Good Agricultural Practices on Rational Use of Pesticide in Tea

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Definitions

**Pest**: any living organism, such as insect, fungus or weed, that could damage any crop, livestock or stored products.

**Pesticide**: a "poison" used for preventing, destroying, repelling, or mitigating any insect/mite pest, pathogen or weed.

In tea, pest damages can be found in,
- field (cultivation)
- Factory (manufacturing)
- Warehouses (storing)
Pest Management

Why Pest Management is necessary?

In general, as Hudson et al., (2002) estimated, the total crop loss due to insect pests, diseases and weeds in tea can go up to 40%

*However, under specific conditions,*

Gnanapragasam (1988) reported that crop loss due to plant parasitic nematodes in the range of 4 to 40%

Visser et al., (1958) reported crop loss due to Blister Blight disease (Up country) in the range of 20% - 25%, if no protection measures adopted.

Wettasinghe (1970) reported 5 - 15 percent yield loss in VP tea under Low country conditions when weeding was delayed for 4 - 6 months.

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Do we recommend controlling pest found all the time in tea field?

**Economic injury level** is the lowest population density that will cause economic damage.

**Economic threshold level** is the population density at which level control measures to be started to prevent the population reaching the economic injury level.

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**ETL**: Economic threshold level

**EIL**: Economic Injury level
Severity of the Common Insect pests & Diseases in the Corporate sector Tea Estates

Severity Ranking of Pest in Different Tea Growing Regions

<table>
<thead>
<tr>
<th>Rank</th>
<th>Low</th>
<th>Mid</th>
<th>Up</th>
<th>Uva</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SHB</td>
<td>SHB</td>
<td>TT</td>
<td>SHB</td>
</tr>
<tr>
<td>2</td>
<td>LCLWT</td>
<td>TT</td>
<td>SHB</td>
<td>MITES</td>
</tr>
<tr>
<td>3</td>
<td>MITES</td>
<td>MITES</td>
<td>TT</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S.TERMITES</td>
<td>S.TERMITES</td>
<td>UCLWT</td>
<td>NG</td>
</tr>
<tr>
<td>5</td>
<td>TT</td>
<td>WG</td>
<td>WG</td>
<td>WG</td>
</tr>
<tr>
<td>6</td>
<td>WG</td>
<td>UCLWT</td>
<td>S.TERMITES</td>
<td>S.TERMITES</td>
</tr>
</tbody>
</table>

Severity Ranking of Diseases in Different Tea Growing Regions

<table>
<thead>
<tr>
<th>Rank</th>
<th>Low</th>
<th>Mid</th>
<th>Up</th>
<th>Uva</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blister Blight</td>
<td>Blister Blight</td>
<td>Blister Blight</td>
<td>Blister Blight</td>
</tr>
<tr>
<td>2</td>
<td>Woodrot</td>
<td>Phomopsis</td>
<td>Woodrot</td>
<td>Woodrot</td>
</tr>
<tr>
<td>3</td>
<td>Macrophoma</td>
<td>Woodrot</td>
<td>Phomopsis</td>
<td>Phomopsis</td>
</tr>
<tr>
<td>4</td>
<td>White root D</td>
<td>Red root D</td>
<td>Red root D</td>
<td>Red root D</td>
</tr>
<tr>
<td>5</td>
<td>Black Blight</td>
<td>Brown root D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diagnostic Survey, TRI, 2008-09

Objectives of Pesticides Use

- Manage Tea Pests effectively
- Minimize the Cost of Pest Management
- Keep the Pesticide Residues at a low level
- Protect the Environment and Workers from Pesticides
Manage Tea Pests effectively

1. Identify the Pests and their damages (Slide 15)
2. Knowledge on the Life Cycle of Pests and the pattern of outbreak (Slide 16)
3. Preventive measures to Pest Incidences/Out-breaks (Slide 18)
4. Adopt the Integrated Pest Management Measures (Slide 23)

Use Pesticide rationally

1. Use only the Recommended Pesticide (Slide 29)
2. Knowledge on Mode of action (Slide 30)
3. Follow correct dosages/time/equipments/PHI, etc. (Slide 32)
4. Educate and train the Pesticide users
5. Follow the Safety Measures
Select the most suitable herbicides based on the range of weed species in the field.

