



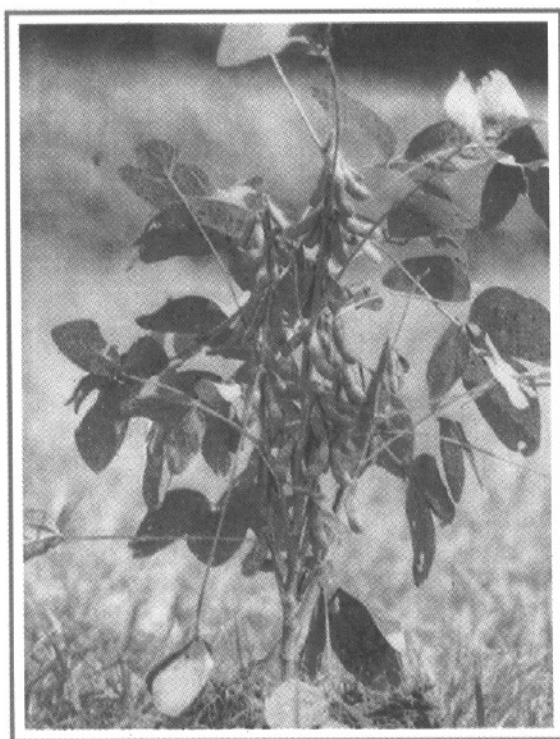
IPM PACKAGE NO. 10



INTEGRATED PEST MANAGEMENT PACKAGE

FOR

SOYBEAN



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 SOYBEAN

CONTENTS

Subject	Page No.
Foreward	i
Preface	ii
Acknowledgements	iii
I. Major Pests:	
A. Pests of National significance	1
B. Pests of Regional significance	2
II. IPM Strategies:	
1. Cultural practices	2
2. Weed Management	4
3. Pest monitoring	5
4. Mechanical practices	5
5. Biological control	6
6. Chemical control	7
III. Inter-cropping	7
IV. Crop stage / Pest vis-a-vis IPM practices	8-10
V. Do's and Don'ts in Soybean Pest Management	11-12
VI. Safety Parameters	13-18
Annexures -I & II	19-24



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

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

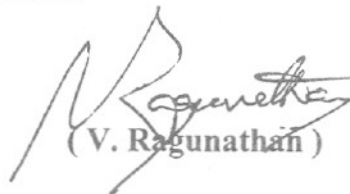
DR.V. RAGUNATHAN
Plant Protection Adviser
To the Government of India

FOREWARD

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

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

April 1, 2002


(V. Raguathan)

P R E F A C E

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

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

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

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

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



(A.D. Pawar)
Director (IPM)

ACKNOWLEDGEMENTS

The IPM Package of Practices for **Soybean** crop was discussed and finalised in the National Workshop on IPM held at National Plant Protection Training Institute (NPPTI), Hyderabad during May 14-17, 2001. The technical input received from the following experts is thankfully acknowledged.

