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Multi-State Effort to Implement IPM Using Predatory Mites in Strawberries through on-Farm Demonstration Trials and Extension Education

The twospotted spider mite (TSSM), *Tetranychus urticae* Koch, is the key pest affecting commercial strawberry production in Florida as well as other areas of the southeast. Traditionally, control strategies for TSSM have relied on several applications of pesticides during the strawberry production season resulting in high control costs and the development of resistance.

In the strawberry agro-ecosystem, the use of predatory mites provides a feasible option to conventional broad-spectrum pesticides. Thus, the effectiveness of *Phytoseiulus persimilis* Athias-Henriot and *Neoseiulus californicus* McGregor was evaluated for control of TSSM during the 2003-2004 growing season. We studied systems in three different regions of the southeastern U.S., (1) south-central Florida (Citrus and Hillsborough counties), where 95% of the commercial strawberries are grown in Florida; (2) north-central Florida (Alachua and Bradford counties); and (3) South Carolina in the Charleston area. In all three regions we conducted field experiments as well as on-farm demonstrations trials.

Field preparations for the experimental plots were executed according to standard production practices in each location. The field experiments involved evaluation of predatory mites in combination or in contrast with conventional or reduced-risk miticides for control of TSSM. The on-farm demonstrations were conducted against the background of conventional practices of each participating grower, adding predatory mites to the regular regiment.

Central and Southwest Florida

On-farm trials were conducted on two grower farms: Ferris Farm (Citrus County) and Hinton Farm (Hillsborough County). A third farm located at the University of Florida Dover

Research Station (Plant City, Hillsborough County) was also used for evaluation studies. Treatments included two predatory mite species, *P. persimilis* and *N. californicus*. A grower standard program acted as a control for comparisons with predatory mite treated areas.

Predatory mites were released at a rate of 1 predatory mite per strawberry plant when approximately 10% of the leaves were infested with TSSM (motiles and eggs). If populations of TSSM exceeded 10%, a miticide (Acramite or Vendex) was sprayed at the recommended rate. One hundred leaves per treatment, collected randomly from each treatment, were sampled weekly.

Populations of TSSM on all three farms were much lower than expected possibly because of a colder than normal winter. Three weeks after releasing predatory mites on February 26 they became established in the field at Ferris Farm. *Neoseiulus californicus* got established about a week after *P. persimilis*. Both predators performed well (Fig. 1).

At Hinton Farm, *P. persimilis* was released on December 16, while *N. californicus* was not released until February 26 because of ‘spotty’ TSSM infestation in the crop. As a result of this large difference in release dates, there was no means to compare the effectiveness of the two predator species. Control of TSSM by *P. persimilis* was unusually slow (about 10 weeks), possibly due to the colder than usual winter (Fig. 2).

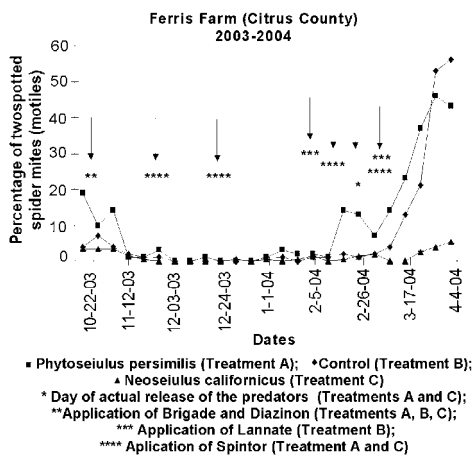


Fig. 1: Ferris Farm

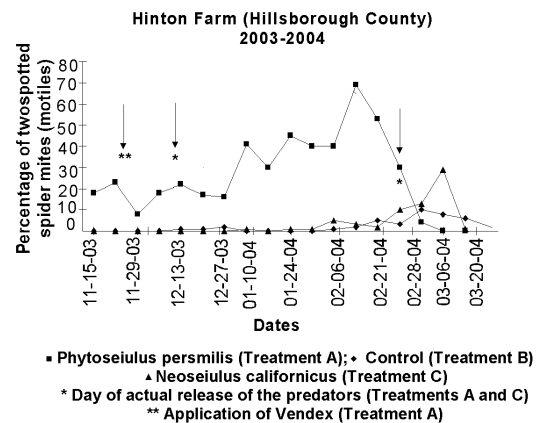


Fig. 2: Hinton Farm

At Dover, the low densities of TSSM resulted in unsatisfactory ecological conditions to make sound inferences about predator effectiveness. *Phytoseiulus persimilis* was released on December 9 and *N. californicus* was released on December 23. Twospotted spider mites were reduced to about 5% level of infestation with both predator species by February 25.

