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RUTGERS COOPERATIVE EXTENSION

NEW JERSEY AGRICULTURAL EXPERIMENT STATION

2001 Annual Report

Vegetable Integrated Pest Management Program

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THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS

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INTRODUCTION

Mission

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.

Rutgers Cooperative Extension Vegetable IPM Working Group

The Vegetable IPM Working Group meets every other month during the winter to advise and direct the Vegetable IPM Program personnel on programming and research efforts. Members include:

Dr. George Hamilton	RCE Specialist in Pest Management
Mr. Joseph Ingerson-Mahar	RCE Vegetable IPM Coordinator
Mr. Kristian Holmstrom	RCE Vegetable IPM Program Associate
Ms. Sarah Walker	RCE Vegetable IPM Program Associate
Dr. Wesley Kline,	Agricultural Agent, RCE of Cumberland County
Mr. Peter J. Nitzsche	Agricultural Agent, RCE of Morris County
Ms. Michelle Infante-Casella	Agricultural Agent, RCE of Gloucester County
Mr. Richard VanVranken	Agricultural Agent, RCE of Atlantic County
Mr. Peter Probasco	Agricultural Agent, RCE of Salem County
Mr. William Sciarappa	Agricultural Agent, RCE of Monmouth County
Mr. Ray Samulis	Agricultural Agent, RCE of Burlington County
Mr. William Tietjen	Agricultural Agent, RCE of Warren County
Mr. Winfred Cowgill	Agricultural Agent, RCE of Hunterdon County
Dr. Gerald M. Ghidiu	RCE Specialist in Entomology
Dr. Stephen A. Johnston	RCE Specialist in Plant Pathology
Dr. Melvin Henninger	RCE Specialist in Vegetable Crops
Dr. Stephen A. Garrison	RCE Specialist in Vegetable Crops
Dr. Bradley Majek	RCE Specialist in Weeds

Other Advisory/Working Groups

IPM Program personnel participate in the RCE Vegetable Working Group meeting, which meets six times a year to discuss current vegetable crop issues. Additionally, personnel participate in the annual Pepper Grower Advisory Group meeting, which consists of a select group of growers who advise RCE agents and specialists on the direction of pepper research. This December IPM personnel attended a new Tomato Grower Advisory group that was established as part of a five year PEG grant on Fresh Market Tomato Production.

Awards

RCE Vegetable IPM staff Joe Ingerson-Mahar, Sally Walker, and Kris Holmstrom, and Agricultural Agents Michelle Infante-Casella, Ray Samulis, Wes Kline, Dave Lee, and Bill Sciarappa were recently recognized as Winners in the Direct Mail Piece Category of the Communications Awards program for the National Association of County Agricultural Agents (NACAA). The direct mail piece was an advertisement for the highly Joe Ingerson-Mahar attends the meetings for the Invasive Species Council, New Jersey Department of Agriculture, in the role of advisor.successful New Jersey Integrated Crop Management (ICM) Tomato School that was held in North and South Jersey last winter. The national award was presented during the annual meeting and professional improvement conference of the NACAA August 5-9 in Albuquerque, New Mexico. Ray Samulis received the award and a cash prize on behalf of

the group from Danny Barrett, representative of AT&T's Preventative Maintenance Division, sponsors of the NACAA Communications program. In his comments, Barrett praised the excellent communications work. The Communications Awards program is conducted by the NACAA to recognize outstanding work in 13 different methods of communications. It is the largest single recognition program of the NACAA with 953 entries submitted this year. Recipients of these awards are among the top communicators in the Cooperative Extension Service.

Web Sites

The Vegetable IPM Program has direct involvement or materials listed in the following web sites:

1. **Rutgers Cooperative Extension.** Visit the Pest Management Office link to find information about the Vegetable IPM Program.
   www.rce.rutgers.edu/ag/index.html
2. **Center for Remote Sensing & Spatial Analysis.** Visit the CEW/ECB Integrated Pest Management link to see the current and historical vegetable pest maps.
   www.crssa.rutgers.edu/projects/gps/web_page/web_page.html
3. **Shelby's Sweet Corn Pest Alert.** The New Jersey Vegetable IPM Program forwards weekly blacklight trap data to be represented on regional pest maps published by Penn State University.
   www.ento.psu.edu/vegetable/sweetcorn/default.html
4. **USDA/OPMP Crop Profiles Database.** The Vegetable IPM Program is participating in the development of vegetable crop profiles for NJ. This web site contains the completed crop profiles for all states.
   http://cipm.ncsu.edu/cropprofiles/

IMPACT AND SUCCESS STORIES

Establishment of a Successful IPM Program for Pumpkins in North Jersey

For the past two years the Rutgers Vegetable IPM Program has been developing and testing a protocol for scouting pumpkins for growers in the northern part of the state. The research and on-farm demonstrations revealed the potential for pesticide reductions as a result of scouting fields and treating at recommended threshold levels of insects and diseases. During the 2000 field season a trial pumpkin IPM program was demonstrated on selected fields for seven participating growers. In 2001, the North Jersey pumpkin scouting program was expanded to a fee-based scouting service with 19 farmer participants enrolling 31 pumpkin fields. The dramatic increase in grower participation was directly attributable to the success of the demonstration project in which foliar fungi and insect and mite pests were managed with fewer pesticide applications than was the norm.

Participants in 2001 were asked to enroll 'indicator' plantings in the scouting program. Indicator plantings, plantings separated by two or more weeks in planting date, or having predominantly powdery mildew resistant or susceptible varieties, were used as a means of representing all of the fields. In this manner, growers could treat all similar fields (by planting date and variety type) as per the recommendation generated from the indicator field, saving acreage fees. While the amount of acreage scouted was 141 at a cost of $25 per acre, the total pumpkin acreage impacted on participating farms was 351.

All fields were scouted twice weekly through the 4 true-leaf stage, and then once a week through fruit maturity. The recommended program for controlling foliar diseases of pumpkins is to start a protective fungicide schedule at vine run. However, by scouting for the primary foliar pathogen, powdery mildew, the schedules can be delayed. Through the scouting program growers were advised as to when the action threshold for powdery mildew, exceeded 1 lesion on 50 older leaves. Growers in the 2001 pumpkin scouting program were able to delay initiation of their foliar fungicide program by an average of nearly three weeks over the standard recommendation, saving 2-3 pesticide applications. With this level of

fungicide reduction, growers saved $59 to $117 per acre in fungicide cost alone, depending on what material they used. Additionally, insecticide use was minimal. Only eight foliar insecticide applications were recommended over the 31 participating fields to control early cucumber beetles feeding on newly emerged plants and centipedes injuring pumpkin rinds. Scouting for diseases and insects in pumpkins has an immediate potential for pesticide reduction as well as improved application timing and choice of materials.

2001: A Good Year To Be In The Sweet Corn IPM Program

The corn earworm (CEW) is a pest of several vegetable crops in New Jersey, including sweet corn. It overwinters in the southern portion of the state only under mild winter conditions. During the course of a growing season in New Jersey, CEW adult pressure generally increases gradually as availability of host crops progresses northward. Sudden increases in the adult CEW population in NJ often occur in the latter half of the growing season as storm systems of tropical origin sweep up the eastern seaboard, carrying moths to NJ from southern regions. RCE IPM personnel and cooperating private consultants monitor CEW populations with the network of 84 blacklight insect survey traps arrayed around the agricultural regions of the state. Sweet corn, the primary host for CEW, requires regular protection from infestation while in the silk stage. CEW moth catches are translated by IPM staff to insecticide schedules on silking sweet corn plantings throughout NJ. The higher the moth catch, the more frequently the silk stage sweet corn is treated.

Occasionally NJ experiences a growing season with no appreciable storm systems of southern origin. When this happens, lower CEW populations and damage are expected. The growing season of 2001 was just such a case, with a significantly lower CEW flight than the previous season. A comparison of CEW population maps from mid-August of 2000 and 2001 serve to illustrate the disparity between moth flights of those years. The sweet corn silking spray intervals derived from CEW trap catches throughout the state were much lower in 2001 as a result of the lower population. For example, in 2000, 16 silk stage insecticide applications were recommended on sweet corn for sites in the northern counties for the period beginning June 15 and ending Sept. 24. Between 8 and 9 sprays were sufficient for the same sites in 2001. In the southernmost counties, 31 applications were recommended in 2000 and only 14 in 2001. With insecticides commonly used on sweet corn today, this type of reduction can translate to between $150-170 per acre. Considering the volume of sweet corn acreage, savings in insecticide alone can be quite large. This type of insecticide reduction can only be achieved through the availability of quality assured data from a regularly maintained insect survey trap network. The RCE Vegetable IPM Program provides this information to the grower community in New Jersey in a variety of formats.