Use correct dosage of herbicide and mix thoroughly in clean water and then make up the spray volume required to cover the area.

Maintain the number of herbicide applications to a minimum

Use a range of herbicides of different mode of action, in rotation than continuing with a single herbicide, to avert build-up of resistant weed species.
Spray weeds when they are relatively young, before they flower/seed.

The ideal stage to spray would be when the weeds are about 10-15 cm in height.

Mature woody plants and deep-rooted species should be slashed, and the tender re-growth be sprayed.

Use spray guards to prevent spray drift on to peripheral branches and green stems.

Use the correct type of poly jet /flood jet nozzles to spray herbicides along inter-rows.

Supervise the entire operation, careful to ensure safe and effective weed control.
Measures to keep the residue levels low in made tea

- Use only the pesticides recommended by TRI
- Strictly follow the TRI guidelines i.e. dosage rates, application intervals, pre-harvest intervals, etc.
- Spray pesticides to the foliage only after plucking.
- Do not use expired pesticides
- Use only appropriate sprayers.
- Strictly maintain the 'Pre Harvest interval'

Thank you for your attention
Types of Pests in Tea

- **Diseases (Fungus)**
  - Blister Blight (caused by fungus Erysiphe cichoracearum, an obligate parasite)

- **Insects**
- **Weeds**
- **Nematodes**
- **Mites**

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**Life Cycle of Blister Blight (18-21 days)**

- **Spores**
  - Spread by wind
  - Germination: 6-10 hrs
  - Spore penetration inside: 10-14 hrs

- **Mature blister**
- **Translucent spots**
- **Rupture the lower epidermis or through stomata**
- **Appressorium**
- **Appropriate period to Use Copper Fungicides**
  - 7-9 days

- **Appropriate period to Use Systemic Fungicides**
  - 8-10 days
Appropriate Stages for Insecticide Spraying

- Egg Masses
- TT Moth (Larval Stage)
- Caterpillar (Larval Stage)
- Pupae
- larvae less than 2.5 cm length

Life Cycle of Tea Tortrix (7-8 Wks)

Preventive Measures

- Identify the small pockets in the field where there is a potential to begin a disease or insect pest attack
- Keep vigilance
- Monitor the population build up
- Use prophylactic measures, if any

- Use resistant cultivars
- Manually control the pest population
  - Hard Plucking
  - Manual collection of egg masses
- Spots application of pesticides
  - Identify the small pockets in the field where there is a potential to begin a disease or insect pest attack
  - Keep vigilance
  - Monitor the population build up

For Insect Pests ex. Tea Tortrix
For Diseases
Ex: Blister Blight

Preventive Measures

✓ Use resistant cultivars: long-term strategy
✓ Manage the environment: Shade management
✓ Identify the Blister Blight pockets in the field
✓ Keep vigilance during conducive environment conditions
✓ Study the stages of life cycle and identify the most suitable stages for chemical control
✓ Spraying recommended fungicides

For Weeds

Preventive Measure

✓ Develop a good tea canopy to cover the soil
✓ Plant the vacant patches with Mana grasses, Green manure crops or cover crops
✓ Thatch the soil
✓ Manage weeds before flowering to minimize the weed seed bank in the soil
✓ Use pre-emergent herbicides
Seed production of some common weeds

<table>
<thead>
<tr>
<th>Weed species</th>
<th>Seeds per plant*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaranthus spp. (Thampala spp)</td>
<td>196,000</td>
</tr>
<tr>
<td>Bidens pilosa (Ottu pul)</td>
<td>6,000</td>
</tr>
<tr>
<td>Digitaria spp (grass spp.)</td>
<td>150,000</td>
</tr>
<tr>
<td>Eleusine indica</td>
<td>41,000</td>
</tr>
</tbody>
</table>

* Average or recorded number of seeds per weed plant


Duration of weed-seed dormancy in the soil

<table>
<thead>
<tr>
<th>Name of the weed</th>
<th>Seed viability (in years)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bidens pilosa (Ottu pul)</em></td>
<td>More than 5</td>
</tr>
<tr>
<td><em>Brassica spp. (Mustard)</em></td>
<td>About 50</td>
</tr>
<tr>
<td><em>Ageratum conyzoides (Hulantala)</em></td>
<td>More than 5</td>
</tr>
<tr>
<td><em>Mimosa pudica (Nidikumba)</em></td>
<td>up to 19</td>
</tr>
</tbody>
</table>

