

**PROCEEDINGS OF THE 2001
GEORGIA VEGETABLE
CONFERENCE**

January 5-7, 2001
Savannah, Georgia

William Terry Kelley, Editor

PROCEEDINGS

2001 Georgia Vegetable Conference

**January 5-7, 2001
Hyatt Regency
Savannah, Georgia**

Editor

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P. O. Box 1209
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**Sponsored by:
Georgia Fruit and Vegetable Growers Association**

In cooperation with:

**The University of Georgia
Cooperative Extension Service
Georgia Watermelon Growers Association
Vidalia Onion Committee**

2001 Conference Committee

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2001 GEORGIA VEGETABLE CONFERENCE & TRADE

SHOW EXHIBITORS AS OF 12/19/00

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FORWARD**

The continued growth and success of the Georgia vegetable industry is dependent upon the dissemination of timely and appropriate information. The assimilation and distribution of technology beneficial to these industries is a major effort of both the Agriculture Experiment Station and the Cooperative Extension Service at the University of Georgia. This is accomplished through basic and applied research, on-farm tests, observations and situation assessments and delivered through personal contact and programs such as this conference. The publication of the proceedings of this conference is done to provide our clientele with an opportunity to evaluate recent information and developments that might fill some need of their concern. We appreciate the participation of growers and research, extension, regulatory and service workers as well as those representatives of the fertilizer, seed, crop protection, publication, processing, packaging and handling industries. The presentations, discussions, and exhibits at this conference are designed to sustain the competitiveness and environmental integrity of the Georgia vegetable industry. Your comments and suggestions are important to us. Please address appropriate comments to authors, moderators or members of the conference committee or to the editor.

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TABLE OF CONTENTS

Conference Committee	ii
Extension Vegetable Team	ii
Association Officers	ii
Conference Exhibitors & Sponsors	iii-iv
Forward.....	v
Vegetable Conference Program	vii-xi
Vegetable Conference Abstracts/Summaries	1-88
Pesticide Registration-Third Party and Section 18.....	2
Vidalia Onions - Part I.....	10
Water Issues Update.....	22
Watermelon Fruit Blotch and Disease Management.....	23
Vidalia Onions - Part II.....	30
A Key to Fresh Produce Profitability - Marketing	37
Tomato Spotted Wilt Virus.....	38
Genetically Modified Organisms.	41
Improving Food Safety Practices on the Farm.....	44
Methyl Bromide & Alternatives - Update.....	52
Grading and Packing.....	63
Greenhouse Vegetable Production	69
Insect Issues and Tomato Yellow Leaf Curl Virus.....	75
Posters	83

2001 Georgia Vegetable Conference Program
January 5-7, 2001
Hyatt Hotel - Savannah, Georgia

Friday January 5, 2001

1:00 - 3:00 p.m. Concurrent Sessions

Session #1 - Pesticide Registration-Third Party & Section 18 - Chatham Room

Moderator: Dr. Stanley Culpepper
UGA Crop & Soil Sciences - Tifton, GA.

- 1:00-1:30 - **Third Party Registration in Florida**
Mr. Dan Botts, FL Fruit & Vegetable Growers' Association
- 1:30-2:00 - **Obtaining Section 18 Labels in Florida**
Mr. Mike Aerts, FL Fruit & Vegetable Growers' Association
- 2:00-2:30 - **Obtaining Section 18 Registrations in Georgia**
Mr. Doug Jones, GA Dept. of Agri., Pesticide Div-Atlanta
- 2:30-3:00 - **How Extension Specialists Work with Industry in the Development of Third-Party Registration**
Dr. Bill Stall, Univ. of FL, Horticulture, Gainesville, FL