Bio-Control in High Tunnel Tomato Production

Two spotted spider mites are a difficult pest to control under normal environmental conditions, and the hot, rain-free conditions of enclosed structures like those in high tunnels (a type of greenhouse) particularly favor spider mite growth and development. Rainbow Haven Farm in Hunterdon County experienced this effect in their high tunnels during the 2000 growing season. A significant spider mite population infested their early season tomato plants in the high-tunnels. Opting to avoid the use of miticides, Rainbow Haven had to abandon the tunnel early due to the mite damage, resulting in a shortened production season in the tunnels and unrealized income from unharvested tomatoes.

In 2001, Rainbow Haven Farm increased early tomato production to two high tunnels and they consulted Kris Holmstrom, Vegetable IPM Program Associate, about possible management options to prevent a reoccurrence of mite problems. Holmstrom suggested regular scouting of the high tunnels in conjunction with a release of a spider mite predator, *Phytoseiulus persimilis,* if the spider mites appeared. *P. persimilis* is a predatory mite that is commercially available for release to control the plant infesting spider mites. In late May, a low level spider mite infestation occurred in the same tunnel that had been infested in 2000. The grower ordered *P. persimilis* and IPM personnel flagged plants that were infested with the spider mites so the grower could release the predator in the appropriate locations. The tunnels were scouted twice weekly for both the pests and the predatory mites. *P. persimilis* was found in

conjunction with spider mite colonies each week through the end of July, when production in the tunnels was ended. No miticide or insecticide applications were needed in the high tunnel tomatoes, primarily as a result of the predator release and the subsequent natural control of the pest mites. The cost of the one predator release was forty dollars, which resulted in the extension of the production season by 2-3 weeks compared to the previous season. And most importantly, tomato quality and yields were excellent.

The 2001 Tomato ICM Schools

An educational program for training farmers, consultants and others in tomato integrated crop management (ICM) was held in two locations, Gloucester County Extension Office and at the Snyder Research Farm in 2001. Eighty-five people attended the Gloucester site and 56 attended the Snyder Farm site. Farmers attending the two ICM schools were also surveyed regarding perceived needs in tomato production. The surveys were used as a database for a grant application in tomato production, which was successfully awarded. The brochure developed to advertise the schools was submitted to the Agricultural Agents Association of New Jersey where it went on to win a national award in the association's communication contest. The press release regarding the award follows:

Rutgers Cooperative Extension Agents, Specialists, and Staff Win National County Agents Association Award

Albuquerque, New Mexico: Rutgers Cooperative Extension Agricultural Agents Michelle Infante-Casella, Ray Samulis, Wes Kline, Dave Lee, and Bill Sciarappa and Rutgers Cooperative Extension Vegetable Integrated Pest Management Staff, Joe Ingerson-Mahar, Sally Walker, and Kris Holmstrom, were recently recognized as Winners in the Direct Mail Piece Category of the Communications Awards program for the National Association of County Agricultural Agents (NACAA). The direct mail piece was an advertisement for the highly successful New Jersey Integrated Crop Management Tomato School that was held in North and South Jersey last winter. The national award was presented during the annual meeting and professional improvement conference of the NACAA August 5-9 in Albuquerque, New Mexico. Ray Samulis received the award and a cash prize on behalf of the group from Danny Barrett, representative of AT&T's Preventative Maintenance Division, sponsors of the NACAA Communications program. In his comments, Barrett praised the excellent communications work. The Communications Awards program is conducted by the NACAA to recognize outstanding work in 13 different methods of communications. It is the largest single recognition program of the NACAA with 953 entries submitted this year. Recipients of these awards are among the top communicators in the Cooperative Extension Service.

Taking IPM to the Field: Farmer and Field Scout IPM Training Programs

A key mission of the RCE IPM Program is advancing grower and field scout education in IPM methods and strategies. For the past three years we have been providing an IPM training program where participants gain hands-on experience scouting fields and evaluating and diagnosing crop and pest problems. These field training sessions are geared toward farmers, farm employees, industry consultants and their field scouts, and others in agribusiness. Consultants and farmers were solicited to participate through the county newsletters, the RCE Plant and Pest Advisory Vegetable Crops Edition, and direct mailings. Participants have come not only from the commercial vegetable industry but also from the field crop and commercial ornamental nursery operations, and have included representatives or owners of small and large farms, organic farmers, and field reps for agribusiness, as well as RCE and private field scouts. New Jersey DEP Pesticide credits and Certified Crop Advisor (CCA) credits were offered for all three sessions.

This past summer three IPM training sessions were held at the Visalli Farm in Gloucester County, a commercial vegetable farm. All three sessions were organized and taught by Joe Ingerson-Mahar and Sally Walker of the RCE IPM program, and Agricultural Agents Wesley Kline of Cumberland County and Michelle Infante-Casella of Gloucester County. For all sessions we advertised for participants to bring crop and/or pest samples for discussion and identification. The three sessions began with a discussion of the crop and pest samples that were brought by the participants and the organizers. The first

session, 'Introduction to Vegetable Scouting', was devoted to a discussion of general pest management procedures and was attended by 8 people, including three field scouts (two RCE and one private scout), one tomato industry representative, and four farmers. In addition to an hour discussion of general IPM principles and methods, participants were taken into the field to scout pickles, sweet corn, and tomatoes. The second session, 'Mid-Season IPM Field Scouting Techniques", was attended by 18 people, including 2 field scouts, 2 organic growers, and several farmers and others in agribusiness. At the request of Atlantic county agent Rick VanVranken a special one-hour segment on plant tissue, soil, and nematode sampling methods was included in addition to an emphasis on tomato scouting and pest identification. The third field session, 'Late Season Vegetable IPM Training', was attended by two field scouts and four farmers and included a discussion of late season pests, end of the season IPM strategies, and how to scout peppers.

In addition to the formal training sessions, RCE personnel conducted numerous individual training sessions for growers, private scouts, and RCE IPM Program field technicians. Five RCE field technicians who were supervised by the program associates were provided individualized and intensive training throughout the field season. One of these scouts completed the requirements of the Delaware Valley College Internship Program for receiving college credit for his summer work with the IPM program. Additionally, one staff member at the RCE Snyder Research and Extension Center was trained in vegetable scouting so that certain research projects at the farm could be effectively monitored on a regular basis. Two private scouts in the employ of two separate consulting companies received on-farm training from the IPM program associates. Through an arrangement with the Cook College Organic Farm, IPM personnel scouted and made recommendations to the student employees about organic crop and pest management. The farm was visited twice a week, and RCE IPM personnel initiated discussion about pest identification and management issues when students were available. Anywhere from 1 to 7 students participated in these informal sessions.

Through our on-farm activities numerous growers receive training in IPM methods and strategies. A total of 88 growers participated in all of our on-farm programs or projects, and the majority were visited regularly for crop and pest evaluations and recommendations. Thirty-two growers, a 20% increase from 2000, participated in the scouting program and received twice weekly reports on pest activity along with periodic recommendations. This year two small acreage farmers new to the IPM Program received training on scouting techniques and using pheromone traps for monitoring insects of sweet corn, tomatoes, and peppers. The IPM Program loaned the traps to the growers, and the program associate assisted with the trap setup and periodically met with the growers to track progress. The day-to-day trap monitoring was conducted the individual grower, which eliminated the cost of having summer help check the traps. Both growers were happy with the training and are planning to use pheromone traps again next season.

PROGRAM DELIVERY

Blacklight Trap Program

A statewide network of eighty-five blacklight traps was maintained for monitoring the levels of several major 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. The value of these commodities is approximately $91,727,000. 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 information from one to three nearby trap locations. Grower and industry (agrichemical companies, processors, and private consultants) support to fund summer field scout hours and mileage was obtained at a cost of $300 per blacklight trap (see industry sponsored programs for more details).

The blacklight trap network information reaches a wider audience than individual growers and industry program participants. The trap information is compiled and presented in the Plant and Pest Advisory Vegetable Crops Edition newsletter as weekly pest distribution maps. The maps are produced in cooperation with Marilyn Hughes at the Center for Remote Sensing and Spatial Analysis (CRSSA) at Cook College using Global Positioning Systems (GPS) and Geographic Information Systems (GIS) technologies. The maps provide a dynamic visual picture of local and regional pest levels that grower and other interested parties can utilize to help improve pest management. In 2001, the Plant and Pest Advisory Vegetable Crops Edition reached 210 people through the subscription, and the newsletter web site was accessed 4,626 times during the production period (February through early November). As well as being published in the Plant and Pest Advisory, pest maps were posted at the CRSSA and RCE web sites.

Field Scouting Program

The Vegetable IPM Program actively supports the development of private consulting to deliver field scouting services to farmers. At this time three 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, sharing insect traps in return for trap data, and providing field scout educational training. In areas where consultants are not available growers provide funding for the Vegetable IPM Program to hire field scouts. In 2001, RCE provided scouting services for 32 growers and 1068 acres of primarily sweet corn, tomatoes, peppers, pumpkins, and cole crops. These figures represent increases of 20 and 23% respectively compared to the 2000 season. Greater than 36,000 acres are 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 web sites, and IPM Program supported crop consultants.

