

RUTGERS COOPERATIVE EXTENSION

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NEW JERSEY AGRICULTURAL EXPERIMENT STATION

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# **1999 Annual Report**

## **Vegetable**

### **Integrated Pest Management**

#### **(IPM) Program**

**Joseph Ingerson-Mahar**

*Vegetable IPM Coordinator*

**Kristian E. Holmstrom**

*IPM Program Associate*

**Sarah D. Walker**

*IPM Program Associate*

**Dr. Wesley Kline**

*Agricultural Agent of Cumberland County*

**Peter Nitzsche**

*Agricultural Agent of Morris County*

website: <http://aesop.rutgers.edu/~hamilton/IPM.htm>

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## **MISSION STATEMENT**

The Vegetable IPM Program is dedicated to developing and improving integrated pest management techniques and practices that will enhance vegetable production in the state of New Jersey. Program objectives are accomplished through the development and delivery of pest monitoring and field scouting programs, grant-funded and sponsored research, and educational outreach.

## **IMPACT AND SUCCESS STORIES**

### **Pumpkin IPM Trial**

In 1999, a pumpkin IPM trial was conducted at the Snyder Research Farm in Pittstown. Pumpkin varietal resistance and field scouting for powdery mildew were utilized in an attempt to reduce fungicide applications while maintaining acceptable yields. In this trial, powdery mildew was detected at very low levels by field scouting, allowing the use of an action threshold for the initiation of a fungicide schedule. The use of the action threshold delayed initiation of the fungicide program by two weeks over the standard recommendation. The powdery mildew tolerant variety reached the action threshold one week later than the standard variety, reducing the fungicide program by one additional spray. Yield and crop quality were maintained in treatments where powdery mildew was scouted. While the 1999 growing season was exceptionally dry, the combination of disease scouting and varietal resistance may result in savings of as much as \$63 per acre in fungicides. Further work in 2000 will validate the 1999 results. At this time, scouting for powdery mildew in pumpkins appears to be a viable approach to disease control in this crop. In addition to trials on the research farm, grower cooperators will be enlisted to validate this approach to pest management on commercial farms.

### **Disease Forecasting Program**

Disease forecasting programs determine the potential for infection of a specific crop by a fungal disease based on an accumulation of environmental conditions favorable for the development of that disease. Disease forecasting programs allow growers to treat fields based on the likelihood of infection rather than on a calendar based schedule, thereby optimizing the use of pesticides. Disease forecasting information was collected and processed by RCE IPM staff from weather stations in southern New Jersey to provide disease forecasts for 27 tomato and white potato growers impacting 3400 acres. For the 1999 season, these programs resulted in reductions of as many as 4 to 8 fungicide treatments per acre. TomCast recommended 7 fungicide applications for the control of foliar diseases and anthracnose on processing tomatoes compared to 15 fungicide applications needed for growers following a calendar (7-day schedule) program. Foliar disease and anthracnose incidence was light in participating growers fields, and participants considered the program beneficial.

The BliteCast fax report for white potatoes delivered to 25 industry people including 12 potato growers with 2200 acres. For white potatoes, BliteCast recommended 6 fungicide applications for the control of late blight compared to 10 fungicide applications needed for growers following a calendar based (7-day schedule) program. No late blight was detected in the region, and the program was considered a success in 1999. The programs were supported through grower and industry funds.

In the northern counties the grant-funded program for disease forecasting for fresh-market tomatoes was transitioned to a grower supported program maintained by the RCE IPM Program. In northern New Jersey, two commercial tomato growers with approximately 10 total acres and the Snyder Research Farm purchased site subscriptions from the weather reporting service SkyBit. Environmental sensing

information provided by SkyBit eliminated the need for the RCE Vegetable IPM Program to hire additional personnel to collect field data. SkyBit forwarded daily environmental information to the RCE Pest Management Office for processing. The resultant information was then distributed twice weekly in the form of TomCast disease severity values to the three parties. In 1999, the TomCast program recommended 8-9 fungicide applications depending on location. A 7-10 day calendar based schedule would have resulted in 14-19 fungicide applications. The successful transition of tomato disease forecasting information on this scale indicates that this information can be made available to a greater number of growers and processors as part of the Tomato IPM Program if SkyBit does not opt to provide disease severity values directly to their clients.

