INTEGRATED PEST MANAGEMENT PACKAGE

FOR

PEA

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 PEA

## Contents

<table>
<thead>
<tr>
<th>Subject</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreward</td>
<td>i</td>
</tr>
<tr>
<td>Preface</td>
<td>ii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>iii</td>
</tr>
</tbody>
</table>

I. **Major Pests**

A. **PESTS OF NATIONAL SIGNIFICANCE**  
   - Page 1

B. **PESTS OF REGIONAL SIGNIFICANCE**  
   - Page 1

II. **PEST MONITORING**  
   - Page 2

III. **IPM Strategies for PEA**

   A. Cultural Practices  
   - Page 3

   B. Mechanical practices  
   - Page 3

   C. Biological control  
   - Page 4

   D. Chemical control  
   - Page 4

   E. Resistant varieties  
   - Page 6

IV. **Crop Stage-Wise IPM Practices in PEA**  
   - Page 7

ANNEXURES - I TO II  
   - Pages 10-13
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. RaguNathan)
PREFACE

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

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

April 1, 2002

(A.D. Pawar)
Director (IPM)
ACKNOWLEDGEMENTS

The IPM Package of Practices for Pea crop was discussed and finalised in the National Workshop on IPM held at Central Insecticide Laboratory (CIL), Dte of Plant Protection, Quarantine & Storage, Faridabad during Feb.20-22, 2002. The technical input received from the following experts is thankfully acknowledged.

I. Chairman, Technical Session : Dr. AD 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. R.G. Chaudhary, Pr. Scientist (Path.) Indian Institute of Pulses Research (ICAR), Kanpur

IV. Expert input : 1. Dr. C.P. Yadava, Pr. Scientist (Ent), Indian Institute of Pulses Research, Kanpur
   2. Dr. T.P. Trivedi, Pr. Scientist, NCIPM (ICAR), New Delhi
   3. Dr. N.S. Rao, Pr. Scientist, Project Dte of Biological Control (ICAR), Bangalore
   4. Sh. M.S. Bist, SPPA, Plant Protection Deptt., Uttrakashi
   5. Dr. R.B.L. Bhaskar, Jt. Director (Bio.), Dte of PPQS, Faridabad
   6. Dr. Raj Singh, Jt. Director (Bio.), Dte of PPQS, Faridabad
   7. Dr. B.S. Phogat, Agronomist (H), Dte. of PPQ&S, Faridabad
   8. Dr. R.K. Upadhyay, DD(PP), Dte of PPQ&S, Faridabad
   9. Sh. K.K. Singh, AD(E), Dte of PPQ&S, Faridabad
  10. Dr. K.S. Kapoor, PPO(E), CIPMC, Jallandhar
  11. Dr. R.P. Mishra, PPO(E), CIPMC, Lucknow
  12. Dr. V.K. Srivastava, PPO(PP), CIPMC, Gorakhpur
  13. Sh. R.S. Sharma, PPO(E), Dte of PPQ&S, Faridabad
  14. Dr. Jasvir Singh, AD(E), Dte of PPQS, Faridabad

V. Technical input:

5. Sh. Laxmi Chand, SSA, IPM Div., Dte of PPQS, Faridabad.
I. MAJOR PESTS

A. Pests of National Significance

1. Insect pests:
   1.1 Pea pod borer (*Etiella zinckenella*)
   1.2 Stemfly (*Ophiomyia phaseoli*)

2. Diseases:
   1.1 Powdery mildew (*Erysiphe pisi* syn. *E. polygoni*).
   1.2 Rust (*Uromyces viciae-fabae* syn. *U. fabae*).

3. Weeds:
   1.1 Bathua (*Chenopodium album*)
   1.2 Matri (*Lathyrus aphaca*)
   1.3 Chatri (*Vicia sativa*)
   1.4 Senji (*Melilotus alba*)

4. Nematodes:
   1.1 Root knot nematodes (*Meloidogyne incognita* and *M. javanica*)

5. Rodents:
   1.1 Smaller Bandicoot

B. Pests of Regional Significance

1. Insect pests:
   1.1 Pea black aphid (*Aphis craccivora*) - Indo gangetic plain
   1.2 Leaf miner (*Chromatomyia horticola*)

2. Diseases:
   1.1 Downy mildew (*Peronospora viciae* syn. *P. pisi*) – Indo Gangetic plains
   1.2 Ascochyta blight (*Ascochyta pisi*, *A. pinodes*, *A. pinodella*) - Himalayan Region.
   1.3 White rot (*Sclerotinia sclerotiorum*) – J &K, Himachal Pradesh
   1.4 Root rot (*Fusarium solani*, *Rhizoctonia solani*) – Early sown crops and irrigated crops of U. P., Bihar and West Bengal.