Disease Forecasting Program

Disease forecasting programs use weather station data in combination with computer models of the target plant diseases to generate information for growers to treat fields based on the likelihood of infection rather than on a preventative calendar-based schedule. These programs have helped growers improve the timing of fungicide applications. When conditions allow for reduced fungicide applications growers can save time and money, and when fungicide applications are needed growers will know how frequently to apply fungicides to maintain disease control. Dr. Steve Johnston, RCE Specialist in Vegetable Pathology, coordinates the disease forecasting program in cooperation with the Vegetable IPM Program. Growers and industry fund the summer help needed to collect the weather station data and to prepare the faxes for distribution. The growers receive twice-weekly reports that include both the updated forecast as well as recommendations by the plant pathologist as needed. Two programs, BLITECAST for white potatoes and tomatoes, and TOM-CAST for tomatoes, were produced for the 2001 season.

The BLITECAST report for forecasting late blight for white potatoes and tomatoes was delivered to 25 industry people including 12 potato growers with approximately 2,000 acres as part of the Potato IPM Fax program. A total of 26 reports were sent to subscribers from mid-April through mid-August. No late blight was detected in the region in 2001.

Data from three weather stations located in Salem and Cumberland counties were used to generate the TOM-CAST disease forecasts for foliar diseases and anthracnose on processing tomatoes. Thirty-six TOM-CAST fax reports with disease control recommendations were provided to two processing tomato companies who forwarded the report to their growers. Early blight and anthracnose were not severe in processing tomato fields treated with fungicides according to the TOM-CAST forecast system in 2001.

RESEARCH PROJECTS

Vegetable IPM Program personnel, in cooperation with industry, university, and other government partners, conducted a total of 14 studies on various crops for 2001. In addition, funding was provided by outside sources for 7 programs that were delivered to vegetable growers and others in the agricultural industry. These programs and projects were supported with grower, industry, grant, and other IPM funds. Specific research projects impacted a wide range of vegetable crops, including sweet corn, tomatoes, peppers, eggplant, white and sweet potatoes, pumpkins, and spinach. Short summaries of the external and internal grant funded projects and industry supported programs that were conducted in 2001 are listed below.

External Grant Funded Projects

1. **Integrated Crop Management (ICM) Training for Tomato Producers** .
J. Ingerson-Mahar, W. Kline, M. Infante-Casella, W. Sciarappa, R. Samulis, K.E. Holmstrom, S.D. Walker. Funded by the Natural Resources Conservation Service ($4750).

   This grant was received in 2000 but the majority of the work was completed in 2001. The objective was to provide an educational training program for tomato producers, consultants, Certified Crop Advisors, and others. The focus of the training was on integrated crop management (ICM) philosophy and practices, recognition of tomato pests and their management, record-keeping strategies, and the economic benefits of ICM practices. A one-day Tomato ICM workshop was held in two locations to accommodate northern and southern growers. Eighty-five growers attended the February workshop held at the Gloucester County Extension Office and 56 growers attended the workshop held at the Snyder Research and Extension Center in Hunterdon County in March. Participants received a manual containing tomato ICM information as well as two books: Weeds *of the Northeast* and *Tomato Diseases.* In addition, three field-training sessions were held on a farm in Gloucester County during the 2001 growing season. These informal field sessions were designed to help farmers with pest identification and sampling techniques of tomatoes and other vegetables.

2. **Development of a Crop Profile for Spinach**.
J. Ingerson-Mahar, P. Hastings and G. C. Hamilton. Funded by the Special Research Grants- Pest Management Alternatives, USDA ($12,000).

   Crop profiles are being developed nationwide to provide the Environmental Protection Agency (EPA) with detailed accounts of crop production and typical pest management and pesticide use information for crops in the states. The EPA will use this information to evaluate pesticides in accordance with the Food Quality Protection Act. The crop profiles for asparagus and alfalfa for New Jersey were completed in 2000 and the third and last profile for spinach is now complete, meeting the requirements of the grant. The finalized crop profiles for all states can be found on the USDA/OPMP Crop Profiles web site (http://cipm.ncsu.edu/cropprofiles/).

3. **Demonstration and Evaluation of Integrated Crop Scouting on Pumpkins in Southern New Jersey.**
Ingerson-Mahar, K. Holmstrom, S. Walker, G. Hamilton, M. Infante-Casella, R. Samulis, S. Johnston, W. Sciarappa, F. Spieker. EPA Strategic Agricultural Partnerships grant ($40,000).

   The objective of this project was to utilize on-farm demonstrations to evaluate jack-o-lantern type pumpkins managed according to the IPM scouting protocol compared to the same variety treated according to the grower's usual practices. As has been observed in the studies in the northern part of the state, the primary threat to pumpkin health is due to foliar diseases, particularly powdery mildew. Disease scouting and treating when powdery mildew exceeded threshold levels resulted in a decrease of 1 to 4 fungicide applications when compared to the standard treatment of initiating applications at vine run. As many as two insecticide treatments were reduced in some of the IPM blocks, with no significant yield effect. Some further insecticide reductions may be possible, especially if the results could be demonstrated over several years under varying pest pressures. In general scouting for diseases and insects in pumpkins has an immediate potential for pesticide reduction as well as

improved application timing and choice of materials. Growers were positive about the results of the demonstration project, and at least one of the five farms is interested in having private consultants scout his pumpkins next year. Two growers liked the benefits of regular scouting, but wanted to see the cost advantages over a few years.

4. **Determining Oriental Beetle Population Levels in Sweetpotatoes using Pheromone Traps.** J. Ingerson-Mahar, S. Walker, G. Ghidiu, M. Henninger, R. VanVranken. Funded by the 2001 Charles E. and Lena Maier 2001 Research Award ($700).

Oriental beetle is one of the principal insect pests damaging the roots of sweet potatoes in the state. Currently there is no reliable way to determine which field will be infested with oriental beetle. We deployed one pheromone trap in each of 9 fields for the purpose of tracking adult male populations, hoping to correlate these counts to field damage. From 1,000 to 10,000 beetles were caught in the pheromone traps from the end of June to the end of August. Five fields that were adjacent to each other had similar patterns of trap counts, which differed from the remaining fields. The four remaining fields, though separated from one and another by approximately a mile, were remarkably similar in the pattern of trapped beetles. However, only one field out of nine had significant crop damage. Even though this was only one year's worth of data it does not seem likely that pheromone traps will be useful predictors of resulting damage unless modifications are made in the sampling scheme. One accomplishment from this year was the development of a sampling procedure for the white grub larval form of oriental beetle. The procedure is to sample five random locations in the field and sift a cubic foot of soil to retrieve the white grubs present. While the procedure needs more testing it does seem able to predict the relative amount of damage at harvest based upon the number of white grubs present, which will be useful in determining the order of fields to be harvested.

5. **Evaluation of Controls for Flea Beetle on Eggplant in an Organic Production System** M.H. Maletta, K. Holmstrom, W. Tietjen, W.P. Cowgill, G. Ghidiu. Funded by a Snyder Research and Extension Center Special Local Needs Grant of $1500.

This project, in its second year, was undertaken to begin addressing the need for research-based information on pest controls used by and/or approved for use by organic growers. Materials and techniques for controlling flea beetle on eggplant were evaluated under field conditions that conformed as much as possible to the organic production requirements of the Northeast Organic Farming Association – New Jersey. An infestation of potato leafhopper resulted in evaluation of the treatments for leafhopper control, as well. Admire, a conventional material prohibited in organic production, provided nearly complete control of leafhopper damage and reduced flea beetle damage that occurred late in the growing season. Rotenone, approved for certified organic production, reduced flea beetle damage more than any other material; it did not reduce leafhopper damage compared to the untreated control. Surround, formulated kaolin clay approved for certified organic production, reduced the late season flea beetle damage and reduced leafhopper damage. Leafhopper populations, as determined by weekly IPM scouting, were lowest in the Admire and Surround treated plots.

Admire treated plots produced the highest total and marketable yields. Surround plot yields were significantly higher than those of the untreated control. Percent marketable yield was reduced by the Surround treatment compared to all other treatments. Plant growth, estimated by plant volume (plant height x width x plot length) and fresh weight, was not significantly different among treatments.

6. **Managing Powdery Mildew on Pumpkins with Resistant Cultivars and Fungicides, 2001**. W. Cowgill, K. E. Holmstrom, M. Maletta, P. Nitzsche, S. A. Johnston, E. Dager. Funded by the Snyder Farm Local Needs grant and the Hunterdon County Board of Chosen Freeholders

This project was designed to assess varietal tolerance to powdery mildew (PM) without fungicides and under a fungicide regimen based on IPM scouting. Five pumpkin varieties were

included in the trial. Jack-O'Lantern types were Howden (PM susceptible), Autumn King, Merlin, and Magic Lantern (PM tolerant). One smaller variety tested was Touch of Autumn (PM tolerant). All plots were scouted weekly for the presence of PM. The IPM based fungicide schedules were initiated when 1 PM lesion was found on 50 older leaves on a variety. Spray schedules began on August 2 (Howden), and August 13 (all other varieties), and were repeated weekly. Plots were evaluated on Sept. 26, for PM, yield, plant vigor, and handle quality.

