

Managing Pests in Flower and Nursery Crops

Successful IPM has five key components

- prevent problems
- regularly monitor crops and growing areas
- accurately diagnose problems
- develop control action thresholds or guidelines
- use effective management methods

I) Pest Prevention

- planning your crop production and IPM program in advance
- Sanitation and exclusion
- Properly managing the environment and cultural practices

II) Monitoring

Building an IPM Monitoring Program

- Start simple
- Develop a clear, concise plan that designates specifically what and how things will be done and who will do them.
- Rely on careful inspection of growing areas and plants, special tools that will vary depending on the key pests (such as traps for monitoring insects), and ongoing knowledge of whether cultural practices and environmental conditions are appropriate for the crop.
- Scout at least every week on a regular schedule, using a professional consultant or a well-trained employee
- Communicate weekly face to face. The grower, scout, and applicator must work together as a team and be committed to basing pest management decisions on monitoring information.
- Designate pest management units (PMU's), contiguous areas of a similar crop for which pest management needs are similar and monitoring results are summarized.
- Have a kit of necessary tools.
- Have some prior knowledge of the problems likely to affect the crop (such as what the pests are and what their damage looks like), and be familiar with the biology of these problems.
- Keep good written records of scouting results and management actions.

- Begin monitoring to learn more about pest problems. Once background information is developed, modify the monitoring and management program based on evaluation of this information.

III) Diagnosing Problems

- adverse environmental conditions
- improper cultural practices
- pathogens, such as fungi and viruses
- invertebrates, including insects and mites
- weeds
- nematodes

IV) Thresholds

- help maintain pesticide efficacy by reducing the development of pesticide resistance
- reduce disruptions of cultural practices that occur during applications and reentry periods
- may improve plant growth and quality by minimizing phytotoxicity
- increase profits by reducing costs for pesticide purchases, application labor, and regulatory compliance

V) Management

- make the growing area as pest free as possible before planting
- start with high quality, pest free stock
- keep pests out of the growing area
- regularly inspect crops and growing areas and promptly eliminate any problems

IPM Questionnaire

Pest Prevention –

1. What do you do to prevent pest problems on your production site?
2. What kind of sanitation practices do you have in place?
3. What happens when a possible pest is found?
4. What other cultural practices do you have in place, such as culling or exclusion?

Monitoring –

1. What areas of your property do you monitor?
2. How do you monitor your crops and growing areas?
3. Who monitors your crops and growing areas?
4. Are there areas that are more prone to problems?

Diagnoses –

1. How do you diagnose problems at your production site?
2. What kind of damage do you experience at your production site?
3. Who do you use for advice or help? PCA? Entomologist?

Thresholds –

1. Have you developed pest thresholds?
2. At what point do you determine action is necessary?

Management –

1. Do you use effective management methods?
2. What kind of education do you offer your employees?
3. Who is involved in your pest management team?
4. Do you maintain records of your IPM plan and scouting finds?

ROBUST IPM PROGRAM LBAM MANAGEMENT

Ongoing Robust IPM and Best Management Practices for Leaf-rollers/Light Brown Apple Moth

1. TRAINING-EDUCATION

- a. Ongoing information and training to staff and especially staff that regularly monitors: on leaf-roller-LBAM life cycles, identification, location and feeding behaviors, host plants (see 2.b.) and IPM methods for control and eradication.
- b. Education and study of natural predators and parasitoids (e.g.: insectivorous birds, predatory spiders, earwigs, trichogramma wasps, mini-wasps, tachinid flies, pirate bugs, assassin bugs, damsel bugs, green lacewings) (See 3.b.).

2. MONITORING

- a. LBAM male pheromone traps at high density (1 per acre, 5X level of CDFA-USDA traps). Traps monitored weekly for target insect.
- b. Weekly and bi-weekly in-house leaf-rollers inspections. Weekly inspections on top 20 host plants (list from CDFA LBAM Conference (K. Hoffman 2008). Bi-weekly total premise inspections with 4 trained employees. (4-5 hours).
- c. Collecting and monitoring of beneficial organisms for leaf-roller/LBAM control.
- d. Non-pheromone sticky traps at premises perimeters to monitor for beneficial insects as well as possible incidental LBAM females.
- e. Records and data collection: in-house inspections, results, issues, corrective and/or compliance actions.

3. CULTURAL-MECAHNICAL CONTROLS

- a. We consistently weed, cut and cull any suspect plants w/signs of possible leaf-roller feeding and discard the material in plastic bags put in our dumpster with lid.
- b. We locate blocks of our most preferred LBAM host plants growing next to a black-light bug-zapper which kills all moths flying in the vicinity.

