



# Strawberry Spider Mite Management

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### Biological Control

#### Predatory Mites

There are many species of beneficial predatory mites, several of which are mass reared commercially for the management of spider mites. They are predatory in both the nymph and adult stages. Predatory mites are one of the most successful commercially available biological control agents.

#### Biological Control of Spider Mite

- *Phytoseiulus persimilis*
- *Neoseiulus californicus*
- *Neoseiulus Cucumeris*
- Others



*Phytoseiulus persimilis*

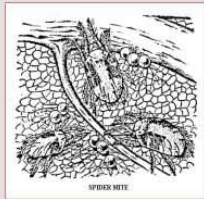
Two-spotted spider mites and many others are the target food of *P. persimilis*, which will consume 5-10 pest adults or up to 20 pest eggs/day.



*Neoseiulus californicus*



*Phytoseiulus persimilis*, a predatory mite (right), next to a two-spotted mite.



Twospotted Spider Mite

Mites, as a group, are the most important arthropod pest species of strawberry. The twospotted spider mite (*Tetranychus urticae* Koch) is the major mite species, followed by another mite species, *Phytonemus pallidus*, the cyclamen mite.

#### Relative Effectiveness of Various Chemicals for Strawberry Mite Control

| Miticide         | Relative Control Rating for Spider Mite |        |        |                            |             |
|------------------|---|--------|--------|----------------------------|-------------|
|                  | Eggs                                    | Larvae | Adults | Safety to Beneficial Mites | Other Pests |
| Agri-Mek 0.15 EC | -                                       | +++    | +++    | +                          | -           |
| Brigade 2 EC     | -                                       | +++    | +++    | -                          | +++         |
| Kelthane         | -                                       | +++    | ++     | -                          | -           |
| Danitol 2.4 EC   | -                                       | +++    | ++     | -                          | ++          |
| Savey 50 WP      | ++++                                    | +++    | -      | ++                         | -           |
| Vendex 50W       | +                                       | ++     | +      | +++                        | -           |
| M-Pede           | -                                       | +      | +      | +                          | +           |
| Acramite 50W     | +++                                     | +++    | +++    | +++                        | -           |

#### Mite Management in Plant Production

- Rotation
- Sanitation
- Isolation
- Traps & monitoring
- Check leaves for mites
- Use mite brushing machine
- Use Berlese funnel
- Use high pressure sprayer
- Use Omite
- Use predatory mites
- Use insect screens
- Sell mite free plants



Mite Applicator

**AG ATTACK**  
http://www.agattack.com

Manual Dispensing

AG ATTACK

YOUTH and the Young at Heart

**AG ATTACK**  
http://www.agattack.com

AG ATTACK

YOUTH and the Young at Heart

Ag Attack  
<http://www.agattack.com>

**Phytoline**

Phytoline

Phytoline

<http://www.syngentabioline.com/>

**Savey 50 WP**

Savey 50 WP

Savey 50 WP

Savey 50 WP

<http://www.gowanco.com>



Red Spider Mite



Strawberry Spider Mite

#### Damage

Mites pierce the epidermis and extract sap from the undersides of leaves. Infested foliage soon assumes a whitish or bronze appearance. Lightly infested leaves have pale blotches or spots showing through the leaf; heavily infested leaves turn completely pale and dry up.



#### Strawberry Mite Management Strategies and Tactics for the Fall

1. Rotate crops to prevent insect & mite pests from becoming established.
2. Keep the environment around planting well maintained and free of broadleaf weeds.
3. Insist on pest free certified and tagged plants.
4. Request spray records from nursery & plant producers.
5. Never take for granted the value of a reputable nursery.
6. Inspect plants by nursery source and lot number for mite stages & mite damage using your 10X hand lens.
7. Plant by source & lot number & keep detailed records of pests, diseases and crop development.
8. Select a suitable miticide and spot treat hot spots.
9. Monitor for mites & spray for coverage.
10. Continue to monitor for mites & order & release predatory mites in the spring when 5% of plants have mites & as plants bloom & fruiting period occurs.