### **Program Support of Private Consultants**

Private consultant scouted acreage continues to increase throughout the state, with most growth occurring in the southern counties. The RCE Vegetable IPM Program conducted two field scout training sessions for two private scouts at the request of one company. Blacklight trapping services (information collected and faxed twice a week) were conducted for another consultant. In the Central counties, RCE personnel cooperated with the private consultant to provide blacklight and scouting services to growers in those counties. As a result, RCE was able to obtain blacklight trap information without the cost of hiring summer help (at a cost of approximately \$5000) and the private consultant was able to provide necessary services to growers with equipment that otherwise would have been prohibitively expensive (19 blacklight traps at a cost of \$550 per trap).

### **Spinach and Greens Trapping Project**

A second year of a trapping study for insects of fall processing spinach and greens was conducted in cooperation with the local processor. The project was initiated and supported by the processor, and the information generated from 3 farms was utilized on approximately 1200 acres of spinach and greens. Trap results from 1999 indicated that as many as 4 fewer insecticide treatments for beet armyworm were needed compared to 1998 to control this pest in fall spinach. In many fields, no insecticide treatments for this pest were needed due to the low population levels recorded in both the fields and the traps. Because this insect pest is primarily migratory, drastic year-to-year variations occur. Trapping for beet armyworm looks promising as a survey tool to inform growers and industry field personnel when population levels are high and more intensive field monitoring is needed. The traps have the potential, with further research, to reduce the amount of scouting time needed to determine beet armyworm populations in the field and improve timing of control measures. A few traps have the potential to provide area wide information that the industry can use to more efficiently monitor this pest.

### **Spatial Mapping Vegetable Pest Populations**

The European corn borer (ECB) and corn earworm (CEW) are pests of many vegetable crops including sweet corn, snap and lima beans, peppers, tomatoes, lettuce, and white potatoes. In New Jersey, these crops account for over 25,000 acres and are valued at approximately \$91,700,000. Growers annually apply approximately \$862,000 in insecticides to control these pests on vegetable crops. Weekly publication of spatial maps of ECB and CEW populations was initiated in 1999 in an effort to better inform the agricultural community of the activity of these pests. Posting of this new format on the RCE website allowed those with web access to view pest population maps in as little as one day after the sample period. Growers and industry personnel are now able to access weekly population maps and quickly determine what the level of ECB or CEW activity is in their area. This information allows them to treat host crops based on an observed economic threat rather than on a calendar basis. New Jersey is in the lead in integrating insect trapping and GPS/GIS technologies for the purpose disseminating time sensitive pest

information. An extensive IPM trap network, combined with high level expertise from the Grant F. Walton Center for Remote Sensing and Special Analysis (CRSSA) have allowed the RCE Vegetable IPM Program to create and publish spatial pest maps whose quality and usefulness exceed others produced in the Northeast and Mid-Atlantic regions.

### **Potato Growers' Adoption of IPM Practices**

A survey of white potato growers on adoption of IPM practices indicates that 60% of the growers are at the basic or established level of IPM adoption as defined by the National Potato Council in their IPM Protocol. Growers from 10 other states averaged an adoption level in the category of established for IPM. The IPM Protocol survey provided an excellent educational tool for comparing among states IPM practices that were developed at the national level by the industry. Through this survey areas of weakness in IPM practices have been determined that can serve as a focus for future potato research and education projects.

### **Cook College Summer Internships**

Four college students were trained in IPM techniques through a cooperative effort with the Cook College Office of Cooperative Education. The Cooperative Education students were able to acquire three college credits each for their work experience in the IPM Program. In addition to completing the normal job duties for a field technician, the students completed daily logs and a final report to meet the requirements established by the faculty sponsors and supervisors. One student participated in a study with Dr. Wesley Kline and Dr. Gerald Ghidui comparing trapping techniques for onion maggot in southern New Jersey. The student paper from this study was delivered by Dr. Kline at the 2000 Annual Meeting of the Northeast Region American Society for Horticultural Science and a seminar will be given by the student in March 2000.

