore, in the beginning of crop season survey routes based upon the endemic areas are required to be identified to undertake roving surveys. Based upon the results of the roving surveys, the state extension functionaries have to concentrate for greater efforts at block and village levels as well as through farmers to initiate field scouting. Therefore, for field scouting farmers should be mobilised to observe the pest and disease occurrence at the intervals as stipulated hereunder. The plant protection measures are required to be taken only when pests and diseases cross ETL as per results of field scouting.

1. Roving survey:- Undertake roving survey at every 10 km distance at 7-10 days intervals (depending upon pest population). Everyday at least 20 spots should be observed.
2. Field scouting:- Field scouting for pests and biocontrol fauna by extension agencies and farmers once in 3-5 days should be undertaken to workout ETL.

C. Pest monitoring through pheromones/light traps etc.

Certain pests required positioning of various kinds of traps, like pheromones, light trap to monitor the initial pest build up therefore, the State Department of Agriculture is to initiate action for positioning of different kinds of traps at strategic locations at village level as per the following details :-

1. Pheromone trap - monitoring :- 5 traps per ha. may be used to monitor yellow stem borer moth population.

2. Light trap :- Chinsurah light trap or any other light trap with 200 watts mercury lamps can be operated for two hours in the event to observe photo-tropic insect pests.
3. Sweep-nets - water pans :- Besides visual observations sweep-nets and water pans may also be used to assess the population of insect pests and biocontrol agents.

D. ECONOMIC THRESHOLD LEVELS (ETLs)

S. No.	Crop Stage and pest	Economic Threshold Levels (ETLs)
A.	Nursery :	
	1. Green leafhopper	1-2 insects/hill in Rice Tungro Disease (RTD) endemic areas
	2. Gall midge	1 silver shoot (gall)/sq m
	3. Stem borer	1 moth or 1 egg mass/sq m
B.	Planting to pre-tillering :	
	1. Leaf folder	1 freshly damaged leaf/hill or 10% damaged leaves.
	2. Yellow stemborer	5% dead-hearts or one egg mass or one moth/sq m
	3. Gall midge	1 gall/sq m in endemic areas or 5% affected tillers in non-endemic areas
	4. Brown Planthopper	5 to 10 insects/hill
	5. Green leafhopper	10-15 insects/hill (in RTV endemic areas 2 insects/hill)
	6. White backed planthopper	5-10 or more insects/hill
	7. Rice hispa	2 adults or 2 damaged leaves/hill
C.	Mid tillering :	
	1. Leaf folder	1-2 freshly damaged leaves/hill
	2. Stem borer	5% dead hearts or 1 egg mass or 1 adult/sq m
	3. Gall midge	5% silver shoots
	4. Brown planthopper	5-10 insects/hill
	5. Green leafhopper	10-20 insects/hill (2 insects/hill in RTD endemic areas)
	6. Hispa	1 adult or 1- 2 damaged leaves/hill or 10% damaged leaves.
	7. Blast	5-10% disease severity
	8. Bacterial leaf blight	2 to 5% disease severity
	9. Sheath blight	5% or more affected tillers
	10. Tungro	1 affected hill/sq. m. and 2 GLH/Hill.
D.	Panicle initiation to booting :	
	1. Stem borer	1 egg mass or 1moth/ sq. m. or 5% dead hearts.
	2. Leaf folder	1-2 freshly damaged leaves/hill or 10% damaged leaves.
	3. Green leafhopper	20 insects/hill
	4. Brown planthopper	5-10 insects/hill
	5. White backed planthopper	5-10 insects/hill
	6. Blast	2-5 % leaf area damaged
	7. Bacterial leaf blight	2-5% disease severity
	8. Sheath blight	5% or more tillers affected
E.	Flowering and after :	
	1. Brown planthopper	5-10 insects/hill
	2. Climbing cutworm/Rice ear cutting caterpillar/Armyworm	4-5 larvae/sq. m.
	3. Gundhi bug	1- 2 bugs/hill
	4. Blast	5% leaf area damaged or 2% neck blast
	5. Sheath rot/brown spot	2-5% tillers affected
	6. Sheath blight	5% or more tillers affected