The incidence of bacterial leaf spot was high in this trial, resulting in significant fruit rot. All sprayed varieties had significantly less PM than the unsprayed except Autumn King, on which PM was equally severe in both treatments. Magic Lantern had significantly less PM than Howden and Autumn King when fungicides were used. There was no significant difference among the Jack-o'lantern varieties when unsprayed. Fungicide applications significantly reduced the level of PM on the small-fruited variety. Fungicides improved plant vigor in all varieties except Autumn King. Among Jack-o'lantern varieties, Magic Lantern was the most vigorous. No significant differences were found between like varieties with respect to yield (total fruit weight per plot). No significant differences were found between Jack-o'lantern varieties, whether sprayed or unsprayed. Handle quality in Touch of Autumn was improved with fungicide applications. IPM based fungicide schedules reduced the incidence of PM, and increased vigor in all varieties, except Autumn King, which did not exhibit tolerance to PM in this test.

Internal Grant Funded Projects

1. **Modeling ECB Flight Patterns Using GIS/GPS Technologies**.
K.E. Holmstrom, M.G. Hughes, S.D. Walker, J. Ingerson-Mahar, W. Kline. Sponsored by NJAES, the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA), and the RCE Vegetable IPM Program.

   RCE IPM staff and Marilyn G. Hughes of the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA) have developed, and are in the process of validating a predictive model for ECB activity in New Jersey. This project involves analysis of 7-year average ECB flight data from statistically grouped blacklight traps relative to average growing degree-day accumulations from the same regions. Ultimately this analysis will result in accurate predictions of ECB adult activity in different regions of the state, allowing the agricultural community to practice pest avoidance when possible, and plan monitoring and control activities for ECB. This project will serve as an example for using weather data and GPS/GIS to model pest occurrences significant to NJ crops.

2. **Voltinism and Larval Parasitism of ECB in NJ**.
K.E. Holmstrom, S.D. Walker, and J. Ingerson-Mahar. Funded by the Vegetable IPM Program.

   The European corn borer (ECB) is a pest of several vegetable crops in New Jersey, including sweet corn, peppers, and snap beans. Cooler climates (as occur in higher elevations of Pennsylvania and New York) are dominated by the univoltine (one generation) strain of ECB. The adult stage of the univoltine strain usually occurs in mid summer. In the mid Atlantic states, the ECB is typically a multivoltine strain insect, completing at least two generations per year. The presence of the univoltine strain in New Jersey has been an unanswered question for some time. Recent review of eight years of adult flight patterns does not support the presence of a univoltine strain, but rather a multivoltine strain with two generations in the northern counties and three in the south. The length of post diapause development (the length of time between achievement of the larval chilling requirement and pupation) is a key to which ECB strain is present. Univoltine individuals require a much longer post diapause period than do bi- or univoltine ECB.

   In March and April of 2000, Rutgers Vegetable IPM Program personnel searched fields of standing corn stalks from the previous season for overwintered European corn borer (ECB) larvae. The larvae, from 3 to 4 sites representing different geographical regions in New Jersey (Elmer and Alloway, Salem county; Clinton, Hunterdon County; and Halsey ('00) and Sussex ('01), Sussex County), were collected and placed in an incubator at 25ºC. Accumulations of heat units (growing

degree-days base 50ºF (GDD50)) prior to incubation were collected from the nearest weather stations to the collection sites. GDD 50 was calculated daily during incubation, and added to the previous accumulations. In this manner, GDD 50 requirements for the post diapause period of larvae from each site could be determined.

An additional benefit to this study is the ability to determine rates of parasitism of ECB larvae by other insects. The wasp *Macrocentrus grandii* (Hymenoptera:braconidae), and the fly *Lydella thompsoni* (Diptera:tachinidae) are two exotic insect parasites that have been released in the U.S. *L. thompsoni* was most recently released in Delaware in the 1970's, in an effort to re-establish the parasite after its' populations declined through the 50's and 60's. *M. grandii* was originally released in the 1920's in Mass. and Ohio. ECB specimens collected so far in both years have exhibited parasitism by *M. grandii* and *L. thompsoni.* In 2000, parasitism rates by *M. grandii* ranged from 0 to 17.65%, while parasitism rates by *L. thompsoni* ranged from 0 to 8.82%. In 2001, parasitism rates were from 0 to 13.86% and from 0 to 4.95% for *M. grandii* and *L. thompsoni*, respectively. In both years, the highest rates of parasitism by both insects came from the Elmer, Salem County site. Overall parasitism rates are higher in the southern sites, with the fly parasite apparently absent at the northern sites.

Post diapause developmental curves from ECB larvae collected from separate geographical locations in the state thus far are consistent with the adult flight patterns. There is no sign of a mid-summer, univoltine adult generation. All larvae collected show shorter post diapause development that is favored in warmer climates and leads to multiple adult generations. We will collect larvae from the same localities for one more season to reinforce our findings regarding voltinism in New Jersey ECB.

3. **Mapping Pest Populations Using GIS/GPS Technologies**.
K.E. Holmstrom, M.G. Hughes, S.D. Walker. Sponsored by NJAES, the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA), and the RCE Vegetable IPM Program.

The RCE Vegetable IPM Program continued its efforts with CRSSA in creating and disseminating time sensitive maps of adult European corn borer (ECB) and corn earworm (CEW) populations. Maps are published weekly in the Vegetable Crops edition of the Plant and Pest Advisory Newsletter, and are posted on the web (http://www.crssa.rutgers.edu/projects/gps/web_page/web_page.html). The high resolution of these insect maps, and their acceptance by the agricultural community has resulted in this program's appearance in several presentations in 2001 and in the publication *Hort Technology*.

4. **Penn State Sweet Corn Pest Monitor Web Site**.
K.E. Holmstrom, S.D. Walker, J. Ingerson-Mahar. Funded by the Vegetable IPM Program.

For the second year RCE IPM personnel contributed weekly trap data to be included in a regional map of sweet corn pest populations that is coordinated and produced by Penn State personnel. Weekly geo-referenced adult ECB and CEW blacklight trap data was forwarded throughout the season to the lab of Dr. Shelby Fleischer of Penn State. The New Jersey trap data was displayed graphically along with other northeastern and Mid-Atlantic states in a web site called the Shelby's Sweet Corn Pest Alert (www.ento.psu.edu/vegetable/sweetcorn/default.html). The information, displayed as color coded points, shows pest activity and general population trends over a large geographical area and is useful especially for tracking regional movement of migratory pests of sweet corn. The activity at the web site has been increasing every year. For the past two years the number of hits on the web site during the five-month growing season (May through September) increased almost two fold, from a total of 85,000 hits in 2000 to 151,000 in 2001. The number of seasonal hits increased 9 times from the first year of the web site, 1999, in which 16,550 hits occurred at this web site. The web activity trends show the greatest activity during the months of August and September when the majority of sweet corn is silking and migratory moth populations are the primary pest concern to growers.

5. **Evaluation of Natural Enemy Populations in Bell Peppers**.
J. Ingerson-Mahar, S.D. Walker, K.E. Holmstrom. Funded by the RCE IPM Program.

The 2001 growing season was the second year of investigating the question of how can a grower raise sufficient amounts of bell peppers with few or no insecticide applications for controlling European corn borer. Two blocks of 10 rows of unsprayed peppers were compared with similar blocks of sprayed peppers. As in 2000, the unsprayed peppers had more beneficial insects although they also had somewhat higher fruit infestation rates of ECB. However, the overall ECB pressure was light this year and it is possible that none of the peppers would have reached conventional thresholds. Field picked fruit culls were discarded mostly because of sunscald. Examination of fresh picked fruit resulted in less than 5% infested by ECB from either treatment through the summer. Despite the farm being in the portion of Salem County that is typically thought of as a "hotspot" for ECB it is apparent that the ECB pressure is not great at this location. The next phase of the study will have to include mapping the farm and locating other host crops in the area of the peppers.

6. **Pheromone and Blacklight Trap Population Levels of Cutworms in White Potatoes.**
S.D. Walker, J. Ingerson-Mahar, G. Ghidiu. Funded by the RCE Vegetable IPM Program.