- I. Chairman, Technical Session : Dr. A.D. Pawar, Director (IPM), Dte of PPQS, Faridabad
- II. Coordinator, Technical Session : Dr. M.P. Misra, Dy. Director (Ent.), Dte. of PPQS, Faridabad
- III. Co-chairman, Technical Session : Dr. Harvir Singh, Principal Scientist & Head Entomology Division Dte of Oil Research (ICAR), Hyderabad
- IV. Expert input : 1. Dr. T.P. Trivedi, Principal Scientist, N.C.I.P.M. (ICAR), New Delhi
2. Dr. Satyajit Roy, Sr. Scientist, CTRI (ICAR), Rajahmundry
3. Dr. V. Nandagopal, Sr. Scientist, NRC for Groundnut (ICAR), Junagarh
4. Dr. N.S. Rao, Sr. Scientist (Ent), PDBC (ICAR), Bangalore
5. Dr. S.D. Sawant, Sr. Scientist, NRC for Grapes (ICAR), Pune
6. Dr. R.K. Sharma, Sr. Scientist, Dte of Maize Research (ICAR), New Delhi
7. Dr. C. Chattopadhyay, Sr. Scientist, NRC for Rapeseed/Mustard, Bharatpur
8. Dr. A.M. K. Mohan Rao, Rodent Specialist, NPPTI, Hyderabad
9. Sh. S. Balasubramanian, Dy. Director (E), Central IPM Centre, Bangalore
10. Dr. J. N. Thakur, AD(E), Central IPM Centre, Solan
11. Sh. N.M. Dev, AD(E), Central IPM Centre, Jalandhar
12. Sh. O. P. Verma, PPO (PP), Central IPM Centre, Srinagar, J&K
13. Sh. Ashok Shukla, PPO(PP), Central IPM Centre, Baroda
14. Sh. C. Elangovan, PPO (PP), Central IPM Centre, Trichirapalli
15. Sh. A.K. Rai, PPO(E), Central IPM Centre, Indore
16. Sh. M. Parry, SSA, Central IPM Centre, Srinagar (J&K)
17. Dr. D. Kantungo, Jt. Director, CIL, Dte of PPQS, Faridabad
18. Dr. Jasvir Singh, AD(E), Dte of PPQS, Faridabad
- V. Technical input:
1. Sh. S.P. Singh, APPO, IPM Div., Dte of PPQS, Faridabad.
 2. Sh. K.S. Sharma, SSA, IPM Div., Dte of PPQS, Faridabad.
 3. Sh. Yogesh Kumar, SSA, IPM Div., Dte of PPQS, Faridabad.
 4. Sh. R.S. Tomer, SSA, IPM Div., Dte of PPQS, Faridabad.
 5. Sh. Laxmi Chand, SSA, IPM Div., Dte of PPQS, Faridabad.
 6. Mohd. Abrar Alam, Stenographer, IPM Div., Dte of PPQS, Faridabad.
 7. Sh. N.K. Mishra, LDC, IPM Div., Dte of PPQS, Faridabad.

IPM PACKAGE FOR SOYBEAN

I. Major Pests

A. Pests of National Significance:

1. Insect pests:

- 1.1 Stem fly (*Melanagromyza sojae*)
- 1.2 Girdle beetle (*Obereopsis bravis*)
- 1.3 Tobacco caterpillar (*Spodoptera litura*)
- 1.4 Green semilooper (*Chrysodeixis acuta*)

2. Diseases:

- 2.1 Rust
- 2.2 Sclerotium stem rot

3. Weeds:

a. Broad leaved weeds

- 3.1 *Amaranthus viridis*
- 3.2 *Cyperus iria*
- 3.3 *Cleome viscosa*
- 3.4 *Trianthema portulacastrum*

b. Grassy weeds

- 3.5 *Dactyloctenium aegyptium*
- 3.6 *Echinochloa spp.*
- 3.7 *Eleusine indica*
- 3.8 *Setaria glauca*

4. Rodents

- 4.1 Soft furred field rat (*Millardia melitana*)
- 4.2 Smaller bandicoot (*Bandicota bengalensis*)
- 4.3 Indian jerbil (*Tatera indica*)

B. Pests of Regional Significance:

1. Insect Pests:

- | | | |
|-----|--|------------------------------------|
| 1.1 | Blue beetle (<i>Cneorane spp.</i>) | M.P., Maharashtra |
| 1.2 | Leaf miner (<i>Aproaerema modicella</i>) | Maharashtra, Karnataka |
| 1.3 | Cotton grey weevil (<i>Myllocerus spp.</i>) | Delhi, Punjab and Rajasthan |
| 1.4 | Bihar hairy caterpillar (<i>Spilosoma obliqua</i>) | Tarai region of U.P., Central M.P. |
| 1.5 | Grey semilooper (<i>Amyna octo</i>) | Western Madhya Pradesh |
| 1.6 | Leaf folder (<i>Hedylepta indicata</i>) | Tamil Nadu |

2. Diseases:

- | | | |
|-----|-----------------------|------------------|
| 2.1 | Bacterial pustules | - Madhya Pradesh |
| 2.2 | Myrothecium leaf spot | - Madhya Pradesh |
| 2.3 | Soybean mosaic | - Northern India |
| 2.4 | Yellow mosaic | - Northern India |

3. Nematodes:

- | | | |
|-----|-----------------|------------------|
| 3.1 | Meloidogyne sp. | - Northern India |
|-----|-----------------|------------------|

II. IPM STRATEGIES:

1. Cultural practices

1.1 Summer deep ploughing:

For exposing the resting stages of girdle beetle, blue beetle, plant pathogens, rhizomes and bulbs of perennial weeds.

