

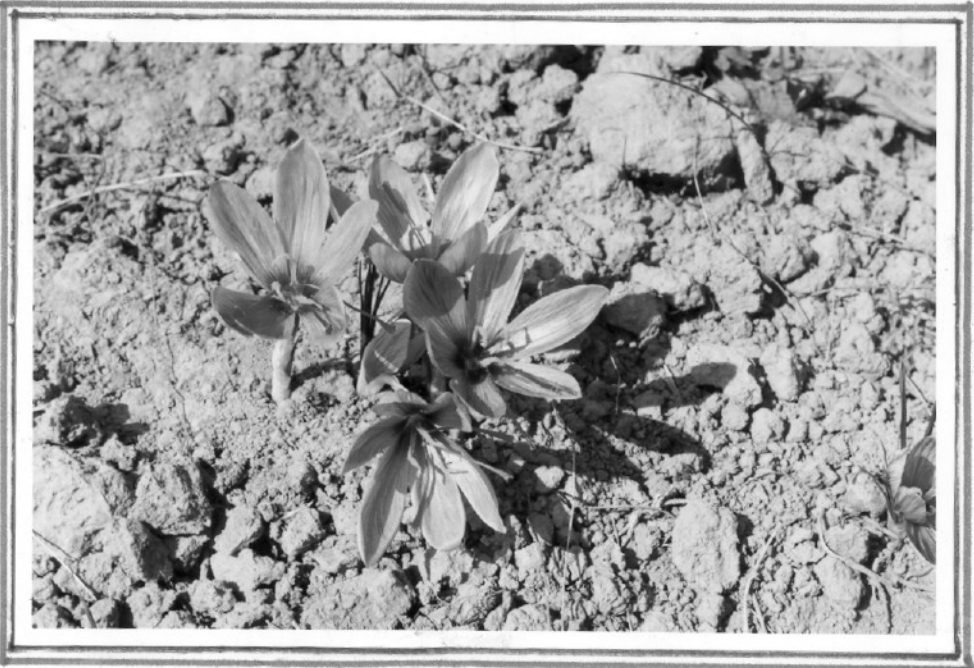


IPM PACKAGE NO. 77



INTEGRATED PEST MANAGEMENT PACKAGE

FOR
SAFFRON



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

IPM PACKAGE FOR SAFFRON

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Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation

DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE
N. H. IV, FARIDABAD - 121 001 (HARYANA)

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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 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, 2002 and 2003 to update and develop IPM Package of Practices for agricultural and horticultural crops. Presently, IPM Package of Practices for 77 crops have been finalized to help the extension workers and farmers to manage the pests and diseases and to minimize 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/Horticulture. 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.


(P. S. CHANDURKAR)
14/8/03

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 14-17, 2001 and Feb. 20-22, 2002 respectively to update 20 available IPM Packages and develop 31 new IPM Packages especially for horticultural crops. Sixth and Seventh National Workshop 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, Pea, 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.

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 (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 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.

7th October, 2003



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IPM PACKAGE FOR SAFFRON

PESTS OF NATIONAL SIGNIFICANCE

I. Major Pests:

1. **Insect Pests :**

1.2 Thrips (Thrips sp.)

1.2 Mite (*Rhizoglyphus sp*)

2. **Diseases :**

2.1 Dry rot (*Fusarium moniliforme var. intermedium*)

2.2 Bulb rot (*Sclerotium spp.*)

(*Septoria gladioli*)

2.3 Root rot (*Sporotrichum narcissi*)

2.4 Bacterial rot (*Bccillus sp*)

3. **Nematodes :**

3.1 Spiral nematode (*Helicotylenchus sp.*)

3.2 Stunt nematode (*Tylenchorhynchus sp.*)

3.3 Root-lesion nematode (*Pratylenchus sp.*)

3.4 Pin nematode (*Xiphinema sp.*)

4. **Weeds :**

4.1 Batak nuer (*Trifolium sp.*)

4.2 Cruss (*Centurea iberica*)

4.3 Tro per (*Marrolium vulgaris*)

4.4 Vish-ki-gassi (*Bromus mollis*)

4.5 Gur doadh (*Euphorbia sp.*)

4.6 Gur gassi (*Poa sp.*)

4.7 Dudh kunditch (*Lactuca turriria*)

5. **Rodents :**

5.1 Soft furred field rat (*Rattus meltada*)

5.2 Indian mole rat/smaller bandicoot (*Bandicota bengalensis*)

5.3 Common house rat (*Rattus rattus.*)

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 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 survey is to monitor the initial development of pest and disease in the endemic areas. Therefore, in the beginning of the crop season, survey routes based upon the endemic areas as indicated during digging for replanting are required to be identified to undertake roving survey from August / September. Based upon the results of roving survey, the state extension functionaries have to concentrate for greater efforts at Block and Village levels as well as through farmers to initiate field scouting for the presence of pest infestation. Therefore, for field scouting, farmers should be mobilized to observe the pest/disease occurrence at the intervals as stipulated under different hoeing operations and during its active growth period i.e. from October to