In some years significant damage to potato yields has been attributed to various cutworm species, particularly black and variegated cutworms. Potato growers questioned whether traps could be used to track cutworm moth populations to better determine when large influxes of moths were possibly laying eggs in the fields. Since blacklight traps are currently being used on potato farms to track European corn borer moth levels, adding these two species was feasible except that some of the species, particularly the variegated cutworm moth, are difficult to correctly identify in the trap. In order to provide growers with current and accurate adult population information, pheromone traps for black and variegated cutworm moths were utilized instead of the blacklight traps. The field scouts saved the blacklight trap catches so that the program associate could identify the main cutworm moth species at a later date for comparison to the pheromone traps. Two sets of pheromone traps were established next to potentially susceptible fields at two locations in the main potato areas of Shirley and Cohansey. The pheromone trap data was graphed and sent to the Potato IPM Fax subscribers twice a week. The disposable wing style traps were used in 2000 and again in 2001. This year increases occurred for both species immediately following a lure change, and the catch declined also as the trap bottoms lost their stickiness due to other insects and dirt and dust. Mid-season a set of wing traps was replaced with the green/white/yellow universal traps at each site. The unitraps were effective in capturing moths and the spike in moth capture following a lure change did not occur with the unitrap compared to the wing trap. The blacklight traps may be a better source of data, but the moths are very difficult to identify by inexperienced field scouts. The proximity of other host crops like corn and the isolation of fields also makes trap interpretation difficult. While the pheromone traps are much easier to use there are still questions about what the trap counts mean relative to the field infestations, since the fields that have had traps have not had larval infestations. At this time we still cannot predict when and what fields could be infested with cutworms.

7. **Research Plot Scouting at the Snyder Research and Extension Center**.
K.E. Holmstrom. Funded by the Vegetable IPM Program.

As a service to the researchers at the Snyder Research and Extension Center in Pittstown, Hunterdon County, the northern New Jersey Program Associate in the Vegetable IPM Program conducted insect and disease scouting on research plots. Some of the plots were monitored regularly, while others were done so at particular times as requested by the farm staff. Examples of regularly scouted research crops were globe artichokes, pumpkins, winter squash, cole crops, and sweet corn. Crops scouted on occasions requested by farm staff included *Echinacea*, and sweet basil. Monitoring of these specialty crops detected the presence of aster leafhopper on *Echinacea*, and Japanese beetle on basil. Regular monitoring of globe artichokes was particularly important, due to uncertainty regarding pests of that crop in NJ. Artichokes were scouted weekly for the presence of insect and

diseases. Several insect pests were identified, including potato leafhopper, European corn borer, green peach aphid, an as yet unidentified aphid species, a species of tortoise beetle, and the bilobed looper. Based on two years of scouting, the ECB has the potential to damage significant numbers of buds, while the unidentified aphid species is capable of causing extreme foliar distortion. In addition to these activities, the Program Associate trained farm staff to conduct regular scouting on research plots of tomatoes, peppers, and white potatoes.

8. **Response to Economic Population Levels of Carrot Weevils in Processing Carrots: Insecticide and Nematode Assays**

J. Ingerson-Mahar, G. Ghidiu, S. Walker, Ian Brown. Funded by RCE and NJAES.

A catastrophic population of carrot weevils at one southern New Jersey farm led to a renewed interest in managing carrot weevils. Hundreds of specimens were collected from an infested field for insecticide and nematode assays. The insecticide assays were conducted with the help of RCE Specialist Peter Shearer and technician Ann Rucker. Field collected carrot weevil adults were exposed to petri dishes that had the recommended field rates sprayed on them with a Potter tower mister apparatus. The materials tested against the control (water) included diazinon, Asana, Baythroid, and Provado. The treatments were replicated 4 times, and 4 adults were placed in each replicate with an untreated carrot piece. Diazinon (94% dead) was significantly better than Asana (56% dead) and Baythroid (68% dead), but all three were better than the control (13% dead) by the 5th day of exposure. As used in this preliminary assay Provado (13% dead) was no better than the control.

A few studies were conducted using laboratory populations of insect parasitic nematodes for reducing the field collected carrot weevil adults, larvae, and pupae. In cooperation with Ian Brown, Rutgers University Entomology Department, two assays using two levels of nematode concentrations were performed at 10 degrees centigrade. In both cases the larval and pupal stages were most susceptible to the nematodes. Even at the high concentration the adults were relatively resistant. Further greenhouse studies are needed before proceeding to field trials. Currently, it is not thought that parasitic nematodes will eliminate the carrot weevil problem but may be an option for management where practical.

Industry and Other Sponsored Programs

1. **Scouting the Organic Farm at Cook College**.

K.E. Holmstrom, J. Ingerson-Mahar. Funded by the Cook College Organic Farm ($360).

At the request of Ralph Coolman, Director of the Cook College Organic Farm, field scouting and blacklight trapping was extended to the organic farm in the same manner as for farmers requesting the vegetable field scouting. Kris Holmstrom and Joe Ingerson-Mahar provided the twice-weekly field scouting. Besides providing the normal field scouting information and blacklight counts of vegetable pests, the opportunity was there to talk directly with 1 to 7 students who conducted most of the work of tending the organically grown vegetable crops. These informal pest identification/recommendation sessions occurred as frequently as the students work schedule allowed.

2. **Cooperation with Garden State Pest Management Company**.

K.E. Holmstrom, F. Spieker. Funded by participating growers, Garden State Pest Management, and the RCE Vegetable IPM Program.

RCE Vegetable IPM personnel continued the cooperative program with the Garden State Pest Management consulting company to provide blacklight trap and scouting services to growers in the central NJ counties. In return for the use of the blacklight traps the private consultant provided the RCE IPM Program with the trap information that otherwise would have to be collected by RCE hired summer help. As a result, RCE was able to obtain essential information without the cost of hiring summer help, which saved the RCE program approximately $5000 in salary and mileage expenses. The benefit to the private consultant was the ability to provide necessary services to growers with

equipment that otherwise would have been prohibitively expensive for a small businessperson ($10,000+ for the traps currently in use). The company also provided a summary of pest activity that was used in the RCE Plant and Pest Advisory newsletter column, the IPM Update. RCE IPM Program personnel met and consulted with GSPM personnel during the season to provide educational training in vegetable IPM methods, including pumpkins and winter squash.

3. **The Potato IPM Fax Program**.
S. Johnston, S.D. Walker, W. Kline, G. Ghidiu, and R. Carpenito. Funded by the White Potato Association ($900), Helena Chemical Company ($300), and UAP Northeast ($300).

The Potato IPM Fax is a twice-weekly seasonal report of current disease and insect information and recommendations for potato growers and others in the agribusiness industry. The funding supports two weather stations, two blacklight traps, and the time and mileage of a summer field technician to collect the data and send out the faxes. The weather stations provide the data for the BLITECAST disease forecasting program, which provides growers with the necessary information to time fungicide applications to prevent late blight. The blacklight trap data provides information for growers to time insecticide applications for European corn borer. The IPM fax is produced from May through August and impacts approximately 12 growers with approximately 2000 acres of potatoes.

4. **TOM-CAST Disease Forecasting Program for Processing Tomatoes**.
S.A. Johnston, W. Kline, S.D. Walker, and R. Carpenito. Funded by Furman Foods ($500) and Violet Processing Co. ($500).

The TOM-CAST disease-forecasting program generates information to help grower's time fungicide applications for certain foliar tomato diseases. Four weather stations located in Cumberland and Salem Counties were maintained and downloaded by RCE personnel to provide the data for the TOM-CAST disease-forecasting program. The data was summarized in chart form with written recommendations and faxed twice a week from June through October to two processing companies who then forwarded the information to their growers.

5. **Insect Trapping for Seabrook Bros. and Sons** .
S.D. Walker, J. VanDerwerken, A. Carpenter. Funded by Seabrook Bros. and Sons ($1200).

A local vegetable processing company supported the IPM program through the purchasing of blacklight trap monitoring services for four locations that were relevant for their production area. The trap data was faxed twice a week from May through September to the field office of the company. The data was utilized to help make pest management decisions concerning two important pests (corn earworm and corn borer) of snap and lima beans. In 2001 Seabrook Bros. contracted 2500 acres of snap beans and lima beans.

6. **Fall Spinach Beet Armyworm Pheromone Trapping Program**.
S.D. Walker, J. Ingerson-Mahar, K.E. Holmstrom, J. VanDerwerken, A. Carpenter. Funded by Seabrook Bros. and Sons ($200).

At the request of the processor, beet armyworm pheromone traps were established and monitored on three farms in Burlington, Cumberland, and Salem Counties. Two green universal bucket traps were placed at each location, one each in an early and a late planting in the same field. Traps were checked weekly, and the growers and processor received the trap data by fax. The beet armyworm moth population in the traps was extremely low at both locations compared to previous years, and growers noted that field populations were low. In years where beet armyworm populations are high, several insecticide applications are needed to control this pest. Very few applications were made this year due to the low levels reported in the traps. Seabrook Bros. used the trap results as an aid in pest management decisions for approximately 700 acres of spinach (16 growers) and 240 acres (6 growers) of processing greens.

7. **Insect Trapping for McConnell Agronomics**.
S.D. Walker, L. McConnell. Funded by McConnell Agronomics and participating growers.

