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IPM PACKAGE NO. 6



# **INTEGRATED PEST MANAGEMENT PACKAGE FOR PIGEONPEA**



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

May, 2001

# IPM PACKAGE FOR PIGEONPEA

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

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**FOR E W A R D**

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

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

April 1, 2002

  
(V. Raguathan)

## P R E F A C E


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

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

IPM technology manages the pest population in such a manner that economic loss is avoided and adverse side effects of chemical pesticides are minimized. The IPM packages encompasses various management strategies for containing the pest and disease problems. Pest monitoring is also one of the important component of IPM to take proper decision to manage any pest problem. It can be done through Agro-Ecosystem Analysis (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 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.

  
(A.D. Pawar)  
Director (IPM)

April 1, 2002

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# IPM PACKAGE FOR PIGEONPEA

## I. MAJOR PESTS

### A. Pests of National Significance

#### 1. Insect Pests

- 1.1 Pod borer (*Helicoverpa armigera*)
- 1.2 Podfly (*Melanogromyza obtusa*)
- 1.3 Leaf webber (*Eucosma critica*)
- 1.4 Spotted podborer (*Maruca testulalis*)
- 1.5 Plume moth (*Exelastis atomosa*)

#### 2. Diseases

- 2.1 Wilt (*Fusarium udum*)
- 2.2 Sterility Mosaic Virus
- 2.3 Stem blight (*Phytophthora drachsleri* var. *cajani*)

#### 3. Weeds

- 3.1 *Cyperus rotundus*
- 3.2 *Digitaria sanguinalis*
- 3.3 *Setaria glauca*
- 3.4 *Cleome viscosa*
- 3.5 *Tridax procumbens*
- 3.6 *Cynodon dactylon*
- 3.7 *Dactyloctenium aegyptium*
- 3.8 *Trianthema monogyna*
- 3.9 *Tribulus terrestris*

#### 4. Nematodes

- 4.1 Cyst nematode (*Heterodera cajani*)
- 4.2 Root knot nematode (*Meloidogyne spp*)
- 4.3 Reniform nematode (*Rotylenchulus reniformis*)

## B. Pest Of Regional Significance

### 1. Insect pests

- 1.1 Hairy caterpillar (*Spilosoma obliqua*) (U.P., Bihar, Haryana)
- 1.2 Red Hairy caterpillar (*Amsacta moori*) (Rajasthan)
- 1.3 Blister beetle (*Mylabris spp*) (TN, UP)
- 1.4 White bug (*Clavigralla gibbosa*) (U.P., Haryana, M.P.)
- 1.5 Grey Weevil (*Myllocerus sp*)
- 1.6 Cowbugs (AP, TN, Karnataka)

### 2. Diseases

- 2.1 Yellow Mosaic (Tamil Nadu, Uttar Pradesh)
- 2.2 Root rot- *Macrophomina* (Tamil Nadu)

### 3. Nematodes

- 3.1 *Hoplolaimus beinhorsti* (Karnataka, Maharashtra, A.P.)

## II. PEST MONITERING

The objective of surveys is to monitor the initial development of pests and diseases in endemic areas. 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. Farmers should be mobilised to observe the pest and disease occurrence by field scouting at the intervals as stipulated here under. The plant protection measures are required to be taken only when pests and diseases cross ETL as per results of field scouting.

1. **Rapid roving survey:-** Undertake roving survey at every 10 km distance initially at weekly intervals and thereafter at 10 days intervals (depending upon pest population). Record incidence of pod borer on all host crops of the locality. Observe at each spot 20 plants at random and record population potential of different biocontrol fauna. Record the major diseases and their intensity.
2. **Field scouting:-** Field scouting for pests and bio control fauna by extension agencies and farmers once in 7 days should be undertaken to workout ETL.



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

### 3. 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 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 condition
5. Climatic factors
6. Farmers past experience.

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

### 4. Pest Monitoring through Pheromone:

Certain pests require positioning of various kinds of traps like pheromones, to monitor the initial pest build up. Therefore, the State Department of Agriculture is to initiate action for positioning of different kinds of traps based upon the results of roving surveys at the strategic locations at village level. While the concept needs to be popularised amongst farming community, the State Department of Agriculture is to take greater initiatives for pest monitoring through specific, pheromone trapping methods. Install pheromone traps at a distance of 50 mtr @ five traps per ha. Use *Helicoverpa* lure and change it after every 20 days. Trapped moths should be removed daily. The details of monitoring are as follows:

Crop stage	Observation	Sample	Frequency	Actions suggested
Early & late vegetative stage	Wilt & blight visual observation	2 sqm or 2m row number of plants & damaged plants at 5 locations in field	Fortnightly	Wilt & blight If the incidence is above 20%, the field may be considered as sick and growing pigeonpea maybe discouraged in affected field.