1.2 Sowing of tolerant varieties:

Insect pest and disease tolerant varieties mentioned below should be grown:-

Insect pest / Disease**Variety**

- | | | |
|-------|-----------------------|---|
| i) | Stem fly | JS 335, PK 262, NRC 12, MACS 124 |
| ii) | Tobacco caterpillar | JS 80-21, PS 564, PK 42, |
| iii) | Green semilooper | NRC 7, Pusa16, Pusa 20, Pusa 24. |
| iv) | Girdle beetle | JS 71-05 |
| v) | Rust | Ankur, JS 80-21, PK 1024, PK 1029,
Indira Soybean 9. |
| vi) | Sclerotium stem rot | PK 262, PK 416, PK 472, PK 1042. |
| vii) | Myrothecium leaf spot | Brag, JS 71-05 |
| viii) | Bacterial pustules | PK 416, PK 472, PS 564, Bragg. |
| ix) | Soybean mosaic | Ankur, PK 327, PK 416, PS 564. |
| x) | Yellow mosaic | PK 416, PK 472, PS 564, Pusa 16,
Pusa20. |

1.3 Sowing time:

Pre-monsoon sowing must be avoided. Regular sowing should be done when soil moisture is sufficient (8-12 cm) to ensure proper germination.

1.4 Seed rate and sowing:

Optimum seed rate (75-100 kg/ ha) should be used depending upon seed size to minimise the incidence of girdle beetle, semilooper, etc. After every 15 rows, a gap of one row should be given to provide moving space for spraying in standing crop.

1.5 Seed treatment:

Seed treatment with thiram 75% DS @ 3 gm / kg seed should be done. This should be followed by seed treatment with *Rhizobium japonicum* and Phosphate Solublizing Bacteria (PSB) @ 5+ 5 gm / kg seed or *T.viride* @ 3 g/kgseed.

1.6 Fertilizer dose:

NPK and S at the rate of 20:60-80; 20:20 kg/ ha should be applied. In no case, nitrogenous fertilizer (urea) should be used as foliar spray on the standing crop. Application of potash fertilizer should be ensured.

2. Weed management:

- 2.1 The crop should be sown timely at optimum moisture in a well prepared field with proper seed rate along with application of balanced doses of NPK and / or any other recommended micronutrient for achieving optimum plant populations and healthy crop stand, which would be capable of competing with weeds at initial stages of crop growth.
- 2.2 The crop should be maintained weed- free initially for 30 to 45 days by resorting to two hand hoeings /weedings or by pre- emergence application of alachlor (2.5 kg a.i. / ha) or metalachlor (1.0 kg a.i. /ha) mainly for controlling grassy weeds and/ or fluchloralin (1.0-1.5 kg a.i. /ha) or trifluralin (0.96-1.2 kg a.i. /ha) for broad leaved weeds and/ or pendimethalin (0.75-1.0 kg a.i./ha) or Imazethapyr (POE) 0.1 kg a.i./ha or Chlorimuron ethyl 6 to 8 gm a.i./ha 3 to 10 days after sowing.

Fluchloralin / trifluralin should be incorporated into the soil immediately after sowing.

3. **Pest Monitoring:**

3.1 **Rapid Roving Survey:**

1. Survey teams should undertake regular insect pest and disease monitoring on pre-selected routes at 15 days interval and assess bio-control potential in addition to insect pest and disease situation to give early forewarnings. Record should be kept about insect pest and disease incidence and bio- potential fauna on 5 plants per spot selected randomly at 10 spots per ha. after every 10 km. distance.
2. Install sex pheromone trap for early deduction of *S.litura* @ 10 traps/ha for mass trapping.