North-Central Florida

Field Experiments. In the field experiments, four treatments: *N. californicus*, *P. persimilis*, Acramite 50 WP and untreated (control) were evaluated using a completely randomized block design with six replicates. Predatory mites were released in the strawberry plots on 12/11/03 and 2/11/04 at a rate of 1 predator per 10 TSSM. Acramite was applied on 12/18/03 and 2/14/04 at the prescribed label rate. The plots were sampled for TSSM once a week starting in November 2003 and finishing in April 2004. One leaflet from six plants selected at random was used for TSSM counts. Yield data were collected weekly from early January to the first week of April by harvesting from the two inside rows of each plot.

The results of the field experiments indicated a significant degree of control by all three treatments when compared with the untreated control. Acramite and *N. californicus* were significantly better than *P. persimilis* in reducing populations of TSSM. Quantification of both TSSM motiles and eggs showed this trend (Fig. 3).

Significantly higher yields were recorded in the plots treated with *N. californicus* compared with plots treated with *P. persimilis* and untreated plots during the late season (Fig. 4). No significant differences were recorded between Acramite and *N. californicus* treated plots.

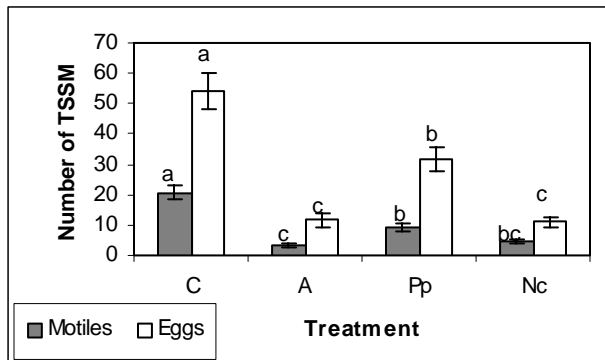


Fig. 3. Response of TSSM to *N. californicus* (Nc), *P. persimilis* (Pp), Acramite (A) and untreated plots (C) (2003).

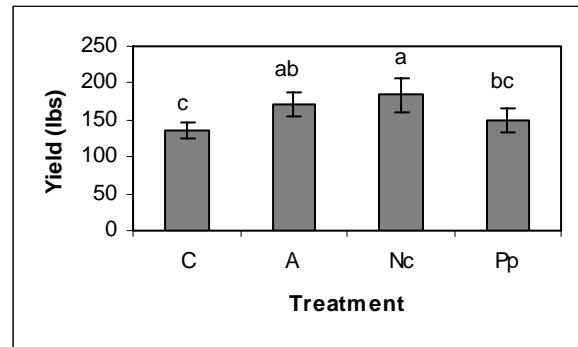


Fig. 4. Total yield collected from strawberry plots treated with *N. californicus* (Nc), *P. persimilis* (Pp), Acramite (A), and control (C).

On- Farm Demonstration. An on-farm demonstration trial was established in Bradford County. Farm plots were sampled weekly for TSSM using the same methods as described above. Three treatments were evaluated: *N. californicus*, *P. persimilis*, and an untreated (control). *Neoseiulus californicus* and *P. persimilis* were released in February 18, 2004.

The results were inconclusive because populations of TSSM were too low to document any treatment differences. Neither *N. californicus* nor *P. persimilis* were recovered in any samplings.

Clemson University Coastal and Research Education Center, Charleston, SC.

Strawberry research plots were established at the Clemson University Coastal and Research Education Center (CREC), Charleston, South Carolina in October 2003. A randomized complete blocked design with three treatments and four replicates were used in this study. Treatments included *P. persimilis*, *N. californicus* and a control. Insecticides and miticides were not applied to the plots throughout the duration of the trial. Predatory mites were released on April 5 and 6, 2004, about one week after the 5% threshold was reached. Two thousand (2000) predatory mites of each species were released at a rate of 1 mite per plant. Data collection started November 28, 2003 and continued weekly until May 2004. Twenty five (25) leaflets were collected from different sampling sites, and were examined for the presence or absences of crawlers and eggs of TSSM and predatory mites. Yield data was collected weekly from a 5 ft section of a row in each plot for a period of 7 weeks.