III. INTEGRATED PEST MANAGEMENT STRATEGIES

A. Insect pests, diseases and weeds

1. Cultural Practices :

- 1.1 Select suitable resistant or moderately resistant variety (Annexure-II).
- 1.2 Use disease and insect free pure seed.
- 1.3 Seed treatment (for diseases) as per local recommendations.
- 1.4 Timely planting/sowing.
- 1.5 Pre-sowing irrigation: Many weeds can be controlled by applying pre-sowing irrigation to area where nursery or seedlings are to be transplanted. The emerged weeds can be ploughed under.
- 1.6 Raising of healthy nursery.
- 1.7 As far as possible rice seedlings should be free from weed seedlings at the time of transplanting.
- 1.8 Seedling root dip/nursery treatment in gall midge/stem borer endemic areas.
- 1.9 Destruction of left over nursery, removal of weeds from field and cleaning of bunds.
- 1.10 Normal spacing with 33 hills/sq m. Higher plant population brings competition and ecological pressure on weeds.
- 1.11 30 cm alley formations at every 2.5 to 3 m distance in planthopper and sheath blight endemic areas.
- 1.12 Balanced use of fertilizers and micro-nutrients as per local recommendations. Excessive use of Nitrogen increases the vulnerability of many insect pests (BPH, WBPH, LF, Gall midge) and diseases (bacterial blight, false smut, sheath blight, kernel bunt/neck blast).
- 1.13 Proper water management (alternate wetting and drying to avoid water stagnation) in planthopper, bacterial blight and stem rot endemic areas. Maintain a thin layer of water on soil surface to minimize weed growth.
- 1.14 In direct sown rice, the crop should be sown in lines at recommended spacing to facilitate inter-weeding operations. Mechanical methods of

weed should be practiced after 2-3 weeks and second time if necessary after 4-6 weeks of sowing.

- 1.15 Harvest close to ground level to destroy insect pest present in the internodes/stubbles. This will also expose the insects to birds thus help in natural biocontrol of insect pests.
- 1.16 Do not sow rice under shade as these places serve as foci for spread of diseases (Bacterial blight) & insect pests (leaf folder & stem borer).
- 1.17 After harvest, the fields should be thoroughly flooded with water and ploughed with discs or rotators to kill hibernating larvae of stem borer present in the stubbles. Ploughing of fields also expose larvae and pupae of rice ear cutting caterpillar (climbing cutworm) hidden in the soil to birds and weather factors.

2. Mechanical Practices :

- 2.1 Collection of egg masses and larvae of pest and their placement in bamboo cages for conservation of biocontrol agents.
- 2.2 Removal and destruction of diseased/pest infested plant parts.
- 2.3 Clipping of rice seedlings tips at the time of transplanting to minimize carryover of rice hispa and case worm infestation from seed bed to the transplanted fields.
- 2.4 Hand weedings at 3-4 weeks followed by 4-6 weeks after transplanting may be done to control weeds.
- 2.5 Use of coir rope in rice crop for dislodging case worm and leaf folder larvae etc.
- 2.6 Lapping of tall varieties of Basmati (Bas.386, Bas.370, Taroari Bas.) at 45 days after transplant to reduce stem borer problem as well as to prevent lodging.

3. Biological Control Practices :

3.1 Conservation

- 3.1.1 Biocontrol agents viz., spiders, drynids, water bugs, mirid bugs, damsel flies, dragonflies, meadow grasshoppers, staphylinid beetles, carabids, coccinellids, *Apanteles*, *Tetrastichus*, *Telenomus*, *Trichogramma*, *Bracon*, *Platygaster* etc. should be conserved.
- 3.1.2 Root dip treatment of rice seedlings with chlorpyrifos is safe for the natural enemies in gall midge endemic areas.
- 3.1.3 As an alternate to seedling root dip, apply 1.5kg a.i./ha of carbofuran or phorate granules in nursery 5 days before uprooting the seedlings for control of insect pests in early transplanted crop.
- 3.1.4 Collection of egg masses of borers and putting them in a bamboo cage-cum-percher till flowering which will permit the escape of egg parasites and trap and kill the hatching larvae. Besides, these would allow perching of predatory birds.
- 3.1.5 Habitat management : Protection of natural habitats within the farm boundary may help in conserving natural enemies of pests. Management of farmland and trees is important as they provide habitat for beneficial insects and birds which control insect pests. Similarly, cats help in the control of rats. Field bunds provide refuse for predating spiders which help in the control of several rice insect pests. Bunds should be kept clean by removing weeds so as to reduce the inoculums of disease like sheath blight.

