



Integrated Pest Management Innovation Lab (IPM IL) Nepal

IPM Recommendations for Management of *Tuta absoluta* in Plastic(tunnel) houses with pest exclusion net (1mm mesh)

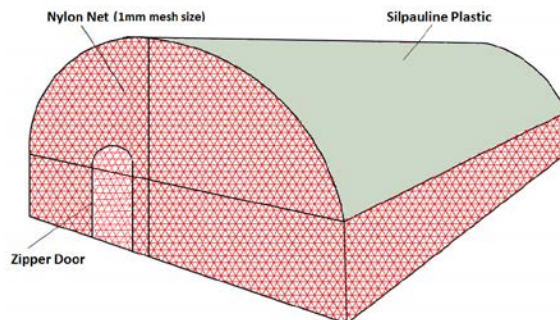
(Updated as of June 22, 2018)

1. Best practice to use the exclusion net with the geographical location should with the altitude more than 500 masl.
2. Best practice is to grow healthy tomato seedlings inside a nylon net using plastic trays and coco-peat.
3. Destroy the crop residue from the previous crops by burning or burying the residue one (1) foot deep in a pit.
4. Do not grow other host crops (Solanaceous crops such as potatoes, eggplant, peppers, tobacco) around the green house. Within an area 50 meters around the green house remove all solanaceous crops and solanaceous weeds.
5. Apply a bio-pesticide *Metarhizium anisopliae* @2g/lit in soil as drenching to kill the larvae and pupae residing in the soil. Alternatively, the entire planting field within the green house can be tilled to a depth of ten (10) centimeters.
6. Best practice is to use plastic mulch to help identify and reduce pupation in the soil.
7. Check the seedlings before transplanting to ensure they are free of *Tuta* infestation.
8. It is very important that there are no holes, gaps or other pathways in the green house exterior for moths to enter. Before transplanting double check to make sure the green house is secure and there after check for holes regularly.
9. Put Wota-T trap with pheromone lures inside the greenhouse to manage the *Tuta* moths accidentally entered inside the house due to the traffic.
10. Spray botanical pesticide neem oil (Azadirachtin 1%EC @3ml/lit) and bio-pesticide *Bacillus thuringiensis kurstaki* 1%WP@2g/lit alternatively on standing crops as soon as there are >50*Tuta* moths trapped per week in any of the pheromone traps. The *Bacillus thuringiensis* is UV light sensitive so it should be sprayed during the evening time.

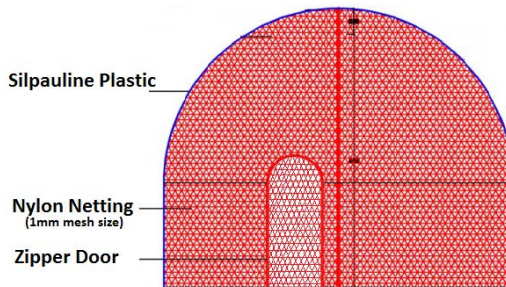
| SN | Common Name | Trade Name | Dose | Waiting Period | Remarks |
|----|--|---|---------|----------------|---|
| 1 | Azadiractin 1%EC | Margosan, Nimbicidine | 3ml/lit | 5-7 days | Registered: PPD <i>Tuta</i> PERSUAP: FtF |
| 2 | <i>Bacillus thuringiensis</i> <i>Kurstaki</i> 1% WP | Biolep, Mahastra, Dipel,Thuricide | 2gm/lit | 7 days | Registered: PPD <i>Tuta</i> PERSUAP |



11. Regular (Daily or once in two days) field inspection is necessary to look for new or further infestation.
12. Remove and destroy any infested leaves, shoots and fruit immediately.
13. In the green house, we are blocking the movement of insect pests as well as pollinators and natural predators, so pollination might be affected. To help ensure pollination, various methods such as hand pollination, can be used. Gently brushing the flowers and shaking the staking ropes by hand is one method. Using a tuning fork or vibrator near flowers to shake the flowers so that the pollen can reach the stigma is another method.
14. The netting around the green house also blocks the movement of air inside the green house, which may cause an increase in temperature and humidity, especially during hot summer months. This environment favors growth of fungus and may lead to development of fungal disease inside the green house.
 - a. When building the green house make provision for ventilation, which will remove the hot air and make space for cool air to come inside the green house. The current recommendation is that the ventilation area be at each end of the green house and should be screened with netting material.
 - b. Alternatively, a shade net can be used over the top of a green house during summer to block the sunlight penetrating inside, which will help reduce the temperature.



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15. There should be provision for a tight and secure door in the green house to prevent moths from entering. A zipper can be used to create a single door system. If a zipper door system is used, one will need to enter and exit the green house carefully and quickly. Checking for pests in the green house is done by using the light and pheromone traps already in place.