Insect data from several blacklight trap locations was faxed twice weekly from May through September to McConnell Agronomics, a private consulting company offered pest management services affecting approximately 6000 acres of sweet corn and other vegetables and grain. In 2001 McConnell Agronomics initiated a new scouting program for processing carrots. The IPM program associate provided materials about previous carrot IPM work and met with company personnel in the spring to review trapping procedures for monitoring adult carrot weevils.

EDUCATIONAL OUTREACH

In 2001 the RCE Vegetable IPM Program personnel provided information on vegetable IPM programs or research at 3 regional and 29 state or local grower, industry, or other educational meetings. IPM personnel organized three educational meetings. In addition, publications for both growers and others in the agricultural and scientific community were produced including 1 refereed journal article, 7 state and regional proceedings articles, and 4 extension publications. Seasonally current pest management information is published in the RCE Plant and Pest Advisory. IPM personnel contributed 21 articles (including pest population maps) for the weekly column 'IPM Update' and 5 additional feature articles for the Vegetable Crops Edition. Also, 3 articles were included in the Organic Crops Edition and 1 article was published in the Field and Forage Edition. Notebooks were compiled for the Tomato ICM Schools (140 distributed) and the Scout and Farmer IPM Training Sessions (20-25 distributed), including information specifically written for the notebooks by IPM personnel.

IPM Training

Joe Ingerson-Mahar, Sally Walker, Wes Kline, and Michelle Infante-Casella conducted three 3-hour field scout IPM training sessions on general pest management and specific techniques for peppers and tomatoes in Gloucester County. Eight participants attended the introduction to field scouting session, 18 attended the mid-season training, and 6 attended the late-season training session. Some of the participants of these sessions included 2 RCE field scouts, one private field scout, several farmers, two organic growers, agricultural salesmen, and one extension specialist from Delaware.

Five RCE field scouts and one private consultant were provided individualized and intensive training throughout the field season under the supervision of the program associates. One of these scouts completed the requirements of the Delaware Valley College Internship Program for receiving college credit for his summer work with the IPM program. Additionally, one staff member at the RCE Snyder Research and Extension Center was trained in vegetable scouting so that research projects at the farm could be scouted on a regular basis.

Two small acreage farmers new to the IPM Program received training on scouting techniques and using pheromone traps for monitoring insects of sweet corn, tomatoes, and peppers. The IPM Program loaned the traps to the growers. The program associate assisted with the trap setup and periodically met with the growers to track progress. The day-to-day trap monitoring was conducted the individual grower. Both growers were happy with the training and are planning to use pheromone traps again next season.

Four consultants received support as needed, including trapping services, scouting assistance, and technical expertise. Two private scouts in the employ of two separate consulting companies received on-farm training from the IPM program associates.

Television Production: Alloway Township School's Family Science Night

On October 3rd Joe Ingerson-Mahar presented a talk on basic entomology for the Alloway Township School for the Family Science Night: Visiting Scientist Program. Portions of his presentation along with

interviews of the lead teacher and kids were televised on the New Jersey Network Television Station (NJN) four times from November 26, 2001, to January 5, 2002.

National or Regional Presentations

1. J. Ingerson-Mahar. **The Tale of Two Soil Pest Insects**. Mid-Atlantic Vegetable Workers Conference. Newark, DE. November 8, 2001.
2. Maletta, M., K.E. Holmstrom, W. Tietjen, W. Cowgill, G. Ghidiu. **Evaluation of Controls for Flea Beetle on Eggplant in an Organic Production System** Mid-Atlantic Vegetable Workers Conference. Newark, DE. November 7-8, 2001.
3. Walker, S. **Demonstration and Evaluation of Integrated Crop Scouting on Pumpkins in South Jersey**. Mid-Atlantic Vegetable Workers Conference. Newark, DE. November 8, 2001.

State or Local Presentations

1. Ingerson-Mahar, J. **Management of Soil Insects in Vegetable Production.** Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ. January 16, 2001.
2. Holmstrom, K.E. **Results of the Pumpkin IPM Program**. Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ. January 16, 2001.
3. Holmstrom, K.E. **State and Regional Monitoring of Sweet Corn Pests**. Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ. January 17, 2001.
4. Walker, S.D. **Managing European Corn Borer in Potatoes – Panel**. Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ. January 17, 2001.
5. Ingerson-Mahar, J., K.E. Holmstrom, S.D. Walker. **Vegetable IPM Program Display**. Vegetable Growers Association of New Jersey Annual Meeting. Atlantic City, NJ. January 16-18, 2001.
6. Ingerson-Mahar, J. **Vegetable IPM Program**. Central Jersey Vegetable Growers Meeting, Monmouth County, NJ. February 2, 2001.
7. Holmstrom, K.E., Walker, S.D., J. Ingerson-Mahar. **The New Jersey IPM Pumpkin Trial and Disease Control Results**. Burlington County Sweet Corn and Pumpkin Mtg. Mt. Holly, NJ. February 14, 2001.
8. Ingerson-Mahar, J. **Vegetable IPM Program**. Salem County Vegetable Meeting. Salem County, NJ. February 16, 2001.
9. Walker, S. **Field Scouting and Sampling of Tomatoes**. South Jersey Tomato ICM School. Gloucester County, NJ. February 22, 2001.
10. Holmstrom, K. **Tomato Diseases – Identification and Management**. South Jersey Tomato ICM School. Gloucester County, NJ. February 22, 2001.
11. Ingerson-Mahar, J. **Slide Quiz**. South Jersey Tomato ICM School. Gloucester County, NJ. February 22, 2001.
12. Holmstrom, K. **Field Scouting and Sampling of Tomatoes**. North Jersey Tomato ICM School. Snyder Research and Extension Center, NJ. March 7, 2001.
13. Ingerson-Mahar, J. **Slide Quiz**. North Jersey Tomato ICM School. Snyder Research and Extension Center, NJ. March 7, 2001.
14. Ingerson-Mahar, J. **Insect Pests of Tomatoes**. North Jersey Tomato ICM School. Snyder Research and Extension Center, NJ. March 7, 2001.
15. Walker, S. **Potato IPM Program and Research Results**. White Potato Association and Council Spring Meeting. Salem County, NJ. March 7, 2001.
16. Ingerson-Mahar, J. K. Holmstrom, S. Walker. **Vegetable IPM Program**. Rutgers Cooperative Extension IPM Meeting, New Brunswick, NJ. March 21, 2001.
17. Holmstrom, K. E. **Vegetable IPM in New Jersey**. Lecture in Agricultural Entomology and Pest Management. Cook College, Rutgers University. April 16, 2001.
18. Walker, S.D. **South Jersey IPM Program Update**. New Jersey Agribusiness Meeting, Extension Roundup. Atlantic County, NJ. May 4, 2001.

19. Walker, S**. IPM Practices**. Cumberland County Board of Agriculture Public Relations Tour: The Importance of Water to Agriculture and How Farmers Use Water Responsibly. Cumberland County, NJ. May 23, 2001.
20. Ingerson-Mahar, J., S.D. Walker, W.L. Kline, M. Infante-Casella. **Introduction to Vegetable Scouting; IPM Training for Farmers and Field Scouts**. Gloucester County, NJ. June 1, 2001.
21. Ingerson-Mahar, J., S.D. Walker, W. Kline, M. Infante-Casella. **Mid-Season Vegetable IPM Field Scout Training**. Visalli Farm, Gloucester County. July 5, 2001.
22. S.D. Walker, W. Kline, M. Infante-Casella. **Scouting Late Season Vegetables: IPM Training for Farmers and Field Scouts**. Visalli Farm, Gloucester County. August 3, 2001.
23. Ingerson-Mahar, J. **Monsters in your Backyard – Crickets**. Burlington County Summer 4-H Program, Burlington County, NJ. August 3, 2001.
24. Ingerson-Mahar, J. **Integrated Pest Management**. Monmouth County Master Gardener Training, Monmouth County, August 15, 2001.
25. Ingerson-Mahar, J., S. Walker. **Pumpkin IPM Pilot Project.** September Vegetable Twilight Meeting. September 25, 2001.
26. Ingerson-Mahar, J. **Basic Entomology**. Hunterdon and Somerset County Master Gardener Training. Hunterdon County, NJ. October 2, 2001.
27. Ingerson-Mahar, J. **Basic Entomology**. Alloway Township School Family Science Night. Alloway, NJ. October 3, 2001. Portions were televised on the New Jersey Network Television Station (NJN) four times starting on November 26.
28. Ingerson-Mahar, J. **Introduction to Insect Identification**. Master Gardener State Conference. New Brunswick, NJ. October 6, 2001.
29. Ingerson-Mahar, J. **Insect Identification**. Middlesex County Master Gardener Training, New Brunswick, NJ. November 30, 2001.

Meetings Organized

1. **Alternative Pest Management Session**, New Jersey Annual Vegetable Meeting, January 15-17, 2001.
2. **South Jersey and North Jersey Tomato Integrated Crop Management (ICM) Schools**, Gloucester County Extension Office, Feb 22, 2001 and Snyder Research and Extension Farm, March 7, 2001.
3. **Three Farmer and Field Scout Training Sessions**. J. Ingerson-Mahar, S.D. Walker, W. Kline, M. Infante-Casella. Visalli Farm, Mullica Hill, NJ. June 1, July 5, August 3, 2001.

