Guide on Field hygiene techniques on pest and disease management of Brinjal

The Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizers in Sri Lanka (SAFE)

1. Purpose:

Brinjal is an important vegetable crop in Sri Lanka due to its high nutritional value and economic importance. However, pests such as brinjal shoot and fruit borer and sucking pests, and diseases such as fungal diseases and bacterial wilt often reduce crop yield and quality.

Farmers frequently use chemical pesticides to manage these challenges, but use of chemical pesticides results in environmental harm, health risks, and development of pesticide-resistant pest populations.

Field hygiene, removing and disposal of infested plant debris can disrupt pest and pathogen life cycles, lower inoculum levels, and reduce the likelihood of infestation. This manual explains effective field hygiene practices and highlights findings from a 2024 field study in Walewela in the Matale District, providing practical solutions for sustainable brinjal production.

2. Basic Concept of Field Hygiene:

Field hygiene is the most basic technique in pest and disease management. It involves keeping the field clean to protect plants from pests and pathogens.

Leaving diseased plants and their remains in or around the field, and ignorance of pests will conserve the source of contamination, resulting in the spread of the pests and disease.

3. Practical implementation of field hygiene on brinjal

Pay attention to the following regarding field hygiene:

(1) Personal Hygiene

Wash hands with soap and water before and after going to the field. Always wear clean clothes while working. This helps prevent the spread of disease to one field to another.

Figure 1: Washing hands

(2) Soil Sanitation

Before starting a new cultivation, choose clean field. If not, clear agricultural residues and disinfect the soil to reduce pathogens such as Bacterial wilt remaining in the soil. Currently, no effective pesticides have been developed for Bacterial wilt.

To remove pathogens, it is crucial to sterilize the soil through methods such as solarization or burning or use of chemicals (e.g. Fungicides / fumigants: chemicals in vapor form).

Figure 2: Brinjal plant wilted die to bacterial wilt

- **Solarization**

  Solarization is a method that kills not only pathogenic bacteria, but also nematodes, soil insects, etc. in the soil, and has the advantage of reducing costs by not using pesticides.

  This method can be used only when there is good sunlight. This will take about 2-4 weeks. Till the soil 20-25 cm deep and then, prepare the high bed suitable for placing seeds. Then, apply water so that it is well moisten & then spread a transparent-polythene on the surface of the bed to cover completely. Seal the edge of the polythene with moist soil so that it is well pressed. Expose it to continuous sunlight for 2 weeks. Remove the polythene and mix up the soil, then repeat the same as before.

Figure 3: Solarization

- **Burning**

  Moisten the soil, then spread straw and paddy husk alternatively until the layer become 5 cm evenly over the soil surface, and set fire against the wind direction.

Figure 4: Prepare raised beds, cover with straw, husk, and burn

- **Use of chemicals**

  In this method, fungicides or soil fumigants can be used to sterilize the nursery beds. First, prepare the nursery beds. Then, the soil should be treated with fungicides 3 days before sowing. Recommended fungicides are listed below:

Table 1: Recommended fungicides

Name	Application rate
Captan 50 % WP	60 g / 50 lit. water / 10 m^2
Captan 80 % WG	40 g / 50 lit. water / 10 m^2
Flutolanil 50 % WP	30 g / 50 lit. water / 10 m^2
Thiuram 80 % WP	70 g / 50 lit. water / 10 m^2
Thiophanate Methyl 50 % + Thiuram 30 % WP	50 g / 50 lit. water / 10 m^2

(DOA, Pesticide Recommendation, 2021)

(3) Water Hygiene

Water hygiene for vegetable cultivation is important for the quality of the produce and the health of consumers. Here are some things to consider:

- **Water source**

  Use clean water. The quality of the water used for irrigation and washing vegetables should be considered free from contamination.

- **Channels and Drainage**

  Provide deep drainage, open channels and make higher beds. Because, Bacterial wilt survives in deep soil. Water also carries pathogens.

  Ideal drainages have channels between beds and surroundings. Outlet water goes down to drainage. The drainage should be deep. This is also a mitigation strategy to reduce damage caused by heavy rain.

(4) Use of Disease-free Seeds and Seedlings

To avoid disease from the beginning of cultivation, be watchful to your seeds and seedlings which you use.

- **Seed Sterilization**

  Seed treatment can be done to ensure the health of seeds. For this, it is advisable to mix a recommended fungicide such as Captan/Thiuram with the seeds.

- **Disease-free, Disease Tolerant Seedlings**

  Tissue culture is a technique that uses meristematic cells, which are undifferentiated cells found at the growing tips of shoots and roots.

Figure 7: Seed treatment

Figure 8: Tissue culture seedling

Grafting is a horticultural technique that joins the upper part of good plant (the scion) to the root system of another strong plant (the rootstock). Coping with Bacterial wilt of brinjal, *Solanum torvum* (Torvum Vigor) is used in other countries such as Japan & India.