3.2 Augmentation :

Based on monitoring, augmentative release of *Trichogramma japonicum* or *T. chilonis* @ 100,000/ha/10 days for 4-5 times starting from the day of appearance of the pest for control of stem borer and leaf folder respectively.

3.3 Pest defender ratio :

2:1 P&D ratio may be useful to avoid application of pesticides.

4. Behavioral Control:

Mass trapping of yellow stem borer male moths by installing pheromone traps at the rate of 20 traps/ha at 20 days after transplanting. Lures containing 5 mg pheromone should be replaced 3 times at an interval of 20-25 days during crop season.

5. Chemical Control Measures:

Need based, judicious and safe application of pesticides are the most vital tripartite segments of chemical control measures under the ambit of IPM. It involves developing IPM skills to play safe with environment by proper crop health monitoring, observing ETL and conserving natural biocontrol potential before deciding in favour of use of chemical pesticides as a last resort. The details of the chemical control measures to be adopted against insect pests and diseases are given in Annexure-III.

B. Nematode Management Practices

Important nematodes and their management approaches are as under:-

1. White tip nematode (*Aphelenchoides besseyi*)

- 1.1 Hot water treatment of seed at 52⁰ C for 10 minutes after a presoak for 6 hours.
- 1.2 Sun drying of seeds for 6 hours for 4 days.
- 1.3 Burning of stubbles to prevent any carryover infection.
- 1.4 Pre-sowing of nursery bed treatment with Carbofuran 3G granules @ 33 kg/ha.
- 1.5 Presoaking seed for 6 hours in 0.2% solution of Monocrotophos.
- 1.6 Growing resistant varieties like Ratna, Triveni, TMK 6, TMK 9, Surya, Kaveri, Indira.

2. Rice Root nematode (*Hirschmanniella oryzae*)

- 2.1 Application of neem cake at 100-120 kg/ha.

- 2.2 Grow resistant varieties like TMK 9, Annapurna in endemic areas.
 - 2.3 Pre-sowing treatment of nursery bed with Carbofuran 3G granules @ 33 kg/ha.
 - 2.4 Seed soaking with 0.2% solution of Monocrotophos for 6 hours.
 - 2.5 Soil application of Carbofuran 3G @ 33 kg/ha.
 - 2.6 Growing *Sesbania rostrata* as rotation crop & incorporation.
 - 2.7 Growing potato or groundnut as rotation crops.
3. **Ufra (*Ditylenchus angustus*)** - West Bengal, Assam.
- 3.1 Destruction of ratoon crops and weeds.
 - 3.2 Summer ploughing.
 - 3.3 Delayed planting.
 - 3.4 Rotation with non-host crops like Jute or Sesamum.
 - 3.5 Seed treatment with Carbofuran 3G.
 - 3.6 Soil application of Carbofuran.
 - 3.7 Growing an early variety like Padmapani, which can escape the nematode infection in endemic areas and resistant variety like Rayda 16-06.
4. **Rootknot nematode (*Meloidogyne graminicola*)**
- 4.1 Rotation with the crops like sweet potato, castor, sunflower, cowpea, sesamum, onion.
 - 4.2 Growing resistant varieties like TKM-6, Hamsa, IR64 and Ramakrishna in endemic areas.
 - 4.3 Soil application of Carbofuran 3G.

5. **Cyst Nematode (*Heterodera oryzae*)** - Kerala only.

- 5.1 Growing resistant varieties like Alaknanda - 41, Hamsa, TKM 6, MTU -17, CR-143 - 2 - 2 in endemic areas.
- 5.2 Soil treatment with Carbofuran 3G @ 33 kg/ha.

C. Rodent Management Practices :

(Working Index (ETL) : Fifteen live burrows per hectare)

1. Bund trimming specially to minimise rodent harbourage.
2. Weed management to reduce alternate source of food.
3. Employment of indigenous traps preferably one month after transplantation.
4. Application of bromodiolone (0.005% a.i.) in baits six weeks after transplantation.
5. The residual live burrows may be treated with second application of bromodiolone (0.005%).
6. The above control operations with rodenticides except Zinc phosphide (as rodents develop bait shyness) may be repeated if the rodent population exceeds working index.