### **Pest Alerts**

Through weekly monitoring activities, the RCE Vegetable IPM Program is able to provide advanced warning of significant pest occurrences. While warnings to individual growers regarding specific pest occurrences are commonplace, occasionally regional warnings are warranted. Notable alerts in 1999 included one for stinkbugs on tomatoes. This alert was published in the July 7, 1999 issue of the Plant and Pest Advisory Vegetable Crops edition. The New Jersey Tomato Council (NJTC), representing over 20 growers with more than 250 staked tomato acres, was also alerted directly as to a significant increase in stinkbug activity. The warning preceded an increase in fruit damage by two weeks as reported by the NJTC. This pest alert provided growers with advanced warning of a significant pest outbreak that had the potential for reducing fruit quality and yield in an industry of approximately 4200 acres valued at over \$27,000,000.

A second significant alert was issued in the August 18, 1999 issue of the Plant and Pest Advisory Vegetable Crops edition after a low pressure system swept up the coast resulting in a major migratory influx of corn earworm adults. Corn earworm is a pest that damages sweet corn, beans, peppers, tomatoes, and lettuce crops. These alerts allow the agricultural community to alter management strategies in time to reduce potential crop losses on crops such as sweet corn, white potatoes, snap and lima beans, peppers and tomatoes having a total value of approximately \$91,727,000.

### **Bell Pepper Integrated Crop and Pest Management Project**

The New Jersey Agricultural Experiment Station (NJAES) funded a three-year project to develop a farm ready bell pepper integrated crop and pest management program for New Jersey. The pepper project was initiated at the request of vegetable growers who attended the 1997 Rutgers Agricultural Research and

Extension Center Advisory Committee meeting. A pepper grower advisory committee was formed at the beginning of the project to prioritize funding. Each year the members of the project research team (including RCE vegetable specialists, agents, and IPM program associates) have reported on their results at the vegetable growers meeting and have published their results in state and regional publications. The team also met with the pepper grower advisory committee each year to review results and discuss ideas for the coming season.

Over the three years of the project the research team investigated a number of pepper crop and pest problems. Project highlights included the determination of the best disease resistant varieties for managing phytophthora and bacterial leaf spot, the testing of pheromone traps that can be used by growers to monitor certain pepper pests, and a number of projects to improve management of the primary insect pest, European corn borer. The culmination of the three year project was a full day pepper workshop held at the 2000 New Jersey Annual Vegetable Meeting. Each participant received a copy of the 'Bell Pepper Integrated Crop and Pest Management Notebook' which includes research results and information requested by growers on soil fertility, irrigation, and post harvest handling. This notebook is a reference book which growers can pull off the shelf to answer questions in more detail than what is in the Rutgers Commercial Vegetable Production Guide.

Despite the end of the project funding, the pepper grower advisory committee will continue to meet on a yearly basis with extension personnel to help direct future pepper research and extension activities. The success of the pepper project, both with the research results and with the grower involvement, has provided a model format that can be used for crop and pest management projects for other commodities in the future.

## **PROGRAM DELIVERY**

### **Blacklight Trapping**

A statewide network of eighty blacklight traps was maintained for monitoring the levels of several agricultural insect pests, including European corn borer (ECB) and corn earworm (CEW). ECB and CEW are important pests of vegetable crops including sweet corn, lettuce, snap and lima beans, tomatoes, white potatoes, and peppers. Blacklight trap counts provide information for growers to forecast pest problems and improve the timing of pest control treatments. Growers in the blacklight trap and/or scouting programs received twice weekly reports of pest levels at their trap location as well as one to three nearby trap locations. Grower and industry (including chemical companies, processors, and private consultants) support to fund summer field scout hours and mileage was obtained at a cost of \$250 per blacklight trap.

Information from the blacklight trap network extends beyond the individual growers and industry program participants through the weekly statewide Vegetable Plant and Pest Advisory newsletter. In 1999, in cooperation with Marilyn Hughes at the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA), data from the blacklight trap network was compiled and presented in the newsletter as weekly pest distribution maps. The maps were produced using Global Positioning Systems (GPS) and Geographic Information Systems (GIS) technologies. The maps provided a dynamic visual picture of local and regional pest levels that growers and other interested parties could utilize to help improve pest control. As well as being published in the Plant and Pest Advisory, pest maps were posted at the CRSSA and RCE websites.