In addition to the research plots, four on-farm IPM plots were established on 2 local strawberry farms (Boone Hall Farm and C Farm) as part of the project. All cultural practices were carried out by the growers. A record of all chemical applications to the IPM plots was kept. Predatory mites were released once on both farms at the same threshold and rate as in the experimental plots. Weekly data collection in these plots started in late November and continued until May 2004. One hundred leaflets were collected and examined for the presence or absences of eggs and crawlers of TSSM and predatory mites. Yield data were not collected from the on-farm plots.

Neoseiulus californicus populations built up to higher levels more quickly in the experimental plots at the University station (Figs. 5 and 6) and in both on-farm plots compared with *P. persimilis* populations. There was a lower population of TSSM at Boone Hall Farm in both of the on-farm IPM managed plots, which was probably due to the combined action of the predatory mites and Acramite, which was applied at one-half the recommended rate. Growers made an average of 7 miticide applications to their fields compared with 3 miticide applications in the IPM plots. The miticide applications in the IPM plots were made before the release of the predatory mites.

There were no statistical yield differences between treated and untreated plots at CREC. This was probably due to the mobility of the predatory mites, which may have kept the TSSM population from reaching yield reducing levels in the control plots.

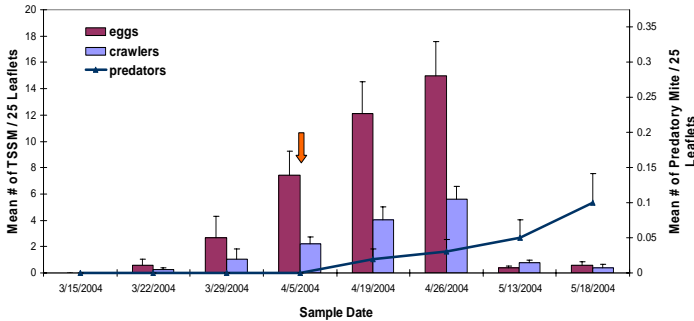


Fig. 5: Response of TSSM to *P. persimilis* at CREC. Arrow indicates the release date of the predators

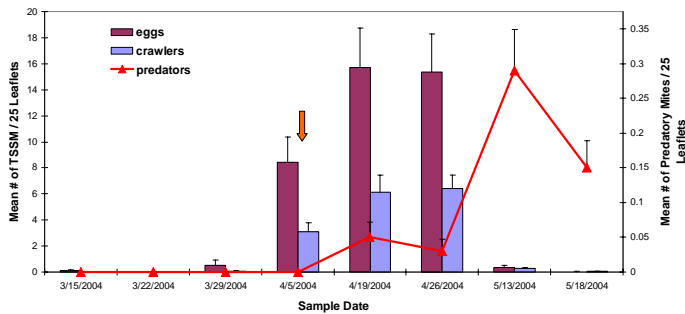


Fig. 6: Response of TSSM to *N. californicus* at CREC. Arrow indicates the release date of the predators.

Outreach

Our on-farm demonstrations served as a model for a selected number of strawberry growers. In addition, our data were presented at the Florida Entomological Society meeting to crop consultants, scientists and other agricultural personnel. Similar information will be presented at the Entomological Society of America national meeting in November, 2004. This report will be uploaded to the fruit and vegetable entomology web-page <http://FruitnVegIPM.ifas.ufl.edu/>. Therefore, growers with internet access will be able to read preliminary results from our 2003-2004 activities. Finally, an extension paper will be submitted to a magazine with a national reputation.

Conclusion

Thus far, our research and extension programs in North Florida and South Carolina have indicated that *N. californicus* has great potential for suppressing TSSM activities in strawberry IPM programs in southeastern United States. The fact that the highest yields were obtained from *N. californicus* plots in north Florida is significant and warrants further research. In central and southwestern Florida, direct comparison of predator performance could not be made because of the difference between release dates. However, it appears that both predators performed well.

Our reduced-risk miticide (Acramite) performed as well as the predatory mites that were released. Also, it appears that Acramite is compatible with early releases of predatory mites.