Important:

- i) Optimum period for undertaking control operation is six weeks after transplantation.
- ii) Zinc phosphide (2.5%) in baits may be applied in rodent outbreak situation.
- iii) For getting effective control, it is recommended that Zinc Phosphide with ISI mark in 10 gm pouches preferably in manufacturers package should be procured.

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.	Quinalphos	Highly toxic	Yellow	Class II - Moderately Hazardous	Mild - anorexia, headache, dizziness, weakness, anxiety, tremors of tongue and eyelids, miosis, impairment of visual acuity.	For extreme symptoms of O.P poisoning, injection of atropine (2-4 mg., for adults, 0.5-1.0 mg for children) is recommended, repeated at 5-10 minute intervals until signs of atropinization occur.
3.	Monocroto phos	Extremely toxic	Bright red	Class I b - Highly hazardous		
4.	Phosalone	Highly toxic	Yellow	Class II - Moderately hazardous	Moderate- nausea, salivation, lacrimation, abdominal cramp, vomiting, sweating, slow pulse, muscular tremors, miosis.	Speed is imperative - Atropine injection - 1 to 4 mg. Repeat 2 mg. when toxic symptoms begin to recur (15-16 minute intervals), Excessive salivation - good sign, more atropine needed; - Keep airways open, Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed. - For ingestion lavage stomach with 5% sodium bicarbonate, if not vomiting. For skin contact, wash with soap and water (eyes- wash with isotonic saline). Wear rubber gloves while washing contact areas.
5.	Phosphami don	Extremely toxic	Bright red	Class I a - Extremely Hazardous		
6.	Acephate	Moderately toxic	Blue	Class III - Slightly hazardous	Severe - diarrhoea, pinpoint and non- reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.	
7.	Phorate	Extremely toxic	Bright red	Class I a - Extremely Hazardous		
8.	Dichlorvos	Highly toxic	Yellow	Class II - Moderately Hazardous		
9.	Chlorpyrip hos	-do-	-do-	-do-		
10.	Triazophos	Highly toxic	Yellow	Class I b - Highly Hazardous		
11.	Ediphenph os	Highly toxic	Yellow	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.	

CARBAMATES

12.	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.	
13.	Carbaryl	Highly toxic	Yellow	Class II - Moderately hazardous			- Keep airway open. Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed.	
14.	BPMC (Fenobucarb)	Moderately toxic	Blue	Class II - Moderately hazardous			- 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	
15.	Cartap	Highly toxic	Yellow	Class II - Moderately Hazardous				

							<p>area.</p> <ul style="list-style-type: none"> - Oxygen - Morphine, if needed. <p>Avoid theophyllin and aminophyllin or barbiturates.</p> <p>2-PAM and other oximes are not harmful and in fact contra indicated for routine usatge.</p> <p>Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.</p>
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FUNGICIDES

16.	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.
17.	Hexaconazole	Slightly toxic	Green	-do-			
18.	Propiconazole	Moderately toxic	Blue	Class III – Slightly hazardous			
19.	Validamycin	Slightly toxic	Green	Table 5 – Unlikely to present acute hazard in normal use			
20.	Captafol	-do-	-do-	Class I a – Extremely Hazardous			
21.	Tricyclazole	Highly toxic	Yellow	Class II – Moderately Hazardous			

22.	Iprobenphos	Moderately toxic	Blue	Class III – Slightly hazardous			
23.	Thiophanate methyl	Slightly Toxic	Green	Table-5 Unlikely to present acute hazard in normal use.			
24.	Carbendazim	-do-	-do-	-do-			
25.	Kasugamycin	-do-	-do-	-do-			

HERBICIDES

26.	Cyhalofop butyl	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.
27.	Butachlor	Moderately toxic	Blue	-do-			
28.	Pendimethalin	-do-	-do-	Class III – Slightly hazardous			
29.	Thiobencarb	Moderately toxic	Blue	Class II – Moderately hazardous			
30.	Pretilachlor	Slightly toxic	Green	Table 5 – Unlikely to present acute hazard in normal use			
31.	Chlormyrane ethyl	Moderately toxic	Blue	-do-			

OTHERS								
38.	Fipronil	Highly toxic	Yellow	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.
39.	Imidacloprid	-do-	-do-	-do-				
40.	Thiomethox am							

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 interrelationship 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 AESA are:-

1. Plants health at different stages. Monitor presence/symptoms of insect pests/diseases and nematodes.
2. Built-in-compensation abilities of the plants.
3. Pest and defender population dynamics.
4. Soil conditions
5. Climatic factors.
6. Farmers past experience.