3.2 **Field Scouting:**

Field scouting should be undertaken by the farmers/ extension functionaries to keep a close watch on the appearance of insect pest, disease and bio-control fauna.

3.3 **Agro- Eco -System Analysis (AESA)**

Based upon weekly AESA, Economic threshold level (ETL) and corresponding change in pest defender ratio the extension functionaries have to take judicious decision in advising farmers for specific pest management practices. Detailed methodology for undertaking AESA exercise is given in Annexure-I.

4. **Mechanical Practices:-**

1. Collection and destruction of girdle beetle infested plant parts, egg masses and gregariously feeding larvae of hairy caterpillar and tobacco caterpillar should be done. Roguing of *Sclerotium* affected seedlings and yellow mosaic affected plants should be undertaken.
2. Erection of bird perchers @ 10-12/ha.

5. Biological Control:

5.1. Conserve spiders, coccinellid beetles tachinid fly, praying mantids, dragon fly, damsel fly, *Chrysoperla* and meadow grass hoppers through minimum use of broad spectrum pesticides, so as to exploit maximum potential of bio- control fauna.

5.2 Release *Telenomus nemus* @ 50000/ha against *S. litura*.

5.3 Spray SNPV @ 250 LE/ha

5.4 Spray of NSKE @ 5% for manage of early stage larvae and sucking pest.

6. Chemical Control:

6.1 Application of pesticides should only be resorted if pest population crosses the economic threshold levels as under:

Pest	Crop stage	Population / meter
Blue beetle	Seedling	4 beetles
Green semilooper	Flowering	4 larvae.
Grey semilooper	Flowering	4 larvae.
Tobacco caterpillar	Pre- flowering	10 larvae.

6.2 Pesticide application:

6.2.1 Apply phorate 10% CG @ 10 kg/ha as soil application at the time of sowing for the control of stem fly, blue beetle, girdle beetle and sucking pests.

6.2.2 Apply Methomyl @ 2 l/ha, Ethofenprox 10 EC @ 1 lit/ha triazophos 40% EC @ 625 ml/ha or quinalphos 25% EC @ 1000 ml/ha or 1.5 % DP @ 17 kg/ ha or for controlling defoliators, tobacco caterpillars and semiloopers, stemfly, girdle beetles and hairy caterpillars.

- 6.2.3 Apply mancozeb 75% WP @ 1500 -2000 gm/ha or hexaconazole 5% EC 0.1% or propiconazole @ 500 ml/ha or triademifon 25% WP @ 0.025% for the control of rust. Carbendazim may be sprayed against foliar diseases after 35 and 50 days of sowing.
- 6.2.4 Poison baiting with 2% zinc phosphide at podding and green seed stage, preceded by 1 day pre- baiting or application of bromadiolone 0.005% ready to use at green seed stage for the control of rodents.

III. INTER - CROPPING:

Inter - cropping soybean either with pigeonpea (early maturing variety) or maize or sorghum in the sequence of 4 rows of soybean with 2 rows of intercrop should be practiced. Such bio-diversity will help build up and conservation of natural bio control fauna viz. coccinellid beetles, *Chrysoperla* etc. In girdle beetle and semi looper endemic areas, intercropping with maize or sorghum should be avoided.