### **Field Scouting**

The Vegetable IPM Program actively supports the development of private consulting to deliver field scouting to farmers. At this time two independent companies and one chemical company are offering pest management services in southern and central counties. IPM personnel collaborate with the consultants by providing trap information in addition to sharing insect traps in return for trap data. In areas where consultants are not available, the Vegetable IPM Program hired field scouts. The primary vegetable crops scouted were sweet corn, tomatoes, peppers, eggplant, and cole crops. In 1999, 24 growers and 842 acres were directly scouted by RCE IPM personnel for these crops. An additional 35,800 acres were impacted by Vegetable IPM Program activities through the use of traps, and other IPM information provided to the agricultural community via newsletters, CRSSA and RCE websites, and IPM Program supported crop consultants.

### **Disease Forecasting Program**

Disease forecasting program information was provided to growers for timing fungicide treatments for certain diseases of tomatoes and white potatoes. The programs were supported through grower and industry funds. In the southern counties a cooperative effort with the RCE Vegetable Pathologist resulted in disease forecasting programs for white potatoes and processing tomatoes. The BliteCast fax report was delivered to 25 industry people including 12 potato growers with 2200 acres. The TomCast fax report for processing tomatoes was provided to 2 processing tomato companies who forwarded the report to 15 growers with approximately 1200 acres. In the northern counties the grant-funded disease forecasting program for fresh-market tomatoes was transitioned to a grower supported program maintained by the RCE IPM program. The weather station data was collected privately through a grower contract with SkyBit. The SkyBit data was transcribed and provided twice weekly to three growers who were participants in the Rutgers IPM scouting program.

## RESEARCH PROJECTS

### Grant Funded Projects: External

1. Development of an IPM Poster for Farm Markets – J. Ingerson-Mahar, K. E. Holmstrom, S. D. Walker, P. J. Nitzsche, and M. Infante, funded by Northeast Center for Rural Development - \$1,000.
2. Development of Crop Profiles for Asparagus, Spinach and Alfalfa – J. Ingerson-Mahar, P. Hastings and G. C. Hamilton, funded by Special Research Grants- Pest Management Alternatives, USDA - \$12,000.

### Grant Funded Projects: Internal

The third year of the three year grant from the New Jersey Agricultural Experiment Station (NJAES) for the Pepper Integrated Crop and Pest Management Project was completed. The following studies were funded for the 1999 season:

1. Effect of planting date on insect infestations in bell peppers (conducted at the Rutgers Agricultural Research and Extension Center- RAREC) - G. C. Hamilton, J. Ingerson-Mahar, W. Kline, S. D. Walker, and G. M. Ghidui.
2. Comparison of pheromone traps vs. blacklight traps for monitoring European corn borer, corn earworm, fall armyworm, and beet armyworm in bell peppers (10 farms: Gloucester, Cumberland, Salem, Atlantic counties) - S. D. Walker, and W. Kline.
3. Effect of sweet corn on corn borer infestations in peppers (RAREC) - G. M. Ghidui.
4. Evaluation of bacterial leaf spot (BLS) resistant bell peppers (RAREC) - S. A. Johnston, and W. Kline.
5. Evaluation of phytophthora resistant peppers, three experiments: phytophthora inoculated field, naturally phytophthora infested field, and non-phytophthora infested field. (RAREC; 1 farm) - S. A. Johnston, W. Kline, and S. A. Garrison.
6. The relationship between corn borer trap catches and larval infestations in unsprayed bell peppers - S. D. Walker, K. E. Holmstrom, T. J. Boucher.
7. Evaluation of striped vs. one-color plastic mulches for bell pepper - M. Infante, S. A. Garrison, and R. Vanvranken.
8. Assessing stinkbug population levels and damage potential on fresh market staked tomatoes – K. E. Holmstrom, S. D. Walker, W. Kline, P. J. Nitzsche, and G. M. Ghidui.

A \$5000 NJAES grant was provided to the Vegetable IPM Working Group for integrated pest management projects. Proposals were submitted to the working group at the spring meeting. The following projects were funded for the 1999 season.