				In the case the disease incidence is less than 20%, care should be taken in the following season, to treat seed with recommended measures. Use resistant varieties, intercropped with sorghum.
Flowering stage	<b>Sterility Mosaic</b> number of affected plants per 10 plants	2 sqm or 2m row number of plants & damaged plants at 5 locations in field	Weekly	If the sterility mosaic is noticed rouging of affected plants is to be done. Only resistant varieties should be grown in the following season.
	<b>Insect pests</b> Number of larvae/plant	-do-	-do-	Action to be initiated at ETL
Pod formation	<b>Borer pests</b> As in Flowering stage	-do-	-do-	Action to be initiated at ETL  For <i>Helicoverpa</i> catch of 5 moths per trap per night should be taken an indication for the need of close monitoring for <i>Helicoverpa</i> egg/larvae by field scouting to as certain ETL.
	<b>Podfly</b> 5 pods to be observed at 5 places	-do-	-do-	Action to be initiated at ETL.

#### 5. Pest monitoring through light trap:

Two hours light exposure upto 8-8.30 p.m. for pest monitoring through light trap should be undertaken in the field if possible.

### III. ECONOMIC THRESHOLD LEVEL (ETL)

Pest	ETL
1. Pod borer ( <i>H. armigera</i> )	2-3 eggs/5 twigs, 1 larva at flowering stage (North zone), 1 larvae/2 plants or 5-10 pod damage (South Zone)
2. Spotted podborer ( <i>Maruca testulalis</i> )	5 larvae/ 10 plants
3. Plume moth ( <i>Exolastis atomosa</i> )	5 larvae / 10 plants (South zone)
4. Pod fly ( <i>Melanogromyza obtusa</i> )	5% oviposition / larvae on grain

### VI. MANAGEMENT OF HELICOVERPA RESISTANT STRAINS

For the last few years, incidence of insecticide resistance in *Helicoverpa* have been reported on important crops like cotton and pigeonpea in some parts of the country. Extension functionaries should get in touch with the experts of respective State Agricultural Universities for mapping such areas. Wherever the scientific input is available about occurrence of insecticide resistance in *Helicoverpa*, the areas should be very clearly demarcated. During the course of surveys and also is advising farmers about *Helicoverpa* management strategies, utmost care need to be taken “NOT TO ADVOCATE” the pesticide for which resistance has been reported in specific areas. Most of the cases of such resistance have been recorded from Andhra Pradesh and Tamil Nadu against synthetic pyrethroids.

### V. INTEGRATED PEST MANAGEMENT STRATEGIES:

#### 1 Cultural practices:

- 1.1 Deep ploughing in summer.
- 1.2 Apply farm yard manure or neem cake.
- 1.3 Select resistant / tolerant varieties as indicated in Annexure -II.
- 1.4 Cultivation of early maturing varieties such as Bahar and Sharad amongst late group, escapes peak activity period of *H. armigera* in NEPZ.
- 1.5 Synchronise sowing with a single variety in a village/ area

- 1.6 Intercrop with sorghum for reducing *Helicoverpa*, wilt and nematode incidence.
- 1.7 Early planting (mid- June) in NWPZ avoids peak infestation period of *H. armigera* on short duration pigeonpea.
- 1.8 Normally nematodes are not serious problem in pigeonpea. In problem soils, avoid growing any crop during the summer months. If it is inevitable, then cultivate non-leguminous crops, preferably cereal. Removal of roots of the previously harvested crop from soil is essential to check further nematode multiplication in soil. If the field is infested with many pests, solarization of soil using transparent polyethelene mulch for at least 15 days is highly effective.
- 1.9 Planting of castor or tall sorghum/maize varieties on borders conserves natural enemies and function as live perchers for predatory bird like Black drongo, Blue jey, Black Mayna.
- 1.10 To facilitate spraying operations, small/short statured crops like cowpea, moong bean, urdbean, fodder soybean etc. may be grown in 1 mtr wide band after every 8-10 rows of pigeonpea. These crops can be harvested before flowering of pigeonpea and the space created will be used for free movement of operator/machine.
- 1.11 Trap crops like marigold etc. should be grown on the border and in between rows as inter crop. After recording heavy oviposition flow may be plucked and disposed.