National or Regional Publications

1. Ingerson-Mahar, J. **The History of Truck Farming in New Jersey**. Article for the Encyclopedia of New Jersey, Rutgers University. In press.
2. Holmstrom, K.E., M.G. Hughes, S.D. Walker, W.L. Kline, J. Ingerson-Mahar. **Spatial Mapping of Adult Corn Earworm and European Corn Borer Populations in New Jersey**. *Hort Technology*. Jan/Mar 2001. v. 11 (1) p. 103-109.
3. Henninger, M., G. Ghidiu, J. Mahar, S. Walker. **Wireworm Damage to Potato Tubers Over Time, 2000**. Proceedings of the 31st Annual Meeting of the Mid-Atlantic Vegetable Workers Conference. May 2001.
4. Walker, S., M. Henninger, G. Ghidiu, J. Ingerson-Mahar, W. Kline. **The Effect of European Corn Borer Damage on Yields in Commercial Potato Fields.** Proceedings of the 31st Annual Meeting of the Mid-Atlantic Vegetable Workers Conference. May 2001.
5. Holmstrom, K.E., M.G. Hughes, S.D. Walker, W.L. Kline. **Spatial Mapping of Two Vegetable Pest Populations.** Proceedings of the 31st Annual Meeting of the Mid-Atlantic Vegetable Workers Conference. May 2001.
6. Maletta, M.H., K. Holmstrom, W. Tietjen, W.P. Cowgill, G. Ghidiu. **Evaluation of Control for Flea Beetle on Eggplant in an Organic Production System.** Proceedings of the 31st Annual Meeting of the Mid-Atlantic Vegetable Workers Conference. May 2001.

State Publications

1. Cowgill, W. P., K. E. Holmstrom, S. A. Johnston, M. Maletta, E. Dager. **Evaluation of Fungicides and Cultivar Tolerance for Powdery and Downy Mildew Control of Pumpkins, 2000**. Vegetable Plant Pathology Research Results. Report No. 25. May 2001.
2. Hamilton, G., J. Ingerson-Mahar, K. Holmstrom, S. Walker. **2001 Vegetable Integrated Pest Management Delivery Program**. Rutgers Cooperative Extension Information Sheet IS005.
3. Ingerson-Mahar, J., K. Holmstrom, S. Walker. **2000 Annual Report**. Rutgers Cooperative Extension publication E266.
4. Ingerson-Mahar, J., K. Holmstrom, S. Walker. **2000 Annual Report** (brochure version). Rutgers Cooperative Extension publication E267.
5. Holmstrom, K. **Pumpkin IPM Scouting Form**. 2001 RCE IPM Program Materials.
6. Ingerson-Mahar, J. **Management of Soil Insects in Vegetable Production**. Proceedings of the New Jersey Annual Vegetable Meeting January 16-18, 2001.
7. Holmstrom, K.E., M.G. Hughes, S.D. Walker, W.L. Kline, J. Ingerson-Mahar. **Spatial Mapping of Two Vegetable Pest Populations**. Proceedings of the New Jersey Annual Vegetable Meeting January 16-18, 2001.
8. Walker, S.D., M. Henninger, G. Ghidiu, J. Ingerson-Mahar, W.L. Kline. **The Effect of European Corn Borer Damage on Yields in Commercial Potato Fields**. Proceedings of the New Jersey Annual Vegetable Meeting January 16-18, 2001.
9. Hughes, M.G. **Weekly ECB and CEW Distribution Maps – 2001**. CRSSA/RCE Web site: http://www.crssa.rutgers.edu/projects/gps/web_page/pest/ppa2001.html
10. Holmstrom, K.E., S.D. Walker. **Vegetable IPM Update**. 21 articles in the *2001 RCE Plant and Pest Advisory Vegetable Crops Edition*. May 9 – October 3, 2001.
11. 2001 RCE Plant and Pest Advisory Vegetable Crops Edition feature articles:
    a. Walker, S.D. **Who to Contact for Vegetable IPM Scouting Services; Summer Jobs Available; Northeast Pepper IPM Manual Now Available**. March 7, 2001.
    b. Ingerson-Mahar, J. **2001 Vegetable IPM Program**. April 4, 2001.
    c. Maletta, M., W. Cowgill, K. Holmstrom, G. Ghidiu, B. Tietjen. **Aphids Take a Toll on Eggplant**. May 2, 2001.
    d. Ingerson-Mahar, J. **Mid-Season Vegetable IPM Field Training**. June 20 and June 27, 2001.
    e. **Scouting Late Season Vegetables**. August 1 and July 25, 2001.
12. 2001 RCE Plant and Pest Advisory Organic Crops Edition articles:
    a. Maletta, M, W. Cowgill, K. Holmstrom, G. Ghidiu, B. Tietjen. Aphids Take a Toll on Eggplant. April 27, 2001.
    b. S.D. Walker. Who to Contact for Vegetable IPM Scouting Service; Summer Jobs Available. March 15, 2001.
    c. Holmstrom, K., S. Walker. Fall Cleanup for Pest Management. October 25, 2001.
13. 2001 RCE Plant and Pest Advisory Field and Forage Edition articles:
    a. Sciarappa, B., D. Kluchinski, D. Foulk, J. Ingerson-Mahar. Initiating True Armyworm IPM for Field Crops. August 16, 2001.

Other Educational Materials

1. Ingerson-Mahar, J., K.E. Holmstrom, S.D. Walker, M. Infante-Casella, R. Samulis, W. Kline, W. Sciarappa. **New Jersey Integrated Crop Management Tomato School Notebook**. Jan. 2001.
2. Walker, S.D., K.E. Holmstrom. **Scouting Methods for Fresh Market Ground and Staked Tomatoes**, for the New Jersey Integrated Crop Management Tomato School Notebook. Jan. 2001.
3. Holmstrom, K.E. **Tomato Insect and Mite Pests Common to New Jersey**, for the New Jersey Integrated Crop Management Tomato School Notebook. Jan. 2001.
4. Walker, S., J. Ingerson-Mahar, W. Kline. **Vegetable Scout Training Folder**. Presented to attendees of the Vegetable Field Scouting training sessions.

5. Walker, S.D. **The Farmer Scout Relationship** for the Introduction to Vegetable Scout Training folder.

Advisory Roles

Joe Ingerson-Mahar serves as an advisor to the Invasive Species Council, New Jersey Department of Agriculture.

COOPERATORS

Rutgers Cooperative Extension

1. Richard Carpenito, RCE IPM Field Technician
2. Kimberly Carll, RCE IPM Field Technician
3. Nancy Arthur, RCE IPM Field Technician
4. Steven Wright, RCE IPM Field Technician
5. Mike Sheets, RCE IPM Field Technician
6. Marilyn G. Hughes, Program Associate, Grant F. Walton CRSSA
7. Martha Maletta, Research Associate RCE of Hunterdon County
8. Winfred Cowgill, Agricultural Agent, RCE of Hunterdon County
9. Michelle Infante-Casella, Agricultural Agent, RCE of Gloucester County
10. Wesley Kline, Agricultural Agent, RCE of Cumberland County
11. Peter J. Nitzsche, Agricultural Agent, RCE of Morris County
12. Peter Probasco, Agricultural Agent, RCE of Salem County
13. Ray Samulis, Agricultural Agent, RCE of Burlington County
14. William Sciarappa, Agricultural Agent, RCE of Monmouth County
15. Richard VanVranken, Agricultural Agent, RCE of Atlantic County
16. William Tietjen, Agricultural Agent, RCE of Warren County
17. Gerald M. Ghidiu, RCE Specialist in Entomology
18. George Hamilton, RCE Specialist in Pest Management
19. Stephen A. Johnston, RCE Specialist in Plant Pathology
20. Melvin Henninger, RCE Specialist in Vegetable Crops
21. Stephen A. Garrison, RCE Specialist in Vegetable Crops
22. Edwin Dager, Farm Supervisor, Snyder Research and Extension Farm

Other Research Institutions

1. Dr. Shelby Fleischer, Penn State University.
2. Paul E. Blom, Penn State University.

Grower Cooperators

Cape May County

1. Bolton Legates, Legates Farm. RCE Blacklight Trap Program.
2. Bob Conover, Conover Farms. RCE Blacklight Trap Program.
3. Tom Buganski, Buganski Farms. RCE Blacklight Trap Program.

Cumberland County

1. David Sheppard, Sheppard Farms Inc. RCE Blacklight Trap Program.
2. Fred VanMeter, VanMeter Farms. Potato IPM Fax Program; Pheromone and Blacklight Trap Population Levels of Cutworms in White Potatoes.
3. Tom Scrivani, Scrivani Farms. RCE Blacklight Trap Program.
4. Lou and Robert Tolotti. RCE Blacklight Trap Program.