1. Surveying wireworm populations to determine the reliability of bait trapping to predict damage in white potato (three-year project) - M. Henninger, G. M. Ghidui, and J. Ingerson-Mahar (\$532 first year)
2. Effect of European corn borer damage on potato yields in grower fields - M. Henninger, G. M. Ghidui, S. D. Walker, and W. Kline (\$1352)
3. Relationship between ECB infestation and yield loss in Superior potatoes - G. M. Ghidui (\$1000)
4. Trial project to develop a comprehensive pumpkin IPM program for NJ growers - K. E. Holmstrom, P. J. Nitzsche, W. Cowgill, J. Ingerson-Mahar, and S. A. Johnston (\$620)



## **Industry Sponsored Projects**

1. The White Potato Association, Helena Chemical Company, and Ag-Chem, Inc. provided financial support for the Potato IPM Fax (\$1500). The Potato IPM Fax provided twice weekly disease and insect information and recommendations to potato growers and industry.
2. Two tomato processing companies provided financial support for the TomCast disease forecasting program (\$1,000).
3. Ag-Chem, Inc. sponsored a project in sweet potatoes to determine the cause of a particular kind of damage occurring to the roots. Ag-Chem purchased insect traps and pheromones to support this study (\$300).
4. Seabrook Bros. and Sons supported the IPM program through the purchasing of blacklight trap services for selected snap and lima bean growers. In 1999 the IPM program provided twice weekly trap monitoring and data faxing for 5 trap locations at a cost of \$1,250. The data was utilized for 2,800 acres of snap and lima beans contracts.
5. Seabrook Bros and Sons provided \$400 to support the study of insect trapping and scouting techniques for fall greens and spinach, impacting 1300 acres spinach.
6. The At-Harvest Stalk Nitrogen test (ASNT) was demonstrated on 30 farms in cooperation with Dr. Joseph Heckman, who provided financial support (\$10/sample).
7. A comparative study of onion maggot trapping techniques was completed by a summer field scout in the Cooperative Education program under the guidance of Wes Kline.
8. The NJAES sponsored the collaboration of Marilyn Hughes at the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA) with the IPM Program to produce the weekly GPS/GIS spatial pest distribution maps that were published in the Vegetable Plant and Pest Advisory.
9. NJAES sponsored the collaboration of Marilyn Hughes at the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA) with K. E. Holmstrom, S. D. Walker, W. Kline and J. Ingerson-Mahar to investigate historical CEW and ECB population data using GPS/GIS technologies.
10. New Jersey IPM Pumpkin Trial 1999 - Insect and Disease Scouting – W. Cowgill, M. Maletta, K. E. Holmstrom, P. J. Nitzsche, T. Hausmann, and S. A. Johnston (\$1500) Snyder Farm local needs grant and Hunterdon Co. Board of Chosen Freeholders.
11. Evaluation of different white, black, and silver plastic mulches for pepper yields, soil temperature, and insect populations. (\$2600) VGANJ and (\$500) Cumberland County Board of Chosen Freeholders through Wesley Kline.

## **EDUCATIONAL OUTREACH**

### **IPM Training**

Two three-hour field scout IPM training sessions in pepper, tomato and potato production and pest management were conducted by Joe Ingerson-Mahar, Wes Kline, and Sally Walker. Five field scouts (3 Rutgers and 2 industry field scouts), attended both sessions held in Cumberland County. In addition, five RCE field scouts and one private consultant were provided individualized training periodically throughout the field season as part of the scouting and blacklight trap programs offered to growers. Four of these scouts completed the requirements of the Cook College Cooperative Education Program for receiving college credit for their summer work with the IPM program.

One farmer was trained in the TomCast disease forecasting program. The weather station information and TomCast program were used for forecasting rust in asparagus. The TomCast program was effective in reducing rust infections with a minimum of pesticide applications compared to a calendar schedule. The one field in which the spray schedule predicted by the TomCast program was not followed was severely infected with rust.

Training on the use of scouting and pheromone traps for monitoring European corn borer in peppers and sweet corn was provided on one farm. At the request of the grower, a high school science project was developed in which the number of corn borer egg masses and damage were compared to the adult trap counts.

Support of four private/industry based consultants was provided in the form of trapping services, scouting assistance and technical expertise, enabling them to provide optimal services to their clientele.