- c. Alternatively, a double door system can be used to minimize the entry of pests. If a double door system is used, when entering the green house, open the first door and get inside it, then close the first door. Place one sticky trap with TLM lure in between two doors to check for moths entering the green house.
16. Irrigation drip drums should be installed and operated from outside the green house to reduce the traffic flow in the green house.
 17. If these recommendations are followed in a greenhouse with pest exclusion netting it is not anticipated that multiple applications of bio-pesticide or chemical pesticide will be necessary to control *Tuta* infestation.
 18. **Our experience is that the safe bio-agents are effective. If the above management strategy fails to manage *Tuta*, it may be necessary to spray recommended chemical pesticides with the correct dosage as a “rescue operation”. Do not spray chemical pesticides unnecessarily until it is very much required. Some of the recommended chemical pesticides with doze and waiting period have been listed below that have been used for the management of *Tuta absoluta*:**

| SN | Common Name | Trade Name | Dose | Waiting Period | Remarks |
|----|------------------------------|-------------------------|------------|----------------|--|
| 1 | Chlorantraniliprole 18.5% SC | Coragen, Alcora | 3ml/10 lit | 7 days | Registered: PPD <i>Tuta</i> PERSUAP |
| 2 | Spinosad 45% SC | Tracer | 1ml/3 lit | 7 days | Registered: PPD <i>Tuta</i> PERSUAP |
| 3 | Emamectin Benzoate 5% WG | Emamec, EMAR, King Star | 5gm/16lit | 10 days | Registered: PPD <i>Tuta</i> PERSUAP |



Integrated Pest Management Innovation Lab Nepal (IPM IL Nepal)

IPM Recommendations for Management of *Tuta absoluta* in Open Field

(Updated as of June 22, 2018)

1. Best practice is to grow healthy tomato seedlings inside a nylon net using plastic trays and coco-peat.
2. Destroy the crop residue from the previous crops by burning or burying the residue one (1) foot deep in a pit.
3. Do not grow other host crops (Solanaceous crops such as potatoes, eggplant, peppers, tobacco) around the farm. Within an area 50 meters around the field remove all solanaceous crops and solanaceous weeds. If other solanaceous crops are grown nearby, the same management practices described below should be followed for these crops.
4. Apply a bio-pesticide *Metarhizium anisopliae* @2g/lit in soil as drenching to kill the larvae and pupae residing in the soil. Alternatively, the entire planting field can be tilled to a depth of ten (10) centimeters.
5. Best practice is to use plastic mulch to help identify and reduce pupation in the soil.
6. Check the seedlings before transplanting to ensure they are free of *Tuta* eggs and larvae.
7. Start mass trapping of *Tuta* moths with pheromone and light traps seven (7) days before transplanting tomato seedlings in the open green house or field.
 - a. **Case 1:** For farmers with one (1) or two (2) open green houses (12x6m area), one (1) light trap (blue LED bulb with 490nm light wavelength) and two (2) water traps (Wota-T and others) with TLM pheromone lures are recommended for each open green house. Maximum trap height forty (40) centimeter above the ground. Change the TLM pheromone lures pursuant to the packaging label based on field viability.
 - b. **Case 2:** For farmers with large continuous areas and no green houses one (1) light trap and four (4) water traps (Wota-T and others) with TLM pheromone lures per ropani (500m²) are recommended. Change pheromone lures as described above.
 - c. **Mass trapping and other treatment activities listed below should be done using a community based approach where all the nearby farmers who are not following the approach and are growing tomatoes or other solanaceous vegetables are at least 50m away.**



19. Spray botanical pesticide neem oil (Azadirachtin 1%EC@3ml/lit) and bio-pesticide *Bacillus thuringiensis*1% @2gm/lit alternatively on standing crops as soon as there are >50 *Tuta* moths trapped per week in any of the pheromone traps. The *Bacillus thuringiensis* is UV light sensitive so it should be sprayed during the evening time.
- 8.

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9. Pesticides with different modes of action, sprayed alternately, have been found to be effective. Do not depend on or use only one (1) pesticide for a long period as this may lead to development of resistance in insects to particular pesticide group.

10. Daily or once in two days field inspection is necessary to look for new or further infestation.

11. Remove and destroy the infested leaves, shoots and fruits immediately.

12. Our experience is that the safe bio-agents are effective. If the above management strategy fails to manage *Tuta*, it may be necessary to spray recommended chemical pesticides with the correct dosage as a “rescue operation”. Do not spray chemical pesticides unnecessarily until it is very much required. Some of the recommended chemical pesticides with doze and waiting period have been listed below that have been used for the management of *Tuta absoluta*:

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