5. Kevin and Robert Flaim. RCE Blacklight Trap Program.
6. Duane Cruzan, Cruzandale Farms. Potato IPM Fax Program; Demonstration and Evaluation of Integrated Crop Scouting on Pumpkins in South Jersey.
7. Lee Mixner. RCE Blacklight Trap Program.
8. Randy Dickinson, M.R. Dickinson and Son. TOM-CAST Disease Forecasting Program for Processing Tomatoes.

Salem County
1. Henry Dubois, H & S DuBois. RCE Blacklight Trap Program; Fall Spinach Pheromone Traps.
2. Tom Bishop, Bishop Farms. Pheromone and Blacklight Trap Population Levels of Cutworms in White Potatoes.
3. Andy Buzby, Buzby Farms. Evaluation of Natural Enemy Populations in Bell Peppers.
4. John Coombs. RCE Potato IPM Fax Program.
5. Charles Paulaitis. RCE Blacklight Trap Program.
6. Marty Catalano. RCE Blacklight Trap Program.
7. M & J Catalano. Fall Spinach Pheromone Traps.
8. Ken Porch. RCE Blacklight Trap Program.
9. Bill Brooks. RCE Potato IPM Fax Program.
10. Kelly Farms. RCE Blacklight Trap Program; Carrot Weevil Assay.
11. George Wright. RCE Scouting Program (peppers).
12. Grant Hitchner. RCE Blacklight Trap Program.
13. Ed Byrnes. TOM-CAST Disease Forecasting Program for Processing Tomatoes.

Atlantic County
1. Charles Muzzarelli, Muzzarelli Farm. Determination of Sweet Potato Tuber Damage.
2. George, J.D., Lori Ruggero, Homestead Farms. RCE Blacklight Trap Program.
3. Joe Deficcio. Deficcio Farms. RCE Blacklight Trap Program.
4. David Rizzotte, Glossy Fruit Farm. RCE Blacklight Trap Program.
5. Ed and August Wuillermin. RCE Blacklight Trap Program.
6. Russell Franceschini. RCE Blacklight Trap Program.

Gloucester County
1. Chuck and Mike Visalli, C&M Visalli Farms. RCE Blacklight Trap Program; Farm Host for Scout Training Sessions.
2. David Duffield, Duffields Farm Market. RCE Blacklight Trap Program; Demonstration and Evaluation of Integrated Crop Scouting on Pumpkins in South Jersey.
3. Ed Gaventa, Cedarvale Farms. Demonstration and Evaluation of Integrated Crop Scouting on Pumpkins in South Jersey.
4. Glen and Gary Stecher. RCE Blacklight Trap Program.
5. Charles Zimmerman. RCE Blacklight Trap Program.
6. Bob Muth. RCE Blacklight Trap Program.

Camden County
1. John Rigolizzo, Johnny Boy Farms. RCE Scouting Program (sweet corn).
2. Dennis Donio, Donio Farms. RCE Scouting Program (sweet corn, peppers).
3. Tom Jarvis, Springdale Farms. RCE Scouting Program (sweet corn).

Burlington County
1. Ray and Ron Abrams, Homestead Farms. RCE Blacklight Trap Program; Fall Spinach Pheromone Traps.

2. Everett Abrams. RCE Scouting Program (sweet corn); Demonstration and Evaluation of Integrated Crop Scouting on Pumpkins in South Jersey.
3. John Abrams. RCE Blacklight Trap Program.
4. Bill, Eric, Peter Johnson, Johnson Corner Farm. RCE Blacklight Trap Program.
5. Lester Eckert. RCE Blacklight Trap Program.
6. Tom Sutton. RCE Blacklight Trap Program.
7. John Hunter. RCE Blacklight Trap Program.
8. Ray Hlubik. RCE Blacklight Trap Program; Private scouting.
9. Walt Katona, Katona Farms. RCE Blacklight Trap Program; Private scouting.
10. Herb Angel, Angel's Acres. RCE Blacklight Trap Program; Private scouting.
11. Nick and Mike Russo. RCE Blacklight Trap Program; Private scouting.

Ocean County
1. Peter DeWolf, DeWolf's U-Pick Farm. RCE Blacklight Trap Program; Private scouting.
2. Doug and Charlie Hallock, Hallock's U-Pick Farm. RCE Blacklight Trap Program; Private scouting.

Monmouth County
1. Tom Orgo, Slope Brook Farm. Demonstration and Evaluation of Integrated Crop Scouting on Pumpkins in South Jersey.
2. Carmine Infante. RCE Blacklight Trap Program; Private scouting.
3. John Samaha. RCE Blacklight Trap Program; Private scouting.
4. Don Pyle. RCE Blacklight Trap Program; Private scouting.
5. Angelo and George DiGregorio. RCE Blacklight Trap Program; Private scouting.

Mercer County
1. Joe Ruggieri. RCE Scouting Program (sweet corn).
2. Gary Mount, Terhune Orchards. RCE Scouting Program (sweet corn, tomatoes).
3. Scott Ellis. RCE Blacklight Trap Program; Private scouting.
4. Ted Wilk. Little Acres Farm. RCE Scouting Program (sweet corn, pumpkins).
5. George Kerr. RCE Scouting Program (sweet corn, pumpkins, tomatoes, peppers)

Middlesex County
1. Mickey Protinick. RCE Blacklight Trap Program; Private scouting.
2. Bob VonThun. RCE Blacklight Trap Program; Private scouting.
3. Jim and Sue Giamarese. RCE Blacklight Trap Program; Private scouting.
4. Pete Sigle, Clare's Market. RCE Blacklight Trap Program; Private scouting.
5. Kip Stults. RCE Blacklight Trap Program; Private scouting.
6. Ralph Coolman, Student Organic Farm. RCE Scouting Program (cucurbits, cole crops, tomatoes, peppers).

Somerset County
1. John Lyman. RCE Scouting Program (sweet corn).

Hunterdon County
1. Peter, John and George Melick, Towne Farm. RCE Scouting Program (sweet corn, tomatoes, pumpkins).
2. George Perehinys, Sweet Valley Farm. RCE Scouting Program (sweet corn, pumpkins).
3. Mike Matthews. Rainbow Haven Farm. RCE Scouting Program (sweet corn, peppers).
4. Ken Ravenberg, Tradition Farm. RCE Scouting Program (sweet corn).
5. Marc Phillips, Phillips Farm. RCE Scouting Program (sweet corn, cole crops, tomatoes, peppers).

6. Bob Lecompte. RCE Scouting Program (sweet corn, pumpkins, tomatoes, peppers, cole crops).
7. Tom Evans. RCE Scouting Program (sweet corn, pumpkins).

Morris County

1. Larry Ashley, Ashley's Turkeys and Produce. RCE Scouting Program (sweet corn, tomatoes).
2. Kurt Alstede, Alstede Farms. RCE Scouting Program (sweet corn, tomatoes, peppers, pumpkins, cole crops).
3. Ken Wightman, Wightman's Farms. RCE Scouting Program (sweet corn, pumpkin).
4. Jeff O'Hara. RCE Scouting Program (sweet corn, tomatoes, cole crops, peppers).
5. Harvey Ort. RCE Scouting Program (sweet corn).
6. Roy Hildebrant, Iona Hill Farm. RCE Scouting Program (cole crops, tomatoes, peppers, pumpkins).
7. Dale Davis, Stony Hill Farm. RCE Scouting Program (sweet corn, pumpkins).

Warren County

1. Larry Freeborn, Freeborn Farms. RCE Scouting Program (sweet corn, pumpkins, tomatoes, peppers).
2. Jim Parks. RCE Scouting Program (sweet corn, tomatoes, pumpkins, peppers).
3. Carl Race. RCE Scouting Program (sweet corn, cole crops).
4. Gary Donaldson. RCE Scouting Program (sweet corn, tomatoes, peppers).
5. Piazza Bros. RCE Scouting Program (sweet corn).
6. Bradley Burke, Long Meadow Farm. RCE Scouting Program (pumpkins).

Sussex County

1. George Fetzer, Valley View Farm. RCE Scouting Program (sweet corn, tomatoes, peppers).

Agricultural Industry

1. Furman Foods. TOM-CAST Disease Forecasting Program for Processing Tomatoes.
2. Garden State Pest Management. RCE Blacklight Trap Program. Demonstration and Evaluation of Integrated Crop Scouting on Pumpkins in South Jersey.
3. Helena Chemical Co. Potato IPM Fax System.
4. McConnell Agronomics. RCE Blacklight Trap Program.
5. Seabrook Bros. and Sons. RCE Blacklight Trap Program; Fall Spinach Insect Trapping
6. UAP Northeast. Potato IPM Fax System.
7. Violet Packing. TOM-CAST Disease Forecasting Program for Processing Tomatoes.
8. White Potato Association. Potato IPM Fax System.