The methodology of AESA is as under:-

A. Field Observations:-

- a) Enter the field at least 5 ft. away from the bund. Select a site with a dimension of 1 sq. mt. randomly.
- b) Record the visual observation in following sequence :-
 - i) Flying insects (both insect pests & defenders)
 - ii) Close observation on pests and defenders which remain on the plants .
 - iii) Observe pests like stem borer, BPH etc. and defenders like *Coccinellid*, *Chrysopa*, ground beetle/ rove beetle and earwigs etc. by scrapping the soil surface around the plants.
 - iv) Record disease, its intensity and percentage.
 - v) Record insect damage and disease incidence in percentage.
- c) Record parameters like number of leaves, plant height and reproductive parts of the selected plants for making observation in the following weeks. Observe nematode damage symptoms.
- 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) Record the climatic factors viz. sunny, partially sunny, cloudy, rainy etc. for the preceding week.

B. Drawing:-

First draw the plant 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 alongwith 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 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 post management practices.

D. Strategy for decision making :

Some of the defenders like spiders, lady beetles, groundnut beetles, rove beetles, wasps play useful role in arriving at P:D ratio.

E. AESA BY EXTENSION FUNCTIONARIES:

The extension functionaries during their regular visit to the village mobilise the farmers, conduct AESA and critically analyse the various factors such as the pest population vis-a-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 need formulations/ 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

F. AESA BY FARMERS:

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

RESISTANT/TOLERANT VARIETIES**A. VARIETIES RESISTANT/TOLERANT TO VARIOUS INSECT PESTS AND DISEASES****i) Insect Pests:**

Stem borer: Ratna, Sasyasree, Vikas, HKR 46, NDGR 21, Pantdhan 6, VLK 39, Prahlad, Birsadhan 201, Bhudeb Ainesh, Matangini, Radha, Sudha, Amulya, Bhagirathi, Jogan, Mandira, Nalini, Sabita, VL 16, VL 206.

Gall midge: Bhadrakali, Pavitra, Panchami, Triguna, Indursamba, Shiva, Vasundhara, Mahamaya, Ratnagiri 3, Erra Mallelu, Kavya, Oragallu, Sneha, Bhuban, Shaktiman, Abhaya, Divya, Ruchi, Vibhava, Kshira, Lalat, MDU 3, Pothana, Suraksha, Tara, Rashmi, Karna, Mahavir, Neela, Rajendradhan 202, Sarsa, Udaya, Pratap, Daya, Dhanya Lakshmi, Kunti, IR 36, Asha, Samalei, Samariddhi, Pusa, Surekha, Phalguna, Vikram, Shakti, Jyoti, Kakatiya, Kanchan, Birsadhan 202.

Brown planthopper: Vijetha, Chaitanay, Krishnaveni, Pratibha, Vajram, Makom, Pavizham, Mansarovar, CO 42, Jyoti, Chandana, Nagarjuna, Sonasali, Rasmi, Neela, Annanga, Daya, Bhadra, Karthika, Aruna, Remya, Kanakam, Bharathidasan, Remya, Triguna, IET 8116, Rajendra Mahsuri-1, Pant dhan 11, Rajshree, Bhudeb, Hanseshwari.

Whitebacked planthopper: HKR 120, HKR 126, HKR 228, PR 108, Menher, Pant dhan 10, Pant dhan 11, Mahananda, Hanseshwari.

Green leaf hopper: Vikramarya, Nidhi, IR 24, Radha, Mahananda, Kunti.

ii) Diseases:

Blast: Rasi, Vikas, Krishna Hamsa, Tulasi, IR 64, Aditya, Swarnadhan, Himalaya 1, Himalaya 2, Himalaya 2216, Pant dhan 10, HKR 228, PNR 519.