November. The plant protection measures may be taken according to the decision taken by the participants.

1. **Roving Survey** :

Undertake roving survey after every 2 field depending upon the plantation stretch both in linear and deep horizontal magnitudes, initially at 15 days interval and thereafter at weekly intervals from the active growth period. During flowering stage it should be done on daily basis depending again on pest population. Observe 10m² as sample areas at random in zig zag fashion for recording the intensity/population of the pests from active growth stages to harvesting. Record population of different potential biocontrol fauna also to arrive at a decision making stage. Record the major diseases and their incidence along with deficiency related diseases if any exhibited by the crop during the course of development.

2. **Field Scouting** :

Field scouting for pests and biocontrol fauna/flora by extension agencies and farmers once in a week should be undertaken to assess increasing/decreasing trend in the pest incidence and availability of bio-control potential. This should be done soon after the resumption of growth i.e. from late September or early October. When the pest get activated on appearance of new flush, the state department of agriculture should make all possible efforts by using different media, mode and publicity to inform the farmers for field scouting in the specific cropped area.

3. **Pest Monitoring through Traps** :

3.1 **Through light traps** : Most of the moths of defoliators and a few beetles get attracted towards light during 6-9 PM daily. Therefore, installation of light traps in the field helps in monitoring of initial build-up of pest population if any.

C. Agronomical Practices for Successful cultivation of Saffron

- Sub temperate climate with altitude varying from 1500m to 2250 m.a.s.l. suitable for the cultivation of the crop may be preferred.
- Localities receiving an annual rainfall of 30-40cms and remaining covered with snow during winter are suitable for the cultivation of crop.
- Soil should be well drained and loamy with neutral to slightly alkaline reaction.
- Sloppy lands should be preferred for cultivation of saffron.
- Damp soils should be avoided for cultivation.
- Inter cropping with almonds in juvenile stage can be done profitably.

III. INTEGRATED PEST MANAGEMENT STRATEGIES

A. Cultural and Mechanical Practices :

- Thorough land preparation be made by repeated ploughing 4-5 times to a depth of 30-55cm during March/April and another ploughing be done during the month of May.
- Incorporate 15 – 20 tonnes of FYM/ha during land preparation.
- Make use of balanced chemical fertilizers (40kg N, 50kg P and 30kg of K) and avoid excessive use. Apply nitrogen in equal split doses one at land preparation while 2nd at first hoeing.
- Lengthwise furrows should be prepared and corms should be planted in furrows at 15-22cm depth with spacing of 8-10cms (corm to corm) and 20cm between rows.
- Proper selection of corms free from any infestation should be selected.
- For planting of corms, the size of 2.0cms – 5.0cms in diameter be preferred for cultivation.
- At the time of transplanting of corms the soils should not be too moist.
- Before planting, the fibrous hairs of corms should be removed.
- Hoeing should be shallow and be done by expert labours only with proper recommended implements.
- Weeding of furrows/beds should be done.

- Avoid contact of flowers with the soil by early picking.
- Reduce the planting cycle to 3-4 years to avoid pest infestation.

B. Biological Practices :

- Before laying or planting of corms in the field make use of *Trichoderma viride* & *Trichoderma harzianum* along with FYM to control soil born diseases in the ration of 1:25/acre.
- Make use of neem cakes also before planting of corms to save then from any soil pest at the rate of 50 kg/ha.
- Conservation of predators, like Green Lace Wings, Lady Bird Beetles, Spiders, Anthrocorids etc. should be encouraged.

C. Chemical Practices :

- Corm treatment with Carbendazim @ 1 gm/litre of water against various rot diseases is desirable.