### Appropriate Pest Management Measures

- **Legal**
  - Eg. Use quarantine regulations

- **Cultural**
  - Eg. Manage shade trees for BB control

- **Mechanical/Manual**
  - Eg. Collect TT egg masses
  - Slashing of weeds
  - Hard Plucking

- **Biological**
  - Eg. Use predators/parasites to control pests, *Macrocentrus*

- **Chemical**
  - Eg. Use of Pesticides

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### Monitoring the Pest Population

*example the Tea Tortrix*

**Method 1**

Identify the TT pockets in each tea fields and set up Pheromone traps to monitor the TT population

**Method 2**

Manually collect all stages from randomly selected bushes and use the TRI guidelines to make decision on using chemicals
**Method 1**

POPULATION MONITORING OF TEA TORTRIX

- High moth catch
- Pheromone traps
- Spraying
- After 3 weeks

**Method 2**

- Select 4 - 5 bushes randomly from the affected area
- Collect all the stages of TT, egg masses, Pupae, *Macrocentrus* cocoons etc.,

*Sort out and group* them as follows;

**Group 1: All larvae (caterpillars)**

- A: Healthy larvae less than 2.5 cm length
- B: Healthy larvae more than 2.5 cm length
- C: Diseased and dead larvae
Group 2: Healthy pupae and fresh egg masses

Group 3: Empty nests, *Macrocentrus* cocoons, empty pupae

Decision Making on Chemical Spraying

- ✓ If the **Group 3** is in the majority; spraying not necessary.
- ✓ If the **Group 2** is in the majority; keep vigilance for new Tea Tortrix generations.
- ✓ If the **Group 1** is in the majority; count A, B and C separately, if A is more than 50% of the collection, spray the recommended pesticides
Recommended Pesticides by the TRI (22)

TRI Advisory Circular PU 1

- Copper Hydroxide
- Copper Oxide
- Copper Oxycarbonate
- Biteranol
- Propiconazole
- Tebuconazole
- Sulfur
- Fipronil
- Diazinon
- Chlorfluazuron
- Imidacloprid
- Dazomet
- Metam Sodium
- Carbofuran
- 2,4-D
- MCPA
- Oxyfluorfen
- Paraquat*
- Glufosinate-ammonium
- Diuron
- Glyphosate

07 Fungicide groups (03 Contact & 04 Systemic)

05 Insecticides & Acaricides

03 Nematicides

07 Herbicides

Mode of Action of Recommended Herbicides (07)

- Selective
  - Foliar-applied
    - Systemic
    - Contact
    - Pre-emergent
  - Soil-applied
    - Systemic
    - Contact
    - Fumigant
- Non-Selective
  - Foliar-applied
    - Systemic
    - Contact
    - Fumigant
  - Soil-applied
    - Systemic
    - Contact
    - Persistent Sterilents

* Diuron has both pre- and post-emergent properties

2,4-D, MCPA, Glufosinate-ammonium, Paraquat, Diuron have persistent sterilents properties.
**Mode of Action of Recommended Fungicides**

- **Fungicides (07)**
  - Contact
    - 50% Copper Fungicides
      - Copper hydroxide
      - Copper oxide
      - Copper oxychloride
  - Systemic
    - Triazoles
      - Hexaconazole
      - Bitertanol
      - Propiconazole
      - Tebuconazole

**Mode of Action of Recommended Insecticides**

- **Insecticides**
  - Contact Poisoning
    - Fipronil
    - Sulfur
  - Stomach Poisoning
    - Chlorfluazuron
    - Diazinon
    - Imidacloprid
  - Respiratory Poisoning
    - Dazomet
    - Metam Sodium
  - Systemic toxicants
    - Carbofuran
Pre Harvest Interval (PHI)

Minimum of 7 Day PHI for all recommended chemicals

Correct Nozzle types

- Hollow cone nozzle
- Solid cone nozzle
- Poly jet nozzle