4. MATING DISRUPTION

- a. Application of Shin-Etsu LBAM pheromone twist-ties at rate of 250-300 per acre from Spring (late Feb.) through Fall (mid Nov.) per label and efficacy duration requirements to suppress LBAM mating and disrupt population dynamics, creating a protection sphere against LBAM and allowing the Robust IPM program to increase eradication efforts. Scheduled to be supplied by cooperative effort of USDA-APHIS.

5. BIOLOGICAL CONTROLS (Natural predation and parasitism)

- a. Encouragement of natural leaf-roller/LBAM controls through use of parasitoid benign chemicals for control treatments (see 6.b.)

b. Education and study of natural predators and parasitoids (e.g.: insectivorous birds, predatory spiders, earwigs, trichogramma wasps, mini-wasps, tachinid flies, pirate bugs, assassin bugs, damsel bugs, green lacewings).

c. We have a 2 acre beneficial garden next to the nurseries that is well-planted with large variety of predatory/parasitoid insect host plants and has been maintained in this capacity for the past 15 years. It has been surveyed by entomologists for its high level of beneficial insects which enhance controls in our nursery operations in their adjacent location.

6. CHEMICAL TREATMENTS

a. Follow-up treatments to weekly and bi-weekly in-house IPM inspections specific to tortricids/leaf-rollers/LBAM on block to block basis as necessary. Regular log/records kept and reported to Santa Cruz Co. Ag. Commissioner.

b. Alternating use of parasitoid benign products for lepidopterous eggs and larvae. Products used:

-BONIDE HORTICULTURAL OIL /ALL-SEASONS ULTRAFINE OIL (eggs)

-INTREPID (larvae and eggs)

-BACCILLUS THURENGIENSIS (larvae)

-SPINOSAD (larvae)

SUMMARY:

The essential elements of this ROBUST IPM Program for tortricids/leaf-rollers/LBAM have been in place in the above nurseries since June 2007.

Very low incidences for LBAM have been found on the premises (< 1-2 yr.)

Full premise chemical treatments will negate the efficacious merits of the multi-component abilities of this program and highly reduce its effectiveness.

In recognition of the adoption of this formal IPM program, finds of presumptive positive leaf-rollers will be treated immediately by the nurseries on an "infested" and adjacent block only, spot-treatment basis and re-inspection protocol in accordance with the compliance agreement.

Nursery Best Management Practices Program Example

Monitoring:

- If shipments are received from another producer, the loading dock workers do visual inspections to determine the cleanliness of the incoming plants.
 - If a pest is found, the infested plants are separated from the rest of the clean stock. Treatments are applied to ensure further cleanliness.
 - The supplier is notified of their infested shipment.
- 14 acres including office buildings. All growing grounds are monitored, including landscaping.
- An LBAM scouting team is implemented, which includes propagation and field crews.
 - The people who water by hand are integral. They are looking at the plants everyday, and are able to scout for LBAM at the same time.
 - Other than watering and dock inspections, the workers also look at the same plants while fertilizing, weeding, and pruning.
- Other than scouting everyday while performing other duties, more intense pest control missions are done, for example “Focus Days”.
 - “Focus Days” are where the scouting team hunts specifically for LBAM, no pruning or other activities are done at the same time.
 - Scouting two solid days, every 14 days.
 - If the scouting team finds a suspect, the block (300-500 1 gal. plants) is taped off, and spot sprayed before the Program arrives. If spot spray takes place within 1-2 days before LBAM Program inspection, the Program inspectors inspect all but the taped off block. The inspectors return to inspect the block once the re-entry period for the pesticide has subsided.
 - Scouting team includes 5-10 people at least.
 - The scouting team visually inspects plants, focusing on susceptible areas of the plant; such as new growth and interior foliage.

Result: Many people looking at the same plant; very well scouted nursery.

Pest Prevention:

- Many different methods to prevent pest problems are used.
- Nursery workers carry Ziplocs while scouting.
- When likely LBAM suspect is found by the scouting team:
 - Block number, leaf of plant with suspect are included in Ziploc.
 - Or plant information is written down.
 - Ziploc/note is then given to appropriate person for life stage identification to determine appropriate chemical for treatment.
 - The block in question is then thoroughly inspected for more suspects.
 - The block is then chemically treated, spot sprayed.
- Bio-Control:
 - Foster the existence of natural beneficial insects, to include:
 - Spiders
 - Wasps
 - Certain beetles, etc.
 - Possibly introduce further beneficial insects.
- Trapping:
 - LBAM pheromone baited traps placed on perimeter of nursery property.