D. Weed Management :

- 6-8 ploughing or spade digging suppresses the initial weed population in the first year.
- In the second year, field preparation is done by hand digging and careful remodelling of bed which takes care of many annual weeds.
- Hoeing just before flowering to the depth of 5-7.5 cm in the third years and subsequent 3 hoeing and hand weeding in the beginning of August provide substantive degree of weed control and good saffron yield.

E. Rodent Management :

- Adopt field sanitation.
- Don't cultivate fodder crops especially oats in the near by fields.
- Make use of Bromodiolon concentrate in bait @ 0.005% a.i. in 2 applications at the interval of 1 week.
- Adoption of community approach may be taken.
- Smoking of rat burrows in fields on community basis.

IV. STAGewise INTEGRATED PEST MANAGEMENT PRACTICES

- Regular Monitoring / Surveillance for the presence of live rodent burrows, weeds, nematodes, insect pests and diseases be conducted.
- Before planting thorough deep ploughing, adequate FYM and use of balanced dose of chemical fertilizers be done.
- Before planting, seed/corms may be treated with *Trichoderma viride*/*T.harzianum* @ 10^8 cfu per ml of solution or be coated with slurry of these biopesticides.
- Application of 15-20 tonnes of well rotten farmyard manure mixed with *Trichoderma viride* or *T. harzianum* per ha. would enhance nematode trapping and reduction of disease inoculum.
- Short cropping cycles of 4-5 years followed by fallow at least for one season would reduce nematode population and also help in reducing the multiplication of disease inoculum.
- Soil solarization may be undertaken to reduce the population of nematodes, arthropods and disease inoculum.
- Application of chopped leaves and stems of weeds would reduce nematode population and improves organic matter contents.
- Growing of marigold an peripheries during kharif reduce nematode population and helps in conservation and augmentation of biogents.
- Corm treatment with nematicide like Phorate or Carbofuran @ 1-2 kg a.i./ha. helps in reduction of nematode infection.

- For the management of blossom thrips the flowers should be picked up daily or at alternate days which will reduce the chances of damage to stigma and style.
- Remove / dug out the diseased and bruised corms to check the corm rot infestation.
- In case of corm rot infestation drench the infested beds with Mancozeb 75WP (0.3%).

V. DO'S & DON'TS

Do's	Don't's
1. Select soils of neutral to slightly alkaline reactions.	Too alkaline or acidic soils should be avoided for the cultivation of crop.
2. Soils should be well drained.	Water lodged/damp soils should be avoided.
3. Corms that have attained size of 2.0cms in diameter must be preferred for cultivation.	Too smaller or too bulbous corms should be avoided for planting.
4. Select healthy and disease free corms for cultivation.	Corm with disease symptoms, bruises or other damages should be avoided for cultivation.
5. Remove outermost fibrous covering of corms before planting.	Don't plant corms with fibrous coverings.
6. Plant 40 quintels of healthy corms/ha.	Don't plant more than recommended quantity per ha.
7. Fields should be ploughed 4-5 times to a depth of 30-55cms during March/April and another ploughing during the month of May and then leveled.	Don't make any cut short in the ploughing schedule while preparing the land.
8. Lengthwise furrows should be prepared and corms should be planted	Don't plant the corms too near or too far in the field.

<p>in furrows at 15-22cms depth with spacing of 8-10 (corm to corm) and 20.0cms between rows.</p> <p>9. Close the furrows after planting of corms and fields should be leveled.</p> <p>10. Maintain proper drainage channels around the beds.</p> <p>11. Critical irrigation particularly in the month of September be arranged incase rains fail to occur.</p> <p>12. Corms should be dug out from the fields after every 4 years of planting and fields should be left fallow for 1-2 years and the cycle is repeated.</p> <p>13. Plant / sow legumes as intercrop before mid November in the inter drainage channels of saffron fields to improve soil fertility.</p> <p>14. Bring the dug out / fallow fields under rabi pulse crops like a) saffron – fallow – lentil – wheat. b) saffron – peas – lentil.</p> <p>15. Flowers should be picked on alternate days in wee hours and stigmas along with styles should be trimmed immediately.</p> <p>16. Proper grading and procedures should be adopted for higher market value and to compete in international market.</p>	<p>Don't leave the corms exposed in any case.</p> <p>Don't allow the water to stagnate near or around the beds.</p> <p>Don't keep the corms beyond 4 years in the soil.</p> <p>Don't grow forage crops like oats in or around saffron fields.</p> <p>Don't bruise unopened buds during plucking operations.</p> <p>Don't allow the flowers to remain for long period in the field.</p> <p>Don't let saffron sweating.</p>
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The methodology of Agro Eco System Analysis (AESA) is an under :