**Useful Web Sites**  
 IPM NCSU - <http://ipm.ncsu.edu>  
 NCSU - [www.cals.ncsu.edu/entomology](http://www.cals.ncsu.edu/entomology)  
 NCSU - [www.ncsu.edu](http://www.ncsu.edu)  
 NCSU - <http://pestdata.ncsu.edu/cropprofiles/>

Identification and monitoring of pests, use of a high pressure sprayer, control, and management are components of IPM. Follow pesticide label for best results.

Final Report on Project Funded by SRSFC for 2005

**Source of Mites and Mite Management in Plant Production and Grower Training for  
Strawberry Plant and Fruit Producers in the Southern Region**

Research and Outreach Proposal

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**OBJECTIVES**

1. Identify the source of infestation for Twospotted Spider Mite in Strawberry production.
2. To examine plants from several nurseries that supply strawberry plants to North Carolina growers.
3. Survey plant nursery producers for mite management practices used and identify needs.
4. Use the information obtained to better manage mites and prevent mite spread and establishment.
5. Produce a fact sheet/poster on sources of mite infestations in strawberry fields and conduct training workshops on Integrated Mite Management.

## JUSTIFICATION AND DESCRIPTION

Strawberries are one of the most important and widely distributed fruit crops in the United States. Approximately 1.4 billion pounds of strawberries are grown annually on 46,740 acres, with an average yield of 29,740 pound per acre.

Twospotted Spider Mite (*Tetranychus urticae* Koch) is the most important pest in U. S. strawberry production (Sorensen, 1983; Aerts M., 1997). Mite presence and damage are the most undiagnosed problem received in the NCSU Plant Disease and Insect Clinic. Mite damage results from the piercing of the epidermis and the extraction of sap from the undersides of leaves. The foliage damaged becomes whitish or bronze in appearance and on heavily infested leaves they turn completely pale and dry up. Yields are lowered due to plant death and loss of plant vigor. Quality is also affected through a reduction in the photosynthetic area and sugar metabolism.

Strawberry production should begin with healthy plants, free of pests. This is the first step to obtain high yields and quality fruit, while avoiding unnecessary use of pesticides. To achieve this is difficult for growers who do not notice the damage or the presence of mites due to their small size. Mites and mite damage on bare root plants and strawberry plugs received from plant nurseries often go undiagnosed when populations are low.

However twospotted spider mite has been reported on over 180 host plants that include cultivated plant species and weeds (Sorensen K.A, 1983). Mites from adjacent plants and sites near strawberry fields may be another local source of mite infestations. Awareness of hosts that

harbor mites and carry them over into the next growing season will indicate what hosts to examine for mites and identify when mites will become a problem.

The procedure we will follow consists of obtaining samples from plant nurseries in North Carolina and out of state and country where growers purchase plants. A sample of plants from each plant producer will be selected. These plants will be taken to the laboratory to detect the presence of mites and their different life stages. Visual inspection with a video camera and over time with berlese funnels will be undertaken to confirm mite presence/absence. Some plants will be kept isolated in cages in a greenhouse and after fifteen days examined for mite stages and damage. This will further confirm the presence or absence of mites. Plant producers will complete a questionnaire on their mite management strategies and specific tactics (including miticides applied) used. The information obtained will be used in identifying needs and improving mite management in plant nurseries. The classes of miticides used by plant producers will help fruit production growers more effectively control mites and help with resistance management. This will delay mites from becoming resistant to specific classes of miticides and their mode of action.

In addition, several strawberry fields will be visited and scouted for mites in each crop phase, taking samples of weeds around plants and fields, which will be examined to detect the presence of mites. This will be done during the growing season and throughout the entire year, even when there are no crops. Results obtained will be an important part of an IPM program that will inform growers about the importance of starting a growing season using plants free of mites and other pests.

A fact sheet/poster will be prepared showing different mites stages and sources of mites and their impact in Strawberry Production. These visual aides along with a power point presentation will be shared at preplant and regional meetings, the Southeast Strawberry EXPO and in electronic newsletters.

Growers will be made aware of the importance of obtaining pest free plants, and the role of host crops and weeds in their fields that serve as a source of mites. With increased understanding of where mites come from, growers will be able to incorporate mite management into their integrated pest management program in strawberry production.