### **Publications: Regional**

1. Holmstrom, K. E., Walker, S. D., Nitzsche, P. J., Ghidui, G., and W. Kline. (*in press*) Assessing Stinkbug Population Levels and Damage Potential on Fresh Market Staked Tomatoes in NJ. Proceedings of the 29<sup>th</sup> Annual Meeting of the Mid-Atlantic Vegetable Workers Conference.
2. Infante-Casella, M. L., Garrison, S. A., and R. VanVranken. (*in press*) Evaluation of different white, black, and silver plastic mulches for pepper yields, soil temperature, and insect populations. Proceedings of the 29<sup>th</sup> Annual Meeting of the Mid-Atlantic Vegetable Workers Conference.
3. Kline, W., and S. D. Walker (*in press*) Vegetable Integrated Pest Management Practices in NJ. Chapter in *Vegetable Crop Budgets Manual*.
4. Walker, S.D., Holmstrom, K.E., and G. Ghidui. (*in press*) Occasional Insect and Mite Pests Specific to Southern States in the Region. Chapter in the *Northeast Pepper IPM Manual*.
5. Ingerson-Mahar, J. The Importance of Controlling Weeds. Pennsylvania Vegetable Gazette, Vol. 13 No. 11. Article reprinted from 9/29/99 issue of the Plant and Pest Advisory Vegetable Crop Edition.
6. Walker, S. D., Kline, W., and K. E. Holmstrom 1998. Fall Processing Spinach and Greens Trapping Study. Proceedings of the 29<sup>th</sup> Annual Meeting of the Mid-Atlantic Vegetable Workers Conference.

### **Publications: State**

1. Hamilton, G. C., Holmstrom, K. E., and S. D. Walker 1999. 1999 Vegetable Integrated Pest Management Delivery Program. RCE Fact Sheet IS005.
2. Holmstrom, K.E., Walker, S.D., Nitzsche, P.J., Ghidui, G., and W. Kline 1999. Assessing Stinkbug Population Levels and Damage Potential on Fresh Market Staked Tomatoes in NJ. Proceedings of the Vegetable Growers Association of New Jersey Annual Meeting
3. Holmstrom K. E., and S. D. Walker 1999. Vegetable IPM Update. 26 articles in the *1999 RCE Plant and Pest Advisory Vegetable Crops Edition*.
4. 1999 RCE Plant and Pest Advisory Vegetable Crops Edition feature articles:
  - a. Vegetable IPM at Rutgers. J. Ingerson-Mahar. 4/14/99.
  - b. Implementing IPM: Field Scouts are Key. J. Ingerson-Mahar, S. D. Walker, K. E. Holmstrom. 4/21/99.
  - c. Who are IPM Providers? J. Ingerson-Mahar. 5/5/99.
  - d. Scouting Tips: Field Identification of Pepper Foliage and Fruit Worm Pests. S. D. Walker, K. E. Holmstrom. 8/4/99.
  - e. Sources of Pest Management Equipment and Supplies. S. D. Walker. 3/31/99.
  - f. The Importance of Controlling Weeds. J. Ingerson-Mahar 9/29/99.
5. Ingerson-Mahar, J., Hamilton, G.C., Walker, S. D., and K. E. Holmstrom 1999. New Jersey Vegetable IPM Guidelines.
6. Walker, S.D., Hamilton, G.C., Kline, W., Ghidui, G., and K. E. Holmstrom 1999. The Effect of Planting Date on Insect Infestations in Bell Peppers. Proceedings of the New Jersey Vegetable Growers Association Annual Meeting.
7. Walker, S.D., and W. Kline 1999. European Corn Borer Monitoring Program for White Potatoes. New Jersey Annual Vegetable Meeting Proceedings.

## **Presentations: National or Regional**

1. Cowgill, W. P., Hausmann, T., Holmstrom, K. E., Maletta, M., Nitzsche, P. J., and S. A. Johnston. Results of the New Jersey IPM pumpkin trial. Mid-Atlantic Vegetable Workers Conference. Newark, DE, November 3-4, 1999.
2. Holmstrom, K. E., Walker, S. D., Hughes, M. G., and G. C. Hamilton. Spatial mapping of European corn borer and corn earworm populations in New Jersey. Poster Presentation. National Meeting of the Entomological Society of America. Atlanta, GA, December 13-15, 1999.
3. Holmstrom, K. E., Walker, S. D., Nitzsche, P. J., Ghidui, G., and W. Kline. Assessing stinkbug population levels and damage potential on fresh market staked tomatoes. Mid-Atlantic Vegetable Workers Conference. Newark, DE, November 3-4, 1999.
4. Infante-Casella, M. L., Garrison, S. A., and R. VanVranken. Evaluation of different white, black, and silver plastic mulches for pepper yields, soil temperature, and insect populations. Mid-Atlantic Vegetable Workers Conference. Newark, DE, November 3-4, 1999.
5. Ingerson-Mahar, J. Update on sweet potato study and wireworm management in potatoes. Mid-Atlantic Vegetable Workers Conference. Newark, DE, November 3-4, 1999.
6. Ingerson-Mahar, J. The morphology of carabid feeding habits. National Meeting of the Entomological Society of America. Atlanta, GA, December 13-15, 1999.
7. Walker, S. D., K. E. Holmstrom, and T. J. Boucher. The relationship between trap catches and larval infestations in unsprayed bell peppers. Mid-Atlantic Vegetable Workers Conference. Newark, DE, November 3-4, 1999.
8. Walker, S. D. Scouting and trapping techniques for spinach and greens. Mid-Atlantic Spinach and Greens Production Workshop. Upper Deerfield, NJ, December 14, 1999.