IV. CROP STAGE/ PEST VIS -A -VIS IPM PRACTICES

S.No.	Crop stage/ pest	IPM practices
1.	PRE-SOWING	<p>Cultural practices</p> <ol style="list-style-type: none"> 1. Deep ploughing in summer to expose soil -borne pathogens, nematodes and insect -pests, rhizomes and bulbs of perennial weeds. 2. Pre-monsoon sowing MUST BE avoided. Regular sowing should be done when soil moisture is sufficient to ensure proper germination <p>Chemical Control</p> <ol style="list-style-type: none"> 1. Fluchloralin (1.0 to 1.5 kg a.i. /ha) or trifluralin (0.96 to 1.2 kg a.i./ha) should be incorporated into the soil for controlling broad leaved weeds.
2.	SEED & SEEDLING	<p>Cultural practices</p> <p>Insects and diseases</p> <ol style="list-style-type: none"> 1. Use insect / disease tolerant varieties. 2. Use optimum seed rate (70-100 kg /ha) 3. N,P,K, and S should be applied @ 20:60-80: 20:20 kg per ha. <p>Weeds</p> <ol style="list-style-type: none"> 1. Crop should be maintained weed -free initially for 30-45 days by resorting to two hand hoeings / weedings. <p>Chemical control</p> <p>Seedling diseases</p> <ol style="list-style-type: none"> 1. Seed treatment with thiram* 75% DS @ 3 g /kg seed should be done. This should be followed by seed treatment with <i>Rhizobium japonicum</i> and Phosphate Solublizing Bacteria (PSB) @ 5 + 5 g /kg seed. <p>Weeds</p> <ol style="list-style-type: none"> 1. Pre- emergence application of alachor (2.5 kg a.i./ha) or metalachlor (1.0 kg

a.i./ha) for grassy weeds and /or pendimethalin (0.75 to 1.0 kg a.i./ha) or metribuzin (0.35 to 0.525 kg a.i./ha) for controlling both grassy and broad leaved weeds.

Stem fly blue beetle
and girdle beetle

1. Apply phorate 10% CG @ 10 kg/ha at the time of sowing.

Mechanical practice

Scalarotium stem rot
Weeds

1. Rogue out Sclerotium affected seedlings. Crop should be maintained weed free initially for 4-6 weeks by resorting to timely interculture and hand picking and use of pre-emergence weedicides.

3. VEGETATIVE STAGE

Mechanical practices:

Girdle beetle, tobacco
Caterpillar and hairy
Caterpillar

1. Collect and destroy girdle beetle infested plant parts, egg masses and gregariously feeding larvae of hairy caterpillar and tobacco caterpillar.

Chemical control

Stemfly, blue beetle
And girdle beetle

1. Apply oxydemeton methyl* 25% @ 500-1000 ml/ ha or dimethoate* 30% EC @ 750 -1000 ml/ha two weeks after germination in case phorate has not been applied at the time of sowing.

Rust

1. Apply mancozeb 75% WP @ 1500 - 2000 g/ha or hexaconazole 5% EC or propiconazole or triadimefon 80% EC @ 0.1% on the appearance of rust infection.

4. FLOWERING STAGE

Green semilooper and
Girdle beetle

1. Apply triazophos 40% EC @ 625 ml/ha or quinalphos 25% EC @ 1000 ml/ha for controlling defoliators, tobacco caterpillars, stem fly and girdle beetle.

Rust

1. Apply mancozeb 75% WP @ 1500-2000 g/ha or hexaconazole 5% EC or propiconazole 25% EC or triadimefon 25% WP @ 0.1% on the appearance of rust infection.

5. PODDING STAGE

Chemical control

Rats

1. Poison baiting with 2% zinc phosphide at podding and green seed stage preceded by one day pre-baiting or application of bromadiolone 0.005% ready to use at green seed stage for the control of rodents.

* These pesticides are not approved under the Insecticide Act, 1968 for use on this crop.

V. DO'S AND DON'TS IN SOYBEAN PEST MANAGEMENT

Do's

1. Grow at least 3-4 recommended varieties differing in maturity
2. Sow the crops after the onset of monsoon.
3. Grow soybean only in kharif season.
4. Always use recommended N.P.K. and S fertilizers.
5. Use recommended herbicides for management of weeds.
6. Rogue the plants infested with griddle beetle, tobacco caterpillar and plants infected with viral diseases.
7. Regular surveillance/monitoring of timely detection of economic threshold values which are required for need based application control measures against different insect-pests.
8. Use only recommended pesticides at the recommended dosages for the control of various pests.
9. A deep ploughing is to be done on bright sunny days during the months of May and June. The field should be kept exposed to sun light at least for 2-3 weeks.
10. Maintain optimum and healthy crop/stand which would be capable of competing with weeds at an early stage of crop.