A. Field observations :

- a) Enter the field at least 15-20 feet away from road/bund. Select 1 square meter area for observation at different spots.
- b) Record the visual observations on the following parameters :
 - i) Flying insects (both pests & defenders).
 - ii) Close observation on pests and defenders which remain on the plant.
 - iii) Observe the pests like aphids, thrips & defoliators and defenders like LBB, green lace wings, spiders, predatory ants, anthocorids and syrphids etc.
 - iv) Record various diseases and their intensities.
 - v) Record insect damage in percentage or otherwise in case of non uniform pests like sucking pests.
- c) The No. of selected 1m² area for sampling would depend largely on the size of the field. The selected area for sampling should be the representative of the entire field in size and location. The predator population is surveyed on the sampling areas along with the pest population and is accomplished by slowly walking around the periphery of the area and recording the adults and larvae visually. The predators survey should be done before samples are collected / observed for determining the pest population or extent of damage. Observe live rodent burrows and weeds also but in a bigger area like 0.5 acre to have an average estimate of the field on these pests. At suspected locations beds should be dug out to know the health of the corms.
- d) Record soil conditions viz dry, wet or water lodged.

- e) Repeat the above steps from (b) to (d) on at least 10sqm sites in a diagonal row or criss cross fashion across the field to have overall average assessment of the field.
- g) Record the climatic factors size, sunny partially sunny, cloudy, rainy etc. for the proceeding week.

B. **Drawing :**

First draw the plant with actual no. of shoots in the centre of the chart. Draw pests on left side and defender on the right side. Indicate the soil condition, Rodent damage, etc. Give natural colours to all the drawings, 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 the pest and defenders and their population count should also be given alongwith diagram. The weather factor should be reflected in the chart by drawing the diagram of sun just above the plant, if it 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 participants by raising questions relating to change in pest and defender population in relation to crop stages, soil conditions, weather factors, such as rainy cloudy or sunny etc. The group may evolve a strategy based upon weekly AESA, Economic Threshold Level (ETL) and corresponding change in P:D (Pest and Defender) ratio and take decision for pest management.

D. **Strategy for Decision Making :**

- i) The group members may closely observe the representative sampling area for the prominent / characteristic symptoms of various diseases and extent of damage prevailing weather conditions and may suggest for removal of infested corms or drenching with recommend fungicide or antagonistic fungi accordingly.
- ii) When number of active / live rat burrows are observed above 25 live burrows/ha, the group may adopt for community rodent management.
- iii) When there is thin or sparse new vegetative growth, the group may advocate for digging of field for observation of corms for infestation of corm rot or rodent damage and when intensity of disease is found more than 5% group may decide for the replacement of disease corms by new healthy ones after treatment.
- iv) When there is stagnation of water or persistent moisture in the field the group may advocate for proper drainage in the field.

AESA BY EXTENSION FUNCTIONARIES :

The extension functionaries during the regular visit to the village, mobilize the farmers to conduct AESA and take the decision to adopt IPM practices accordingly.

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

BASIC PRECAUTIONS IN PESTICIDE USAGE

A. Purchase:

1. Purchase only JUST required quantity e.g. 100,250,500 or 1000 g/ml for single application in specified area.
2. Do not purchase leaking containers, loose, unsealed or torn bags.
3. Do not purchase pesticides without proper/ approved LABELS.

B. Storage:

1. Avoid storage of pesticides in the house premises.
2. Keep only in original container with intact seal.
3. Do not transfer pesticides to other container.
4. Never keep them together with food or feed/ fodder.
5. Keep away from the reach of children and livestock.
6. Do not expose to sun-light or rain water.
7. Do not store weedicides along with other pesticides.

C. Handling:

1. Never carry/ transport pesticides along with food materials.
2. Avoid carrying bulk - pesticides (dusts / granules) on head, shoulders or on the back.

D. Precautions for Preparing Spray Solution :

1. Use clean water.
2. Always protect your NOSE, EYES, MOUTH, EARS and HANDS.
3. Use hand gloves, face mask and cover your head with cap.
4. Use polyethylene bags as hand gloves, handkerchiefs or piece of clean cloth as mask and a cap or towel to cover the head (Do not use 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 burried deep into soil away from water source.
3. Never re-use empty pesticide container for any purpose.