3. Nematodes :
   1.1 Reniform nematode

(IPM Package for Pea)
II. PEST MONITORING:

The objectives of pest monitoring is to detect the initial development of pest and diseases and also the bio-control agents in the field situations.

1. Rapid Roving Survey:

   a. In the beginning of the crop season, survey routes are required to be identified in the pest and disease endemic areas to undertake Rapid Roving Surveys. During survey the observations are to be made at every 5 to 10 kms, distance in the pre-selected route at 7 to 10 days intervals depending upon pest and disease situation. Record the incidence of pests and diseases and defender population at each spot on 5 plants at random. (12 spots per ha.)

   b. Root-knot produces diagnostic symptoms are “gall” formation on roots. Reniform produces “dirty roots system.” Stunting of plants and early fluorescence. Patches and uneven rows of plants in the field indicate heavy infestation of root knot nematode.

   c. The working index for rodent pests: 25 live burrows/ha.

2. Field Scouting

Based on the observation of Rapid Roving Survey the farmers at village level are to be mobilized to undertake field scouting. During field scouting farmers may record pest, disease and defenders populations once in 7 to 10 days in their own fields as per Agro Eco System Analysis (AESA) approach. The State Departments of Agriculture should make all possible efforts by using different media mode and publicity to inform the farmers about field scouting in the specific crop areas having indication of insect 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 situation with regard to pest, 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. Plant health at different stages
2. Built in – compensation abilities of the plants
3. Pests and defenders population dynamics
4. Soil conditions
5. Climatic factors
6. Farmers’ past experience

The details of the AESA are given in Annexure-I.
4. Economic Threshold Levels (ETLs)

Insects
Pea pod borer – 5% pod damage
Stem fly - 5% plant damage
Rodents -25 live burrows/ha.
Nematode -1 to 2 larvae per gram of soil or 1 gall/knot on root system.

Diseases:
1. Powdery mildew – 5 to 10% severity/ if achieved.
2. Rust – 5 to 10% severity/ before grain.
3. Downy mildew - 10 to 15% severity/filling stage.
4. Root rots - 5.0 -10% incidence.

III. INTEGRATED PEST MANAGEMENT PRACTICES:

A. Cultural:

1. Deep ploughing in summer.
2. Use of tolerant/resistant varieties
3. Crop rotation with non leguminous crops.
4. Early and timely sowing of selected varieties
5. Inter crop with linseed/mustard/barley
6. Hoeing/weeding 30-35 DAS
7. Collection and burning of crop residues
8. Green manuring in Kharif in those fields where root rots are above 10%
9. Wider spacing particularly for tall varieties to avoid damage by rust, powdery mildew, white rot and *Ascochyta* blight.
10. Optimum depth of sowing (5-7 cm) to avoid seed rots.
11. Timely weeding to remove *Vicia sativa*, *Chenopodium album*, *Melilotus alba* and *V. hirsuta*.
12. Intercropping with mustard or faba bean to reduce powdery and rust.
14. Apply need based and light irrigation (Excessive moisture increase root rots, rust white rot and powdery mildew).

B. Mechanical:

1. Clean the seed properly. No crop residue should be intermixed with the seed.
2. Rogue out the plants showing virus symptoms such as mosaic, top yellows, streaks, brown ring spots etc.
3. Use of bird scarers for crows.
4. Use of barriers for porcupine.
C. Biological:

Inundative release of *Coccinella septempunctata* @ 1000 adults/4000 sq.m. for aphid management (2 release at 10 days interval).

1. Soil amendment with pearl millet residues, mustard cake or mustard pod straw to reduce root rots.
2. Seed treatment with *Bacillus subtilis*, *Pseudomonas fluorescens* or *Gliocladium virens* for the management of root rots and damping off diseases.
3. Soil application of *Trichoderma harzianum* or spraying of *B. subtilis* for the management of white rot disease.
4. *Paecilomyces lilacinus* @ $10^8$ spore (Pinch)/kg. seed as seed treatment for nematodes.
5. *Aspergillus niger* @ $10^8$ spore, (Pinch)/kg seed, as seed treatment for nematodes.