Don't

1. Do not grow the under -script varieties.
3. Avoid early sowing of the crop because it favours build up of insect-pest population.
4. Do not grow soybean in rabi/summer to avoid incidence of rust.
5. Do not use under, over or imbalanced fertilizer application which might result in poor plant health and reduced resistance to various insect pest or diseases.
5. Do not use non-recommended herbicides.
6. Do not keep the infested plants in the field to check the further spread of the insects pests/diseases.
7. Do not go for blanket sprays without surveillance because of many adverse effects of the insecticides.
8. Do not use unrecommended or mixtures of various insecticides in any cases.
9. Do not plant or irrigate the field after ploughing at least for 2-3 weeks to allow desiccation of weed's bulbs and/or rhizomes of perennial weeds.
10. Crops should be exposed to moisture stress at their critical growth stages.

11. Pre-emergence herbicides should be applied after sowing before the emergence of weeds and crop.

12. Herbicides like fluchloralin should be incorporated in to soil immediately after spraying to avoid its photo-degradation.

13. Apply only recommended herbicides dose, proper time, appropriate spray solution with standard equipment along with flat fan or flat jet nozzle.

11. Pre-emergence herbicides should not be applied after emergence of crop and weeds as they will not control the germinated weeds as well as may cause phytotoxicity to the crop.

12. Soil incorporation of fluchloralin not be delayed or avoided for achieving effective weed control.

13. Herbicides should not be applied along with irrigation water or by mixing with soil, sand or urea.

The spray equipments including nozzles used herbicides application should not be used for insecticides or fungicide to avoid possible phytotoxicity to crop.

VI. SAFETY PARAMETERS:

Safety parameters inter alia classification of toxicity as per Insecticides Rules, 1971, WHO classification of hazards, Colour of toxicity triangle, First aid measures, symptoms of poisoning and treatment of poisoning, the extension functionaries of the state Department of Agriculture have to make use of this information as under:-

- vi) Basic precautions which are required to be taken as per classification of toxicity as well as hazard criteria by WHO may be seen as per Annexure - II.
- ii) The extension functionaries are to educate the farmers on safety use of pesticides with the help of colour toxicity triangle as the farming community can follow the colour and corresponding safety precautions.
- iii). The symptom of poisoning must be known to the extension functionaries to enable them to extend first aid measures to affected persons to the extent possible.
- vi) Basically, the information on first aid measures and treatment of poisoning is required to be passed on by the extension functionaries to the doctors at Primary Health Centres as well as to the Private Doctors in the vicinity of spraying of pesticides.
- v) Extension functionaries must ensure that names of common pesticides during plant protection measures along with a copy of the leaflet which is an integral part of a pesticide container must be made available to the doctors in the vicinity of plant protection operations.
- vi) Extension functionaries are to request the doctors to intervene in procurement of antidotes for different pesticides as cited under "Treatment of poisoning"

CROP: SOYBEAN

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 Jocote Primary Health Centre immediately along with the original container, leaflet and label.</p>	<p>Nausea, vomiting, restlessness, tremor, apprehension, convulsions, coma, respiratory failure and death</p>	<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.	Chlorpyrifos	-do-	-do-	-do-			
4.	Dimethoate	-do-	-do-	-do-			
5.	Oxydemeton methyl	-do-	-do-	-do-		Moderate- nausea, salivation, lacrimation, abdominal cramp, vomiting, sweating, slow pulse, muscular tremors, miosis.	Speed is imperative
6.	Ethion	-do-	-do-	-do-			- 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:
7.	Triazophos	-do-	-do-	Class I b - Highly hazardous			- Keep airways open. Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed.
8.	Phorate	Extremely toxic	Bright red	Class I a - Extremely hazardous.		Severe - diarrhoea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma and heart block.	- 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.
9.	Monocrotophos	-do-	-do-	Class I b - Highly hazardous			In addition to atropine give 2-PAM (2-pyridine aldoxime methiodide). 1 g and 0.25 g for infants

							<p>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> <p>Avoid morphine, theophyllin, aminophyllin, barbiturates of phenothiazines.</p> <p>Do not give atropine to a cyanotic patient. Give artificial respiration first then administer atropine.</p>
--	--	--	--	--	--	--	--