## **Presentations: State**

1. Holmstrom, K. E. Update on the activities of the 1999 RCE vegetable IPM program. North Jersey Vegetable Growers Meeting. Pittstown, NJ, February 18, 1999.
2. Holmstrom, K. E. Using pheromone and blacklight traps. Northeast Organic Farming Association (NOFA) of NJ twilight meeting. Monmouth County, NJ, July 12, 1999.
3. Holmstrom, K. E. IPM strategies for three major vegetable crops in New Jersey. Undergraduate lecture: "Topics in Sustainable Agriculture". Cook College, NJ, October 27, 1999.
4. Holmstrom, K. E., Walker, S. D., Nitzsche, P. J., Ghidui, G., and W. Kline. Assessing stinkbug population levels and damage potential on fresh market staked tomatoes in NJ. Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ, January 19-21, 1999.
5. Ingerson-Mahar, J. Overview of the RCE vegetable IPM program. NOFA twilight meeting. Monmouth County, NJ, July 12, 1999.
6. Ingerson-Mahar, J. Update on sweet potato study and wireworm management in potatoes. South Jersey Vegetable Twilight Meeting. Upper Deerfield, NJ, October 18, 1999.
7. Ingerson-Mahar, J. and S.D. Walker. National potato IPM protocol survey. NJ Potato Association Meeting. Upper Deerfield, NJ, November 3, 1999.
9. Walker, S. D., and K. E. Holmstrom. Vegetable IPM program description display board with supporting materials presented at the trade show of the Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ, January 19-21, 1999.
8. Walker, S. D., and W. Kline. European corn borer monitoring program for white potatoes. Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ, January 19-21, 1999.
9. Walker, S.D., Hamilton, G.C., Kline, W., Ghidui, G., and K. E. Holmstrom. Effect of planting date and fruit size on insect infestations in bell peppers. Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ, January 19-21, 1999.

10. Walker, S. D. Pheromone trap catches and worm infestations for pepper IPM. Gloucester County Vegetable Growers Meeting. Clayton, NJ, February 4, 1999.
11. Walker, S. D. 1998 pepper IPM project research. Pepper Grower Advisory Group Meeting. Upper Deerfield, NJ, February 16, 1999.
12. Walker, S. D. Summary of the potato IPM program. NJ Potato Association Meeting. Elmer, NJ, March 9, 1999.
13. Walker, S. D. Update on the pepper planting date study at RAREC. South Jersey Vegetable Twilight Meeting. Upper Deerfield, NJ, August 16, 1999.
14. Walker, S. D. Interviewed on New Jersey Network News regarding spinach production. Conducted October 5, 1999 in Burlington County, NJ, aired October 14, 1999.

### **Meetings Organized**

1. Pepper Grower Advisory Meeting. W. Kline and S.D. Walker. Upper Deerfield, NJ, January 16, 1999.
2. Symposium: Generalist Predators in Agriculture; Historical Perspectives, and Future Applications. Ingerson-Mahar and J. Hough-Goldstein. National Meeting of the Entomological Society of America. Atlanta, GA. December 13-15, 1999.