D. Chemicals:

I. Insects:

<table>
<thead>
<tr>
<th>Insecticides</th>
<th>Insects</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phorate (Seed dressing)</td>
<td>Stemfly</td>
<td>1.5 kg a.i./ha</td>
</tr>
<tr>
<td>Carbofuran (soil Application)</td>
<td>Stemfly</td>
<td>2.0 kg a.i./ha</td>
</tr>
<tr>
<td>Phorate (Granules)</td>
<td>Pea pod borer</td>
<td>1-2 kg a.i./ha</td>
</tr>
<tr>
<td>Carbofuran Granules</td>
<td>Pea leaf miner</td>
<td>1.0 kg a.i./ha</td>
</tr>
<tr>
<td>*Cypermethrin EC</td>
<td>Pea pod borer</td>
<td>0.002%</td>
</tr>
<tr>
<td>Endosulfan EC</td>
<td>Pea pod borer</td>
<td>0.03%</td>
</tr>
<tr>
<td>*Methomyl EC</td>
<td>Pea pod borer</td>
<td>0.04%</td>
</tr>
<tr>
<td>Monoerotophos EC</td>
<td>Pea pod borer</td>
<td>0.04%</td>
</tr>
<tr>
<td>*Cypermethrin EC</td>
<td>Black aphid</td>
<td>0.002%</td>
</tr>
<tr>
<td>Fenvalerate EC</td>
<td>Black aphid</td>
<td>0.004%</td>
</tr>
</tbody>
</table>
II. Diseases:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Disease</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Carbendazim</td>
<td>Seed rot, Damping off, root rots, collar rot</td>
<td>2-3 g /1 kg seed</td>
</tr>
<tr>
<td>*Carbendazim + Thiram</td>
<td>-do-</td>
<td>1+2 g /1 kg seed</td>
</tr>
<tr>
<td>*Thiram</td>
<td>-do-</td>
<td>3 g/1 kg seed</td>
</tr>
<tr>
<td>Captan</td>
<td>-do-</td>
<td>3 g/1 kg seed</td>
</tr>
<tr>
<td>Wettable sulphur</td>
<td>Powdery mildew and rust</td>
<td>3g/lit water</td>
</tr>
<tr>
<td>*Carbendazim</td>
<td>Powdery mildew white rot, <em>Ascochyta</em> blight</td>
<td>0.5-1.0 g/lit</td>
</tr>
<tr>
<td>*Triadimefon</td>
<td>White rot, powdery mildew</td>
<td>0.25-0.5 g/lit</td>
</tr>
<tr>
<td>Dinochop</td>
<td>Powdery mildew</td>
<td>1-2 g/lit</td>
</tr>
<tr>
<td>Tridemorph</td>
<td>Powdery mildew</td>
<td>0.5 g/lit</td>
</tr>
<tr>
<td>Mancozeb</td>
<td>Rust, Downy mildew, <em>Ascochyta</em> blight</td>
<td>2-3 g/lit</td>
</tr>
<tr>
<td>*Copper oxychloride</td>
<td><em>Ascochyta</em> blight</td>
<td>2.5-3 g/lit</td>
</tr>
<tr>
<td>*Zineb</td>
<td><em>Ascochyta</em> blight</td>
<td>2.5-3 g/lit</td>
</tr>
</tbody>
</table>

III. Rodents:

Bromadiolone Rats 10-15 g/burrows 0.005%

IV. Nematodes:

Seed treatment

1. *Chlorpyriphos 20EC @ 0.2%
2. *Trizophos 40 EC @ 1%
3. *Dimethoate 30 EC @ 0.2%
4. *Carbosulfan @ 3%