BLB: Ajaya, IR 36, IR 64, Swarna, Bhumbleshwari, PR 111, PR 113, PR 114, PR 115, PR 116, PR 118, Rajendra Basmati, Pant dhan 11, Govind, Radha, Kamini, Pant dhan 10, Jayshree, Kanchan.

RTD: Vikramarya, Nidhi, Amulya, Dinesh, Lakshmi, Nalini.

Sheath blight: PR 108, Bhudeb Dinesh, Jogan, Mandira, Nalini, Neeraj, Sabita.

B. VARIETIES WITH RESISTANCE TO MORE THAN ONE PEST OR DISEASE

S.No.	Variety	Released in	Resistant to
1.	Udaya	Orissa	BPH, GM, GLH, RTD, RKN
2.	Suraksha	Andhra Pradesh, Orissa, West Bengal	GM, BPH, WBPH, BL
3.	Vikramarya	Andhra Pradesh	GM, GLH, RTD
4.	Shaktiman	Orissa, West Bengal	GM, BPH, WBPH, BL
5.	Rasmi	Kerala	GM, BPH, BL
6.	Daya	Orissa	GM, BPH, GLH, BLB
7.	Samalei	Orissa, MP	GM, BPH, GLH, BL
8.	Bhuban	Orissa	GM, BLB
9.	Kunti	West Bengal	GM, BL
10.	Lalat	Orissa	GM, BPH, GLH, BL
11.	Sneha	Orissa	GB, RTD

Abbreviations:

GM- Gall midge, BPH-Brown planthopper, WBPH- White backed planthopper

GLH-Green leafhopper, BL- Blast, RTD- Rice Tungro Disease,

RKN- Root-knot nematode, GB-Gundhi bug, BLB-Bacterial leaf blight.

A. Insect pests:**Nursery****Gall midge/Stem borer, Thrips :**

Apply carbofuran granules @ 1 kg a.i./ha or spray monocrotophos or carbaryl @ 0.5 kg a.i./ha.

Gall midge Endemic Areas:

Adopt seedling root dip technique after pulling nursery for planting.

Procedure for seedling root dip: A smooth area of 10 X 1 m can be bunded strongly on all sides. A polythene sheet of 10.5 X 1.5 m is spread over the area touching the soil surface and extended along the bunds upto a height of 10-15 cm. Let in water to a depth of about 2 cm and add 200 ml of chlorpyrifos 20 EC and mix thoroughly. Uprooted rice seedlings required to plant one acre are closely arranged within the polythene lined area immersing roots in chlorpyrifos solution (0.02%). All these operations are done towards evening and seedling are allowed to remain in the insecticide solution overnight (for 12 hours) and are transplanted next day morning.

In case of time shortage – add one percent urea to insecticide emulsion in bunded area and mix thoroughly. Dip roots in this solution for 3 hours and plant. As an alternative to seedling root dip, apply carbofuran granules @ 1.5 kg a.i./ha of nursery area 5 days before pulling seedling for transplanting.

Planting to Pre-tillering**Leaf folder**

Spray monocrotopho, chlorpyrifos, quinalphos, fenthion, phosphamidon, cartap or phosalone @ 0.5 kg a.i./ha or apply cartap granules @ 1.00 kg a.i./ha.

Stem borer

Apply carbofuran 1.0 kg a.i./ha, quinalphos or cartap granules @ 1.0 kg a.i./ha.

Green leafhopper

Spray monocrotophos, carbaryl, phosalone, phosphamidon @ 0.5 kg a.i./ha or imidacloprid @ 25 g a.i./ha or ethofenprox @ 75 g a.i./ha or apply carbofuran @ 0.75 kg a.i./ha.

Whitebacked planthopper, Brown planthopper

Spray quinalphos, fenthion, chlorpyrifos, carbaryl or monocrotophos @ 0.5 kg a.i./ha, imidacloprid @ 25 g a.i./ha or ethofenprox @ 75 g a.i./ha.

Whorl maggot

Apply carbofuran or fenthion granules @ 1.0 kg a.i./ha.

Gall midge

Apply carbofuran, quinalphos or fenthion granules @ 1 kg a.i./ha.