## **METHODS USED**

Mites are the number one problem on strawberries in North Carolina and the United States. Mites often come from plant nurseries in North Carolina and out of state and country where growers purchase plants. A sample of plants from each plant producer was selected. These plants were taken to the laboratory to detect the presence of mites and their different life stages. Visual inspection with a video camera and over time with berlease funnels was undertaken to confirm mite presence/absence. Some plants were kept isolated in cages in a greenhouse and after fifteen days examined for mite stages and damage. Plant producers were questioned on their mite management strategies and specific tactics (including miticides applied) used. The information obtained has been used in identifying needs and improving mite management in plant nurseries. Mites as well as their weed hosts often leads to serious economic losses to strawberry growers in the southern region. In addition, there is an association between alternate

weed hosts and mite populations that provides a carryover for the next growing season and makes control more difficult with the development of resistance to similar classes of miticides. Mites look for shelter and alternative hosts when there are no strawberries and then return to the strawberry plants when a new growing season begins. Hence it is important to know the relationship between strawberry pests and weeds, to identify host weeds for pest and predatory mites and to better understand the links within the agroecosystem and develop tactics that help manage mites in a sustainable system. This will be done by collecting and identifying weed hosts, counting mites in strawberries leaves and weeds and evaluating mites during the growing season and when there are no crops. The knowledge of the major weeds in strawberry fields that are mite hosts will help develop control practices and determine the appropriate time to control weeds and thus eliminate mites. The results obtained will be integrated into an intensive strawberry IPM program throughout the southern states that will reduce the risk of crop loss, provide increased profits and help ensure a safe product for the consuming public in an environmental friendly manner. Hospitalization in February and again in June coupled with a long recovery period inhibited some of my plans and plant inspections. However I was able to overlap 2 crop seasons and obtain relevant results.

## **RESULTS**

The source of mite infestations continues to be from plants obtained from plant nurseries and from nearby weed hosts. Plants obtained through nurseries in North Carolina were found to contain mites. Mites have periodically attacked MPU at NCSU in various stages of plant increase. Even though isolation practices were followed, screened cages were used and frequent

inspections and applications of miticides approved for use in plant production were made, mites and the threat of mite infestations remains of concern to all who grow and market strawberry plants. Plant producers are restricted in that only a few miticides are approved for use in their operations. Also with plants grown in greenhouses they are under constant pressure from mite infestations and population buildup. In fruit production fields we observed little if any rotation of plantings from one year to the next. We also documented in several fields where mite movement to and from weed hosts, that mite populations have been established and hence movement from and to strawberries is common. We have shared these findings at field days, preplant meetings, annual and regional meetings, workshops, agent-training sessions via word, handouts, power point presentations and poster displays. I provided a power point presentation on Organic Insect Management and shared this with county agents in the southeast at the November training workshop in Raleigh. Our recommendations reinforce these sources of infestations and urge both plant and fruit producers to be better stewards of mite management strategies and tactics.

We prepared color insect identification sheets and pocket guides for field use. We also have assembled and displayed a poster display with handouts on the source of mites in strawberry plant and fruit production. In addition we have demonstrated the importance of two-way information exchange on the miticides and practices used and on visual inspection of plants with a 10 X hand lenses. We also encouraged the use and isolation of different plant sources and lots.

## **CONCLUSIONS**

1. Mites can and do move on plants grown in plant nurseries.

2. Mites move into and out of strawberry fields and establish on many alternative host weeds.
3. Communication between plant and fruit producers on mite management is needed.
4. Rotation of miticide classes is encouraged to lessen the chance of mites developing resistance over time.
5. Refer to identification aides, mite management handouts, production guides and pesticide labels for relevant information and application.
6. Encourage further studies on mite management from the plant nursery through harvest and sales of strawberries.

## **IMPACT STATEMENT**

Mites continue to threaten the strawberry industry at all levels. They establish in plant nurseries and on alternate weed hosts around plant and fruit production fields. Rotation and isolation of fields along with removal and control of alternate weed hosts are sound practices to follow. Strawberry growers must maintain constant vigilance and records with plant and leaf inspections for mites and mite stages throughout the year. The timely and effective use and application of several miticide classes should be adhered to if resistance management is to be avoided.

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