Soil application

1. Carbofuran 3G @ 1 kg a.i./ha at sowing
2. *Phorate 10G @ 1 kg a.i./ha

*Not as per the approved usage under Insecticide Act, 1968.
### E. Resistant varieties:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield (Q/ha)</th>
<th>Adaption</th>
<th>Special character</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMR 11</td>
<td>18-22</td>
<td>NHZ, NWPZ, NEPZ, CZ</td>
<td>PM resistant</td>
</tr>
<tr>
<td>HUP 2 (Malviya matar 2)</td>
<td>18-22</td>
<td>NEPZ</td>
<td>PM resistant</td>
</tr>
<tr>
<td>Pant P 5</td>
<td>18-22</td>
<td>NWPZ</td>
<td>PM resistant</td>
</tr>
<tr>
<td>JP 885</td>
<td>18-22</td>
<td>CZ</td>
<td>PM resistant</td>
</tr>
<tr>
<td>HFP 4 (Aparna)</td>
<td>20-25</td>
<td>NWPZ</td>
<td>Dwarf, PM resistant</td>
</tr>
<tr>
<td>KFP 103</td>
<td>18-22</td>
<td>NWPZ</td>
<td>PM resistant</td>
</tr>
<tr>
<td>DMR 7 (Alankar)</td>
<td>20-24</td>
<td>NWPZ</td>
<td>PM resistant</td>
</tr>
<tr>
<td>DDR 13</td>
<td>18-22</td>
<td>NEPZ and CZ</td>
<td>Dwarf, PM resistant</td>
</tr>
<tr>
<td>HFP 8909</td>
<td>20-25</td>
<td>NEPZ and CZ</td>
<td>Dwarf, PM resistant</td>
</tr>
<tr>
<td>KPMR 114-1</td>
<td>20-25</td>
<td>NEPZ</td>
<td>Dwarf, PM resistant</td>
</tr>
<tr>
<td>Malviya Matar 15</td>
<td>22-30</td>
<td>NEPZ</td>
<td>Dwarf, PM &amp; rust resistant</td>
</tr>
<tr>
<td>Rachna (KMPR 10)</td>
<td>20-25</td>
<td>NEPZ and NWPZ</td>
<td>Dwarf, PM resistant and tall type</td>
</tr>
</tbody>
</table>

NHZ : North Hill Zone (J & K and Hilly areas of Himachal Pradesh and U.P.)
NWPZ : North West Plain Zone (Punjab, Haryana, Western U.P.)
NEPZ : North East Plain Zone (Eastern U.P., Bihar, West Bengal, Plain of Assam)
CZ : Central Zone (M.P.) Parts of Rajasthan
PM : Powdery Mildew

**Nematode : Tolerant varieties**

DDR16, HFP4, AVT-2(D), HFP9510, LFP227
**IV. CROP STAGE/PEST-VIZ-A-VIZ IPM PRACTICES**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Crop Stage</th>
<th>Pest</th>
<th>IPM Component</th>
<th>IPM Practices</th>
</tr>
</thead>
</table>
| 1.    | Pre-sowing | Root rot Nematodes stemfly weeds | Cultural | 1. Deep summer ploughing  
2. Green manuring in Kharif in those fields where root rots are above 10 percent  
3. Use of tolerant varieties  
4. Crop rotation with non-leguminous and non-solanaceous crops  
5. Application of FYM/neem cake/Mahua cake @ 500 Kg/ha prior to sowing  
6. Follow optimum sowing depth of 5-7 cm  
7. Inter-cropping with mustard/linseed/barley/wheat  
8. Use 20 kg:40kg:20 kg and 20 kg NPKS per hectare  
9. Wider spacing for tall varieties  
10. Timely sowing, avoid very early sowing |
|       |            |      | Biological    |               |
|       |            |      |               | 1. Soil amendment with pearl millet or mustard residues  
2. Seed treatment with *Bacillus subtilis, Pseudomonous fluorescens or Gliocladium veres* if root rots are problem  
3. Soil application of Trichoderma harzianum for white rot management  
4. Seed treatment with the latex of Calotropis @ 1 g/kg seed, *Pacilomyces bilacinus or Aspergillus niger* @ 10⁶ spore (pinch)/kg seed for nematode management |
|       |            |      | Chemical      |               |
|       |            |      |               | 1. Seed treatments with Phorate for Stemfly management  
2. Seed treatment with *Thiram, *Thiram+Carbendazim, Carbendazim or Captan for root rot management  
3. Seed treatment with *Chlorpyriphos, Dimethoate or Carbosulfan for nematodes. |

*(IPM Package for Pea)*
<table>
<thead>
<tr>
<th>Phase</th>
<th>Stage/Problem</th>
<th>Cultural</th>
<th>Mechanical</th>
<th>Chemical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed and</td>
<td>Root rots Nematodes</td>
<td>1. Avoid early irrigation</td>
<td>1. Weed out the plants showing virus symptoms</td>
<td>1. Pre-emergence spray of Pendimethalin @ 0.75</td>
</tr>
<tr>
<td>seedling</td>
<td>Stemfly weeds</td>
<td>unless absolutely essential.</td>
<td>such as mosaic, top yellows, streaks etc.</td>
<td>1.0 kg a.i./ha</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetative</td>
<td>Root rots Nematodes</td>
<td>1. Do manual weeding if needed</td>
<td>1. Spray Mancozeb @ 2.5 g/lit at the ETL of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weed Downy mildew</td>
<td></td>
<td>downy mildew.</td>
<td></td>
</tr>
<tr>
<td>Flowering</td>
<td>Root rots Nematodes</td>
<td>1. Need based and only light</td>
<td>1. Fix bird scarers</td>
<td></td>
</tr>
<tr>
<td>and podding</td>
<td>Pod borer Rust</td>
<td>irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Powdery mildew Leaf</td>
<td>2. Weed out virus infected</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>miner Aphids Rodents</td>
<td>plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Birds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post harvest</td>
<td>Rust seed borne fungi</td>
<td>1. Spray Bacillus subtilis</td>
<td>1. Spray Endosulfan or Monocrotophos for insect</td>
<td>1. Apply Bromadiolone (0.005%) baits inside</td>
</tr>
<tr>
<td></td>
<td>Bruchids</td>
<td>in white rot prone areas.</td>
<td>pest management</td>
<td>the rodents burrows.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>septempunctata at the ETL of</td>
<td>oxychloride, Mancozeb or *Carbendazim etc. as</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>aphids</td>
<td>per the need for disease management</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Apply Bromadiolone</td>
<td>3. Applying Bromadiolone (0.005%) baits inside</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.005%) baits inside the</td>
<td>the rodents burrows.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>rodents burrows.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Not as per the approved usage under Insecticide Act, 1968
Strategy for decision making (Examples)