## 2. Mechanical practices:

- 2.1 Remove and destroy Sterility Mosaic affected plants.
- 2.2 For insect pests like blister beetle, leaf tiers, hairy caterpillars and lepidopteran larvae etc. hand picking, jarring on cloth sheets or in bags is effective in a limited way in small areas.
- 2.3 Erection of 50-70 bird perchers/ha. These should be removed after maturity/harvesting of the crop.

## 3. Biological control practices

- 3.1 Seed treatment with Trichoderma @ 4gm /kg seed.
- 3.2 Spiders, *Campeletis*, *chrysoperla*, Reduviid bugs, predatory wasps and birds play significant role in bringing down pest population. Indiscriminate use of pesticides should be avoided to conserve them and install bird percher for the benefit of predatory birds.

- 3.3 Spray NPV @ 250 LE per ha. on noticing eggs and first instar larvae of *Helicoverpa* (2-3)eggs or 1 larvae/ 5 twigs).
- 3.4 Spray Bt at 0.75-1 kg /ha.
- 3.5 NSKE 5% spray at preflowering stage 3 times at 15 days interval.

#### 4. **Chemical Control**

- 4.1 Pest infesting floral buds, pods and seeds: To control lepidopteran, dipteran and coleopteran insects infesting floral parts, pods and seeds use 0.07% endosulfan (2 ml of 35 EC / litre of water) or 0.04% monocrotophos (1 ml of 36 SL/litre of water) or chlorpyrifos 3.5 ml of 20 EC/litre water or only one spray of fenvalerate 75 g a.i. /ha. Spraying should be done @ 600-1000 litre. ha with hand sprayer or 200-300 l/ha with low volume power sprayer.
- 4.2 Indoxacarb\* @ 50 g a i/ha against *Helicoverpa* can be considered if approved.

#### 5. **Disease Management**

Resistant varieties as indicated in Annexure -II may be grown in endemic pocket for management of Sterility Mosaic, wilt and Alternaria blight.

#### 6. **Seed treatment:**

- 6.1 Wilt/ rootrot - Seed treatment with carbendazim\* + thiram\*(1 g + 2g/ kg seed)
- 6.2 Phytophthora blight - Seed treatment with Metalaxyl (Apron ) \* 6g/kg seed) + ridge planting + cover crop (soybean or cowpea in NEPZ).

#### 7. **Weed Management Practices:**

- 7.1 Follow recommended agronomic practices for land preparation, seed rate, proper fertilizer and irrigation management so as to achieve optimum plant population and healthy crop to reduce weed competition at early crop stage.
- 7.2 The crop should be maintained weed free initially for 6-8 weeks by following timely inter-culture and hand weeding.

## **8. Nematode Management Practices:**

- 8.1 Normally nematodes are not very serious problem in pigeonpea. In problem soils avoid growing any crop during summer months. If it is inevitable, then cultivate non-leguminous crops preferably cereal. Removal of roots of the previously harvested crop from soil is essential to check further nematode multiplication in soil. If the field is infested with many pests, solarization of soil using transparent polyethelene mulch for at least 15 days is highly effective.
- 8.2 For problem soils rotation of pigconpea with sorghum, millets and maize for two years may be followed. Antagonistic plants like marigold, sesame, mustard can be encouraged.

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\* Not as per approved usage under Insecticide Act 1968.