Figure 9: Brinjal grafting

(5) Field monitoring and removal of infected plant debris and weed

Field sanitation is an important and highly effective farm practice to keep most diseases and pests under control. Early detection and timely action are crucial for managing pests and diseases, so it is important to regularly observe the field to monitor its condition. Pay attention to the status of the plants, such as withered tender leaves (little leaves), excessive growth of brinjal leaves, or the presence of weeds. Carefully inspect conditions that may facilitate the spread of pests or diseases and take appropriate measures to address them.

Figure 10: Infected leaf

- **Removal and/or destruction of infected plants**
  Remove infested plant parts due to pests and diseases (For example, if the shoot borer attack happens, remove the damage branch/shoot together with the caterpillar inside. Cut it 1-2 cm below the point/place of damage. Or if it is in early stage, kill insect inside the stem)

- **Removal of dried leaves, fallen leaves and dropped fruits**
  Remove dried leaves, yellow color leaves in the lower part of the trunk of tree and dropped leaves and decayed fruits.

Figure 11: Shoot borer damage

- **Removal of weeds**

  Regularly remove weeds. Monitor for pests like aphids or damping-off disease. If found, remove them.

- **Disposal of infected plants and crop residue**

  Dispose infected plants and crop residues properly. If there is virus infection, completely burn infected parts in the deep pit.

  Weeds act as hosts for pathogenic bacteria, insect pests and vectors capable of transmitting viral diseases. Therefore, it is essential to control them effectively.

Dig a disposal pit in a location away from the field and bring the removed weeds there to burn them. If the uprooted weeds are left in the field, pathogens and pests present on them may return to the field.

Figure 12: Plant debris

Figure 13: Burning in pit

(6) Equipment sanitation

Wash and disinfect boots, agricultural equipment, materials, etc. to keep them clean to avoid bringing infectious sources into the field.

- **Disinfecting of tools (Shears, secateurs, knives and machetes)**

  Frequently disinfect tools such as knives and shears to prevent the spread of diseases to other plants.

  To disinfect secateurs, you can use a disinfectant solution, rubbing alcohol, or a bleach solution. The simplest way is to use kitchen detergent solution.

- **Washing out soil from tools (Tilling tools and machinery)**

  Wash and disinfect boots, agricultural equipment, materials, etc. to keep them clean to avoid bringing infectious sources into the field. (After ploughing, carefully remove soil that has adhered to tractor tires, rotaries, and other working equipment, and then thoroughly wash with water)

Figure 14: Equipment disinfection

Figure 15: Washing out soil

(7) Monitoring of surroundings

Weeds in and around the surrounding fields serve as hosts for pathogenic bacteria and sources of insects and funguses that transmit viral diseases, so be sure to thoroughly control them.

- **Contamination from weeds to Brinjals**

<Fungus>
Powdery mildew

<Insects (vectors)>
Whitefly (BPYV, ToCV)
Aphids (CMV, BBWV)
Leafhopper (Little leaf disease)

Figure 16: Powdery mildew

(4) Demonstration summary:

In a field trial conducted in Matale in 2024, the following two field conditions were tested to observe the effect of crop hygiene practice on shoot and pod borer incidences, mite damage of fruits and Phomopsis blight infected fruits.

Crop hygienic practice	Removal of infested plant parts, dried leaves, lower leaves, yellowed leaves, weeds and proper disposal.
Farmer's conventional practice	No removal of infested plant parts (except damaged shoots), dried leaves, lower leaves, yellowed leaves and partially removal of weeds.

- **Observations:**

During the practice, the mite damages as well as Phomopsis blight couldn't be observed in both fields (treatment plot & farmer's plot). The crop hygiene practices are beneficial in minimizing both shoot and fruit borer damage, potentially leading to improved crop health and quality. Therefore, crop hygiene practices are recommended for inclusion in an Integrated Pest Management (IPM) to promote sustainable pest management.

5. Points to note when using the manual:

1) Provide deep disposal pit before planting. It is important to provide pit in advance for burning diseased plants/infested plant parts and crop debris.

2) Do not forget to disinfect tools every time after pruning. Otherwise, you might bring pathogens to the next plants.

3) Please maintain and store the tools in clean condition.

4) Always care about personal hygiene.

Recent Trends in Control Methods: Vaccination of Bacteriophage

If brinjals are inoculated with RSM (Response Surface Methodology) phage-infected bacterial wilt bacteria (non-pathogenic), even if they are subsequently inoculated with pathogenic bacterial wilt bacteria, they will exhibit strong resistance and exhibit a high preventive effect to pathogenic bacterial wilt bacteria.

- Figure 6 : Tissue culture illustration: https://plantcelltechnology.com/blogs/blog/blogtissue-culture-an-effective-way-to-maximize-cannabis-yield
- Figure 7: Brinjal grafting photo: https://akagefarm.com/s-re-nae3.html
- Figure 11: Burning in pit photo: https://evangap.exblog.jp/29241039/
- Figure 13: Washing out soil illustration: https://www.wikihow.com/Disinfect-Gardening-Tools
- Figure 14: Powdery mildew photo: https://www.gardendesign.com/how-to/powdery-mildew.html

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