Hispa

Spray phosalone, chlorpyrifos, quinalphos, monocrotophos or fenthion @ 0.5 kg a.i./ha or apply carbofuran granules @ 1.0 kg a.i./ha.

Mid-tillering

Stem borer : As recommended earlier.

Gall midge: Apply carbofuran, quinalphos or fenthion granules @ 1 kg a.i./ha.

Mite: Spray endosulfan or Anthio or Kelthane @ 0.5 kg a.i./ha.

Hispa: As recommended earlier.

Brown planthopper: As recommended earlier.

Whitebacked planthopper: As recommended earlier.

Case worm : Spray endosulfan or monocrotophos @ 0.5 kg a.i./ha.

Green leafhopper: As recommended earlier.

Leaf folder: As recommended earlier.

Panicle initiation to booting:

Stem borer : Spray quinalphos, phosalone, monocrotophos, chlorpyrifos or endosulfan or cartap @ 0.5 kg a.i./ha. Repeat 7 to 10 days after or apply carbofuran or cartap hydrochloride granules @ 1.0 a.i./ha.

Leaf folder: As recommended earlier.

Green leafhopper: As recommended earlier.

Mite : As recommended earlier.

Brown planthopper/Whitebacked planthopper: As recommended earlier.

Flowering and after

Stem borer : Spray as recommended earlier, but during afternoon hours.

Brown planthopper/Whitebacked planthopper:

Preferably spray as suggested earlier or dust Folidol or carbaryl or Ekalux 25 to 30 kg of dust/ha (repeat application if hopper population persists beyond a week after application)

Note: For the control of planthopper, while spraying, nozzle should be directed at the basal portion of the plant. Application should be done during evening hours. Application with power sprayer is preferable.

Cut worm: Spray thoroughly with chlorpyrifos, dichlorvos, endosulfan or monocrotophos @ 0.5 kg a.i./ha during afternoon hours.

Gundhi bug: Dust folidol or malathion @ 20 kg/ha.
(Caution: Do not use synthetic pyrethroids as these cause resurgence of planthoppers.)

B. Diseases:

Blast

Spray carbendazim, ediphenphos @ 0.1% or isoprothiolane or iprobenphos @ 0.15% or Kasugamycin @ 0.2% or tricyclozole @ 0.06%.

Tungro

Apply carbofuran granules @ 1 kg a.i./ha to control vector population. Remove and destroy infected seedling before transplanting.

Foot rot

Seed dress with captafol 75 WP @ 4 g/kg seed or mancozeb 75 WP @ 2.75 g/kg seed. When observed in nursery, spray carbendazim 50 WP @ 0.1%.

Pre-tillering to mid-tillering

Blast

Spray ediphenphos @ 0.1% or isoprothiolane or iprobenphos @ 0.15% or Kasugamycin @ 0.2% or tricyclozole @ 0.06%. Delay topdressing of N fertilizers when infection is seen.

Bacterial leaf blight

Reduce nitrogen application and apply if needed only small dose of N in more split doses.

Sheath blight

Apply validamycin 3 L @ 2ml/L, hexaconazole or iprobenphos @ 0.2% or propiconazole @ 0.1%. Reduce or delay top dressing of nitrogen fertilizers and apply in 2 or 3 split doses.

Tungro

Remove and destroy infected plants and apply additional nitrogen for early recovery. Apply carbofuran granules @ 1 kg a.i./ha, or spray monocrotophos @ 0.5 kg a.i./ha to control insect vector.

Panicle intitiatioonto booting

Blast

Spray ediphenphos @ 0.1% or isoprothiolane or iprobenphos @ 0.15% or Kasugamycin @ 0.2% or tricyclozole @ 0.06%. Apply nitrogen in small dose, if needed.

Bacterial leaf blight

Skip top dressing of nitrogen fertilizer.

Sheath blight

Apply validamycin 3L @ 2 ml/L, hexaconazole or iprobenphos @ 0.2% or propiconazole @ 0.1%. Reduce or delay top dressing of nitrogen fertilizer and apply in 2 or 3 split doses.

Stem rot

Drain fields, spray Iprobenphos 48 EC @ 2 ml/L or carbendazim 50 WP or thiophanate-methyl @ 0.1% and addition of organic manure reduce disease incidence.