## VI. CROP STAGE-WISE I.P.M. PRACTICES:

Crop stage/pests/diseases	IPM Practice	IPM Practices to be adopted
<p>1. <b>Pre sowing</b> Pod borer, wilt, sterility Mosaic, Alternaria blight</p> <p>Nematode</p>	<p>Cultural Practices</p>	<ol style="list-style-type: none"> <li>1. Deep ploughing in summer.</li> <li>2. Apply FYM or neem cake.</li> <li>3. Synchronise sowing with a single variety in a village/area.</li> <li>4. Inter-crop with sorghum for reducing <i>Helicoverpa</i>, wilt and nematode incidence.</li> <li>5. Early planting (mid-June) in NWPZ for avoiding peak infestation period of <i>H. armigera</i> on short duration pigeonpea.</li> <li>6. Resistant/tolerant varieties as indicated in Annexure-II.</li> <li>7. Cultivating early maturing varieties such as Bahar and Sharad amongst late varieties for escaping peak activity period of <i>H. armigera</i> in NEPZ.</li> <li>8. Planting of castor or tall sorgham/maize varieties on borders for conserving natural enemies. These plants also function as live perches for predatory birds.</li> <li>9. Planting short statured crops like cowpea, mungbean, urdbean, fodder Soybean etc. in 1 mtr. wide band after 8-10 rows of pigeonpea to facilitate spraying and other operations after the harvest of these band crops before flowering of pigeonpea.</li> </ol> <ol style="list-style-type: none"> <li>1. Summer fallow and deep summer ploughing. Avoiding any crop during summer, if at all only non-leguminous i.e. any cereal crop to be grown.</li> <li>2. Solar-treatment to the soil using transparent polyethylene mulch for at least 15 days.</li> <li>3. Adopt crop rotation of pigeonpea with sorghum, millet, rice and maize for two years.</li> </ol>
<p>2. <b>Seed and Seedlings</b> Phytophthora blight, wilt</p> <p>Wilt/Root rot Or</p>	<p>Cultural practices</p> <p>Biological practice</p> <p>Chemical practice</p>	<ol style="list-style-type: none"> <li>1. Growing trap crop like marigold on the borders and in between rows as inter crop. Their flowers shall attract oviposition which can then be plucked and disposed.</li> <li>2. Ridge Planting + cover crops like soybeans or cowpea in NEPZ.</li> <li>3. Treatment of the seed with <i>Trichoderma viride</i> @ 4 grams/kg seed.</li> <li>4. Seed treatment with carbendazim* + thiram* (1 gm + 2 gm/kg seed, or carbendazim (2 gm/kg seed) or thiram (3 gm/kg seed)</li> </ol>



Phytophthora blight	Chemical practices	5. Seed treatment with metalaxyl* (Apron 6 gm/kg seed).
Nematode	Chemical practices	6. Soil treatment with carbofuran* granule @ 8 kg a.i./ha at planting or seed treatment @ 1-2% w/w
Weeds	Cultural practices	7. Follow recommended agronomic practices for land preparation, seed rate proper and balanced fertilizer and irrigation management so as to have a desirable crop stand.
3. Vegetative stage Weeds	Cultural practices	1. Inter-culture and hand weeding for keeping the crop, weed free for 6-8 weeks.
Hairy caterpillar	Mechanical practices	2. Hand picking, jarring on cloth or in bags is effective in a limited way in small areas.
All pests	Biological control	3. Conservation of predatory spiders and wasps etc. by avoiding indiscriminate use of insecticides.
		4. Installation of bird perchers for the predatory birds.
4. Pre-flowering and flowering stage Sterility Mosaic	Mechanical practices	1. Removal and destruction. Of sterility mosaic affected plants.
Blister beetles, white bug, Leaf tiers		2. Hand picking and jarring on cloth or in bags is effective in a limited way in small areas.
All pests	Biological control	3. Conservation of predatory spiders and wasps etc. by avoiding indiscriminate use of pesticides.
Pod borer, <i>H. armigera</i>		4. Installation of bird perchers for the predatory birds.
		5. Application of NPV @ 250 LE per ha. on noticing eggs and 1st instar larvae (2-3 eggs or 1 larva per 5 twigs).
		6. B.t. Spray @ 0.07-1.0 kg/ha
		7. Spray of NSKE 5% at pre-flowering stage 3 times at 15 days interval.
Lepidopterous, Dipterous, Coleopterous pests	Chemical Control	8. Spraying of 0.07% endosulfan (2ml of 35 EC/lit. of water) or 0.04% monocrotophos (1 ml of 36 SL/litre of water) or chlorpyrifos 20 EC @ 3.5 ml./lit. of water at 600-1000 lit. of spray material per ha. with hand sprayer or 200-300 lit./ha with power sprayer.
5. Pod stage (Pod borer, <i>H. armigera</i> )	Biological control	1. HANPV @ 250 LE per ha. on noticing eggs and 1st instar larvae (2-3 eggs or 1 larvae/5 twigs)
Lepidopterous, Dipterous, Coleopterous pests	Chemical control	2. Spraying the crop with 0.07% endosulfan or 0.04% monocrotophos or chlorpyrifos 20 EC 3.5 ml./lit. of water or only one time fenvelrate 75 gm a.i./ha. in 600 to 1000 of spray liquid per ha. or Indoxacarb @ 50 g a.i./ha.