- 3 LBAM Program issued traps on nursery property. 1 per 5 acres.
- Pheromone bated Orange Tortrix traps placed near LBAM traps. Catches 5 Orange Tortrix to 1 LBAM.
- Yellow sticky traps for general insect population identification.
- Chemical Control (*not LBAM Program required treatments*):
 - Pesticides effective against tortricids.
 - Plants treated within 24-48 hours.
 - Depending on weather: If rainy or windy, don't spray.
 - Many different types of chemicals are used, in order to not build resistance.
 - At times, chemical cocktails are mixed; 2 chemicals for one treatment.
 - Some chemicals used include: Dipel, Orthene, Conserve, Talstar, Intrepid, Mavrik.
 - Intrepid and Oils are used for preventative measures for eggs/larvae.
 - Chemicals are applied according to label rate.
 - Every 75-80 days, the whole nursery is treated with Intrepid, because of its 30 day larvacidal and 14 day ovicidal residual effect.
 - Twist-ties
 - Last year 3500-3600 twist-ties were used on the nursery property. Plans to deploy them again this year.
 - Label rate is 200-300 twist-ties per sq. acre, not to exceed 1,199 per acre per year.
 - One twist-tie on a 2ft. tall stake was placed in 1 gal. plants.
 - Each twist-tied 1gal. plant was placed in a 12ft. grid.
 - The grid was spread across physical barriers (roads, hedges) to continue on to the next grid of nursery plants.
 - Twist-ties were placed on 5 and 15gal. vines. This created variable heights.
 - In propagation hoop houses, twist-ties were tied 12-13ft. apart on pipes horizontally and vertically.
 - Spreading them out like so, created an invisible cloud.
- Chemical Control (*when required by LBAM Program*):
 - Typically Spinosad and All Seasons Oils are used.
 - Chemicals are applied according to label rate.

Result: Treat according to the life stage found. Contact pesticides are not as effective because they are leaf rollers and protect themselves well. However, using preventative pesticides, like Intrepid, they act as a growth inhibitor, causing the insect to prematurely molt; dying within its own shedding skin.

Cultural:

- Pruning and culling plants depends on the plant: If seasonal or deciduous leafy material.
- Pruned plant material and cuttings are disposed of properly.
 - Put into black trash bags, then sealed.
 - Plant material is not exposed to open air.
 - Bags are put in a protected/covered dumpster.
- Weeding is critical, nursery is kept organized and clean so LBAM reservoirs aren't built.
 - Nursery workers manually pull weeds.
 - Also, Round Up, Barricade, or Pre-emergence is sprayed.
- Frost sensitive plants are covered with frost cloth; as an added benefit it prevents oviposition.
- Main lights outside of nursery property are turned off at night, so as to not attract LBAM.

Management and Training:

- Nursery staff are trained on the topics of LBAM.
 - To include, LBAM life stages and how to recognize.
 - Staff are trained to recognize host plants more prone to LBAM.

- When LBAM is found on new host plants, the staff are informed the same day.
- LBAM ID cards provided by the LBAM Program are posted and passed out.
- LBAM Program Inspectors report to office to be briefed on most current nursery concerns and safety hazards once they arrive.
 - Topics include most recent treated areas on property.
 - Which blocks to avoid until re-entry period is clear.
 - And any new host plants LBAM inspectors find within the quarantined county.
- Multiple resources are used for advice and questions for the BMP.
 - For advice on BMPs and what works, communicates with:
 - A group of nurseries.
 - The chemical sales representative from Western Farm once a week.
 - LBAM Program staff.
 - Also use the internet to check the CDFA and USDA websites for recent information and updates on LBAM and BMP in general.
 - Read current literature, to include information on newly released chemicals.

Records:

- Once suspect is found, and host plant is identified; document pest presence and plants affected.
- Pest report is kept for a year at a time. Includes:
 - Date pest found.
 - Host plants more prone to LBAM (Myrica, Penstemon, etc.)
 - Block number.
- Spray log (date, pesticides used, oz./gal.) is kept and sent to the county once a month.
- Plant inventory is recorded in computer with:
 - Plant name.
 - Block number.
 - Date planted.
 - Total number of plants in inventory is constantly updated.

End Note: The scouting team typically only finds one LBAM suspect larva at a time, per block. Multiple finds are rare.