1. If during early growth stage 5% plant damage by stemfly are observed, such fields should not be grown with Pea/Rajmah next year.

2. If during podding stage, 5% Pod damage by Pea pod borer is observed, apply 0.07% Endosulfan or 0.04% Monocrotophos.

3. a) If 5-10% severity on surface area of powdery mildew or rust are recorded before grain filing stage, apply wettable sulphur @ 3 gm/lit.
   b) Apply Mancozeb @ 2-3 gm/lit. if only rust is present.
   c) Apply Carbendazium 0.5-1 gm/litre.
AGRO-ECO-SYSTEM ANALYSIS (AESA)

Agro-eco-system analysis (AESA) is a process which involves periodical (weekly) observations of plant health, plant compensation abilities, ETL, climate factors, change of pest and defenders population and their inter-relationship. AESA can be practices by more than one group of trained farmers in a village. AESA helps in decision making on management practice required to be adopted at each crop growth stage. AESA technique may be useful in farmer to farmer IPM training programme also.

Method:

A. Field Observations
   a) Enter the field at least 5 ft (1.5 m) away from the bund. Select a site with a dimension of one sq. mt. randomly.
   b) Record the observations in following sequence:
      i) Flying insects (both pests and defenders)
      ii) Close observation on pests and defenders which remain on the plants.
      iii) Observe pests like S. litura and defenders like ground beetle/rove beetle/earwigs by scraping the soil surface around the plants.
      iv) Record disease and its intensity.
      v) Record insect damage in percentage.
      vi) Record species wise weed population/sq. m

   c) Record in one of the selected plants, parameters like number of leaves, branches, plant height and reproductive parts (plant 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.
   f) Repeat the step (a) to (d) for other randomly selected four sites.
   g) Record the climate factors viz. sunny, cloudy, partly cloudy, rainy etc. for the preceding week.

(IPM Package for Pea)
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 alongside 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 observation using the previous and current charts should be discussed among the group members by raising/note raising of question relating to change in pest and defenders population, crop stage, etc. The group may evolve a strategy based up on weekly AESA, ETL and corresponding change in P:D ratio and take judicious decision for specific pest management practices.

D. **Strategy for Decision Making : (Example)**

Some of the defenders like lady beetles, *Chrysoperla, Syrphids*, etc. play useful role in arriving at P:D ratio.

1. **By Farmers:**

After a brief exposure during IPM demonstrations/field training, farmers can practice AESA in their own fields. Wherever trained farmers are available their experiences could be utilized in training their fellow farmers in their own villages. Thus a large group of farmers could be made proficiently competent in undertaking weekly AESA thereby empowering themselves in decision making on any specific pest situations. Farmers – to – farmers training approach will go a long way in practicing IPM on a large area on sustainable basis.

2. **By Extension Workers:**

The extension functionaries during their regular visit to the village mobilise the farmer, conduct AESA and critically analyse the various factors such as the pest population vis-à-vis defender population and their role in natural suppression of the pest, the influence of prevailing weather condition / soil conditions on the likely build up of defender/pest population. They may also take the decision based on the AESA, which IPM components like release of defenders, application of 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.

***

(IPM Package for Pea)
ANNEXURE II

BASIC PRECAUTIONS IN PESTICIDE USAGE

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

B. Storage:
1. Avoid storage of pesticides in 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 toothbrush tied with the sprayer and clean with water.
5. Do not use same sprayer for weedicide and insecticide.

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

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