6. <b>After harvest</b>	Mechanical practices	<p>1. Destroy crop residues infected with diseases and nematodes.</p> <p>Removal of roots of the nematode infested crop and burning/destroying them is essential to check further multiplication of nematodes in the soil.</p>
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\* Not as per approved usage under Insecticide Act 1968.

## VII. Do's and Don'ts in Pigeonpea IPM:

Do's	Don'ts
1. Grow only recommended varieties for particular area. Only resistant varieties should be grown in disease prone areas.	1. Do not grow pigeonpea at least for 3 years in wilt infected fields.
2. Grow pigeonpea inter-crop with sorghum in order to reduce wilt incidence	2. Do not spray synthetic pyrethroids (Fenvalerate) more than once and that too only at pod formation stage.
3. Observe status of insecticide resistance in <i>Helicoverpa</i> in the area while advocating insecticidal control of <i>Helicoverpa</i> . Only those insecticides are to be applied for which resistance is not known.	
4. Grow medium and late maturing varieties like Bahar, early upto middle of June to escape peak <i>Helicoverpa</i> attack.	

## VIII. SAFETY PARAMETERS IN PESTICIDES USAGE

S. No	Name of pesticide	Classification as per Insecticides Rules, 1971	Colour of Toxicity Triangle	WHO classification by hazard	First aid measures	Symptoms of poisoning	Treatment of poisoning	Waiting period (No. of days)
<b>INSECTICIDES</b>								
<b>ORGANOCHLORINE PESTICIDES</b>								
1.	Endosulfan	Highly toxic	Yellow	Class II - Moderately Hazardous	<p>Remove the person from the contaminated environment.</p> <p>In case of (a) Skin contact - Remove all contaminated clothings and immediately wash with lot of water and soap; (b) Eye contamination - Wash the eyes with plenty of cool and clean water; (c) Inhalation - Carry the person to the open fresh air, loosen the clothings around neck and chest, and (d) Ingestion - If the victim is fully conscious, induce vomiting by tickling back of the throat. Do not administer milk, alcohol and fatty substances. In case the person is unconscious make sure the breathing passage is kept clear without any obstruction. Victim's head should be little lowered and face should be turned to one side in the lying down position. In case of breathing difficulty, give mouth to mouth or mouth to nose breathing.</p> <p>Medical aid: Take the patient to the docotr/Primary Health Centre immediately along with the original container, leaflet and label.</p>	Nausea, vomiting, restlessness, tremor, apprehension, convulsions, coma, respiratory failure and death	<ul style="list-style-type: none"> <li>- Gastric lavage with 2-4 L. tap water - Catharsis with 30 gm. (10 oz) sodium sulphate in one cup of water</li> <li>- Barbiturates in appropriate dosages repeated as necessary for restlessness or convulsions</li> <li>- Watch breathing closely, aspirate, oxygen and/or artificial respiration, if needed.</li> <li>- Avoid oils, oil laxatives and epinephrine (Adrenalin) - do not give stimulants.</li> <li>- Give calcium gluconate (10% in 10 ml. Ampules) intravenously every four hours.</li> </ul>	
<b>ORGANOPHOSPHATE PESTICIDES</b>								
2.	Monocroto phos	Extremely toxic	Bright red	Class I b - Highly hazardous		Mild - anorexia, headache, weakness, dizziness, anxiety,	For extreme symptoms of O.P poisoning, injection of atropine (2-4 mg., for	

3.	Chlorpyrifos	Highly toxic	Yellow	Class II - Moderately hazardous		<p>tremors of tongue and eyelids, miosis, impairment of visual acuity.</p> <p>Moderate- nausea, salivation, lacrimation, abdominal cramp, vomiting, sweating, slow pulse, muscular tremors, miosis.</p> <p>Severe - diarrhoea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.</p>	<p>adults, 0.5-1.0 mg for children) is recommended, repeated at 5-10 minute intervals until signs of atropinization occur.</p> <p>Speed is imperative</p> <ul style="list-style-type: none"> <li>- 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;</li> <li>- Keep airways open, Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed.</li> <li>- 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.</li> </ul> <p>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.</p>	
							Avoid morphine,	

						<p>theophyllin, aminophyllin, barbiturates or phenothiazines.</p> <p>Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.</p>
<b>CARBAMATES</b>						
4.	Carbofuran	Extremely toxic	Red	Class I b - Highly hazardous		<p>Constriction of pupils, salivation, profuse sweating, lassitude, muscle incoordination, nausea, vomiting, diarrhoea, epigastric pain, tightness in chest.</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- Keep airway open. Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed.</li> <li>- 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.</li> <li>- Oxygen</li> <li>- Morphine, if needed.</li> </ul> <p>Avoid theophyllin and aminophyllin or barbiturates. 2-PAM and other oximes are not harmful and in fact contra indicated for routine usatge.</p>



Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.