Flowering and after**Blast**

Spray ediphenphos @ 0.1% or isoprothiolane or iprobenphos @ 0.15% or Kasugamycin @ 0.2% or tricyclozole @ 0.06%.

Sheat rot, Bron spot or Panicle discolouration

Apply mancozeb @ 0.25% or carbendazim 50 WP @ 0.1% during early morning or afternoon hours (spraying is to be avoided during the period of flowering).

Sheath blight

Apply validamycin 3L @ 2 ml/L, hexaconazole or iprobenphos @ 0.2% or propiconazole @ 0.1%. Reduce or delay top dressing of nitrogen fertilizers and apply in 2 or 3 split doses.

False smut

Apply chlorothalonil or propiconazole @ 2 ml/L around flowering.

Glume discolouration (in Hybrid seed production)

Apply any one fungicide: propiconazole 25 EC @ 1.0 ml/L or carbendazim 50 WP @ 1.0 g/L or hexaconazole 5 EC @ 2 ml/L or carbendazime-mancozeb 75 WP @ 1.5 g/L.

C. Weeds:

1. Apply cyhalo-up-butyl @ 75-80 g a.i./ha @ 18-20 days after sowing in grassy weeds in direct seeded rice followed by one hand weeding given after 4-6 weeks.
2. Apply Butachlor @ 1.25-2.0 kg a.i./ha or Thiobencarb @ 1.5 kg a.i./ha or Pretilachlor @ 0.5-0.75 kg a.i./ha or Oxadiargyl @ 100 g a.i./ha or Chlorimuron ethyl @ 6 g a.i./ha or Metsulfuran methyl @ 4 g a.i./ha or Anilophos @ 0.4-0.5 kg a.i./ha or Ethoxysulfuron @ 12.5-15.0 g a.i./ha or Cinmethalin @ 75-100 g a.i./ha as pre-emergence within 4-6 days after transplanting.
3. Apply Metsulfuron methyl + Chlorifuran methyl @ 4-6 g a.i./ha or Anilophos + 2,4-D @ 300-480 g a.i./ha at 3-10 days after transplanting.

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.
Avoid carrying bulk - pesticides (dusts / granules) on head, shoulders or on the back.

D. Precautions for Preparing Spray Solution :

1. Use clean water.
2. Always protect your NOSE, EYES, MOUTH, EARS and HANDS.
3. Use hand gloves, face mask and cover your head with cap.

4. Use polyethylene bags as hand gloves, handkerchiefs or piece of clean cloth as mask and a cap or towel to cover the head (Do not use polyethylene bag contaminated with pesticides).
5. Read the label on the container before preparing spray solution.
6. Prepare spray solution as per requirement.
7. Do not mix granules with water.
8. Concentrated pesticides must not fall on hands etc. while opening sealed containers. Do not smell the sprayer tank.
9. Avoid spilling of pesticide solution while filling the sprayer tank.
10. Do not eat, drink, smoke or chew while preparing solution.
11. The operator should protect his bare feet and hands with polyethylene bags.

E. **Equipment:**

1. Select right kind of equipment.
2. Do not use leaky, defective equipment.
3. Select right kind of nozzle.
4. Don't blow/clean clogged- nozzle with mouth. Use old tooth- brush tied with the sprayer and clean with water.
5. Do not use same sprayer for weedicide and insecticide.

F. **Precautions for applying pesticides:**

1. Apply only at recommended dose and dilution.
2. Do not apply on hot sunny day or strong windy condition.
3. Do not apply just before the rains and also after the rains.
4. Do not apply against the wind direction.
5. Emulsifiable concentrate formulations should not be used for spraying with battery operated ULV sprayer.
6. Wash the sprayer and bucket etc with soap water after spraying.
7. Containers, buckets etc. used for mixing pesticides should not be used for domestic purposes.

8. Avoid entry of animals and workers in the fields immediately after the spraying.

G. **Disposal:**

1. Left over spray solution should not be drained in ponds or water lines etc. Throw it in barren isolated area, if possible.
2. The used/ empty containers should be crushed with a stone / stick and buried deep into soil away from water source.
3. Never re-use empty pesticide container for any purpose.

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