## **COOPERATORS**

### **Rutgers Cooperative Extension**

1. Richard Carpenito – RCE IPM field technician
2. Jessica Clarke – RCE IPM field technician
3. Winfred Cowgill – RCE of Hunterdon County
4. Chris Dugan – RCE IPM field technician
5. Erin Egan – RCE IPM field technician
6. Stephen Garrison – RCE Specialist in Plant Science
7. Gerald M. Ghidui – RCE Specialist in Entomology
8. Scott Haag – RCE IPM field technician
9. Tara Hausmann – Research Assistant, Rutgers Snyder Research Farm
10. Melvin Henninger – RCE Specialist in Plant Science
11. Marilyn G. Hughes – Program Associate – Grant F. Walton CRSSA
12. Michelle Infante – RCE of Gloucester County
13. Stephen A. Johnston – RCE Specialist in Plant Pathology
14. Wesley Kline – RCE of Cumberland County
15. Martha Maletta – Research Associate – RCE of Hunterdon County
16. Peter J. Nitzsche – RCE of Morris County
17. Richard Vanvranken – RCE of Atlantic County

### **Other Research Institutions**

1. T. Jude Boucher – Vegetable Crop IPM Coordinator, Univ. of Connecticut
2. Judy Hough-Goldstein – Chair, Dept. of Entomology, Univ. of Delaware

### **Growers**

1. Homestead Farms, Ron and Ray Abrams, Burlington County: Study of insect trapping and scouting techniques for fall greens and spinach.

2. Ashley's Turkeys and Produce, Larry Ashley, Morris County: Trial project to develop a comprehensive pumpkin IPM program for NJ growers.
3. Frank Baitinger, Cumberland County: Scout training session.
4. Bill Brooks, Salem County: Study of insect trapping and scouting techniques for fall greens and spinach.
5. Dennis Donio, Camden County: Comparison of traps for monitoring bell pepper pests.
6. Henry DuBois, Salem County: Study of insect trapping and scouting techniques for fall greens and spinach.
7. Flaim Farms, Cumberland County: Comparison of traps for monitoring bell pepper pests.
8. Franceschini Farms, Atlantic County: Comparison of traps for monitoring bell pepper pests.
9. Dan Hitchner, Salem County: Effect of ECB damage on potato yield in grower fields.
10. Raymond Hlubik, Burlington County: The relationship between ECB trap catches and larval infestations in unsprayed bell peppers; Comparison of traps for monitoring bell pepper pests.
11. Town Farm, Peter and George Melick, Hunterdon County – Assessing stinkbug population levels and damage potential on fresh market staked tomatoes; Trial project to develop a comprehensive pumpkin IPM program for NJ growers.
12. Bob Muth, Gloucester County: Comparison of traps for monitoring bell pepper pests.
13. Charles Muzzerelli, Atlantic County – Determination of sweet potato tuber damage.
14. Dick Nixholm, Gloucester County - Determination of sweet potato tuber damage.
15. Ken Porch, Salem County: Comparison of traps for monitoring bell pepper pests.
16. Sheppard Farms Inc., David Sheppard, Cumberland County: Comparison of traps for monitoring bell pepper pests; Assessing stinkbug population levels and damage potential on fresh market staked tomatoes.
17. Fred VanMeter, Cumberland County – Scout training session; Surveying wireworm populations to determine the reliability of bait trapping to predict damage in white potato.
18. Visalli Farms, Chuck and Mike Visalli, Gloucester County: Comparison of traps for monitoring bell pepper pests.
19. Walker Bros. Farm, Salem County: Comparison of traps for monitoring bell pepper pests; The relationship between corn borer trap catches and larval infestations in unsprayed bell peppers.

### **Grower Organizations or Cooperatives**

1. New Jersey Tomato Council - Assessing stinkbug population levels and damage potential on fresh market staked tomatoes.
2. Pepper Grower Advisory Committee – NJAES Bell Pepper Integrated Crop and Pest Management Project.
3. White Potato Association - Potato IPM Fax System.

### **Other Companies**

1. Ag-Chem Inc. - Potato IPM Fax System; Determination of sweet potato tuber damage.
2. Furman Foods - TomCast disease forecasting program.
3. Garden State Pest Management – Collection of blacklight information; the relationship between corn borer trap catches and larval infestations in unsprayed bell peppers.
4. Helena Chemical Co. - Potato IPM Fax System.
5. Seabrook Bros. and Sons - Study of insect trapping and scouting techniques for fall greens and spinach.
6. Violet Packing - TomCast disease forecasting program.

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NEW BRUNSWICK**

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