**FUNGICIDES**

5.	Carbendazim	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.	Metalaxyl	Moderately toxic	Blue	Class III - Slightly hazardous			
7.	Thiram	-do-	Blue	-do-			

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.
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 observations in following sequence.
  - i) Flying insects (both pests & defenders)
  - ii) Close observation on pests and defenders which remain on the plants.
  - iii) Observe pest like *S. litura* and defenders like ground beetle / rove beetle / earwigs by scrapping the soil surface around the plants.
  - iv) Record disease and its intensity.
  - v) Record insect damage in percentage.
- c) Record parameters like number of leaves, branches, plant height and reproductive parts of the selected plants which should be flagged for making observation in the following weeks.
- d) Record the types of weeds, their size and population density in relation to crop plant.
- e) Record soil conditions viz. flooded, wet or dry.
- f) Observe rodent live burrows.

g) Repeat the step (a) to (f) in four sites randomly selected.

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

### **B. Drawing :**

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

### **C. Group Discussion and decision making :**

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

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

- i) When large number of egg masses and early instar larvae of *Spodoptera/Helicoverpa* are observed, the group may conclude application of NPV.
- ii) 25 % defoliation up to 30 DAS or after 60 DAS in groundnut will not affect the yield. Such information may be useful to decide management practice for defoliators in groundnut and other crops.
- iii) Some of the defenders like lady beetles, groundnut beetles, rove beetles, wasps play useful role in arriving at P:D ratio.

## **AESA BY EXTENSION FUNCTIONARIES**

The extension functionaries during their regular visit to the village mobilise the farmers, conduct AESA and critically analyse the various factors such as the pest population viz-a-viz 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 neem formulations / pest population. They may also take the decision based on the AESA, 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 villages and motivate the farmers to adopt AESA in their fields.

## **AESA BY FARMERS**

After a brief exposure during IPM demonstrations / field training's, 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 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 VARIETIES OF PIGEONPEA

Varieties	Areas
<p>1. <b>Wilt resistant/tolerant varieties</b> NP(WR) 15, Sharad (DA 11), Birsa Arhar 1, Sharda</p> <p>BDN1, BDN2, Asha (ICPL 87119) and Vishaka (TT6)</p> <p>Maruthi (ICO 8863), Asha (ICPL 87119), Vishaka (TT 6), BDN 2</p>	<p>Central &amp; Easter U.P., Bihar, Assam and Bengal.</p> <p>M.P., Maharashtra, Gujarat and Bundelkhand (U.P.)</p> <p>A. P., Tamilnadu, Orissa and Karnataka</p>
<p>2. <b>Sterility mosaic resistant</b> Bahar, Sharad (DA 11), Pusa 9, Hyb 3 C, Asha (ICPL 87119)</p> <p>Asha (ICPL 87119)</p>	<p>A.P., Tamilnadu, Karnataka and Orissa.</p> <p>Maharashtra, M. P., Gujarat and Bundelkhand (U.P.)</p>
<p>3. <b>Alternaria blight resistant</b> Sharad (DA 11), Pusa 9</p>	<p>Eastern U.P., Bihar, Assam and Bengal.</p>

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**ANNEXURE – III****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 containers.
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 Sprav 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 polythelene bags as hand gloves, handkerchiefs or piece of clean cloth as mask and a cap or towel to cover the head (Do not use polyethelene 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 polyethelene 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. Don not apply on hot sunny day or strong windy condition.
3. Do not apply just before the rains and also after the rains.
4. Do not apply against the wind direction.
5. Emulsifiable concentrate formulations should not be used for spraying with battery operated ULV sprayer.
6. Wash the sprayer and buckets etc. with soap water after spraying.

7. Containers, buckets etc. used for mixing pesticides should not be used for domestic purposes.
8. Avoid entry of animals and workers in the fields immediately after the spraying.

G. Disposal :

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