CARBAMATES

10.	Methomyl	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"> - Atropine injection 1 to 4 mg. Repeat 2 mg when toxic symptoms begin to recur (15-60 minute intervals). Excessive salivation - good sign, more atropine needed. - Keep airway open. Aspirate, use oxygen, insert endotracheal tube. Do tracheotomy and give artificial respiration as needed. - For ingestion, lavage stomach with 5% sodium bicarbonate, if not vomiting. For skin contact wash with soap and water (eyes - wash with isotonic saline). Wear rubber gloves while washing contact
-----	----------	-----------------	-----	------------------------------	--	--	--

							<p>area.</p> <ul style="list-style-type: none"> - Oxygen - Morphine, if needed. <p>Avoid theophyllin and aminophyllin or barbiturates. 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>
--	--	--	--	--	--	--	---

FUNGICIDES

11.	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.
12.	Carbendazim	-do-	-do-	-do-			
13.	Thiophanate methyl	-do-	-do-	-do-			
14.	Hexaconazole	Moderately toxic	Blue	Table 5 – Unlikely to produce hazards in normal use.			
15.	Propiconazole	Moderately toxic	Blue	Table 5 Unlikely to produce hazards in normal use.			

16.	Tridemofon	-do-	-do-	Class II – Moderately hazardous			
17.	Thiram	Moderately toxic	Blue	Class III – Slightly hazardous			

OTHERS

18.	Bromodalon	Extremely toxic	Red	Class I b – Highly hazardous		Headache, palpitation, nausea, vomiting, flushed face, irritation of nose, throat eyes and skin etc.,	No specific antidote. Treatment is essentially symptomatic.
19.	Zinc phosphide	-do-	-do-	-do-			
20.	Metolachlor	Moderately toxic	Blue	Class III – Slightly hazardous			

AGRO ECO SYSTEM ANALYSIS (AESA)

AESA is an approach, which can be gainfully employed by extension functionaries and farmers to analyse field situations with regard to pests, defenders, soil conditions, plant health, the influence of climatic factors and their inter relationship for growing healthy crop. Such a critical analysis of the field situations will help in 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 dynamic.
4. Soil conditions.
5. Climatic factors.
6. Farmers past experience.

The methodology of AESA is as under :-

A. Field Observation :-

- a) Enter the field at least 5ft. away from the bund. Select a site with a dimension fl sq. m. 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 pests like S litrura and defenders like ground beetle /rove beetle /earwings 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 or leaves, branches plant height and reproductive parts of the selected plants which should be flagged for making observation in the following weeks.

- d) 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 flowing weeks.
- e) Record soil conditions viz. flooded, wt 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, White 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 messes and early instar larvae of *Spodoptera / Helicoverpa* are observed, the group may conclude application of NPV.

- ii) 25% defoliation upto 30 DAS or after 30 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 / safe pesticides are to be used for specific pest situation. Such an exercise may be repeated by the extension functionaries during every visit to the village and motivate the farmers to adopt AESA in their fields.

AESA BY FARMERS :-

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

BASIC PRECAUTIONS IN PESTICIDE USAGE

A. Purchase:

1. Purchase only JUST required quantity e.g. 100,250,500 or 1000 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 polyethelene 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 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 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 some 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.

H. Other Precautions:

1. Seed Treatment
 - 1.1 For seed dressing, use either metal seed dresser/earthen pots or polyethylene bags.
 - 1.2 After seed treatment, do not open lid/cover of the polybag/earthen pot immediately to avoid inhalation of pesticide/fungicide.
 - 1.3 Do not use left over treated seeds either for human consumption or as animal feed.
2. Harvest
 - 2.1 Do not harvest fruits, vegetables immediately after pesticide application.
 - 2.2 Observe safety intervals.
 - 2.3 Do not spray/dip harvested produce in pesticide solution.
3. Cautions
 - 3.1 If operator feels giddiness, uneasy, he must discontinue spraying/dusting at once.
 - 3.2 Operator should not spray/dust more than 4 hours at a strength in a day.
 - 3.3 Operator should not take up spray/dusting work with empty stomach.