Session #2 - Vidalia Onions - Part 1 - Sloane Room

Moderator, Mr. David Curry
UGA, Toombs County Extension Coordinator, Lyons, GA

- 1:00-1:25 - **Chemigation with Metam Sodium and it's Effect on Phoma Terrestris and Weed Control in the Vidalia Onion Production Area**
Mr. Reid Torrance, UGA, Tattnall County Extension Coordinator, Reidsville, GA
- 1:25-1:50 - **Bacterial Diseases in Onions**
Dr. Ron Gitiatis, UGA, Plant Pathology, Tifton, GA
- 1:50-2:15 - **Action Threshold for Insecticide Control of Thrips in Onions**
Dr. David Riley, UGA, Entomology, Tifton, GA
- 2:15-2:40 - **Sweet Onion Growth and Yield as Affected by Use of Mulches and Drip Irrigation**
Dr. Juan Carlos Diaz Perez, UGA, Horticulture, Tifton, GA
- 2:40-3:00 - **Mechanization in Onions**
Dr. Bryan Maw, UGA, Ag Engineering, Tifton, GA

Session #3 - Water Issues Update - Waterfront Room

Moderator: Mr. Kerry Harrison

UGA, Ag Engineering, Tifton, GA

- 1:00-1:40 - **New Horizons in Agricultural Meteorology**
Dr. David Stooksbury, UGA, State Climatologist, Athens, GA
- 1:40-2:20 - **The Effect of Land Use and Climate on Water Resources**
Dr. Elizabeth Blood, James Research Center, Newton, GA
- 2:20-3:00 - **Grower Involvements and Perspective on Water Management**
Mr. Greg Murray, Murray Brothers Farm, Bainbridge, GA
Mr. Murray Campbell, Hopeful, GA

3:45-5:00 p.m. Concurrent Sessions

Session #4 - Watermelon Fruit Blotch and Disease Management - Chatham Room

Moderator: Mr. Ken Lewis

UGA, Crisp County Extension Coordinator, Cordele, GA

- 3:45-4:10 - **Bacterial Fruit Blotch Observations from Georgia**
Dr. Ron Walcott, UGA, Plant Pathology, Athens, GA
- 4:10-4:35 - **Control of Watermelon Fruit Blotch**
Dr. Don Hopkins, Univ. of FL, Plant Pathology, Gainesville, FL
- 4:35-5:00 - **Management of Gummy Stem Blight and Powdery Mildew**
Dr. David Langston, UGA, Plant Pathology, Tifton, GA

Session #5 - Vidalia Onions - Part II - Sloane Room

Moderator: Mr. Reid Torrance

UGA, Tattnall County Extension Coordinator, Reidsville, GA

- 3:45-4:10 - **Management of Foliar Diseases of Vidalia Onions**
Mr. David Curry, UGA, Toombs County Extension Coordinator,
Lyons, GA
Dr. David Langston, UGA, Plant Pathology, Tifton, GA
- 4:10-4:35 - **What Happens to a Vidalia Onion When It Is Stored**
Dr. Al Purvis, UGA, Horticulture, Tifton, GA
- 4:35-5:00 - **Advancements in Understanding Flavor Development in Onion**
Dr. Bill Randle, UGA, Horticulture, Athens, GA

Session #6 - A Key to Fresh Produce Profitability - Marketing - Waterfront Room

Moderator: Mr. Howard McGlamory
Georgia Dept. of Agriculture, Atlanta, GA

3:15-5:00 - Produce Marketing From A Buyer's Perspective

A panel of three produce buyers from major retailers discuss what they are looking for from growers followed by Q & A

6:00 PM President's Reception - in Atrium area
(Open to all registered attendees)
Award's Banquet - Harborside Ballroom
(Included in full conference registration fee)

Dance to the music from "*Men of Distinction*" playing your favorite 50's, 60's, 70's, 80's and 90's music - Harborside Ballroom

Saturday January 6, 2001

8:30-10:00 a.m. General Session

10:45 - 12:00 noon General Session

1:30-3:00 p.m Concurrent Sessions

Session #7 - Tomato Spotted Wilt Virus - Savannah Room

Moderator: Mr. Tim Flanders
Grady County Extension Coordinator, Cairo, GA

1:30-2:00 - Tomato Spotted Wilt Virus Resistant Pepper Varieties

Mr. Curt Pollard, Novartis Rogers Brand Seeds, Valdosta, GA

2:00-2:30 - Research Update on TSWV

Dr. Hannu Pappu, UGA, Plant Pathology, Tifton, GA

2:30-3:00 - Thrips and Tomato Spotted Wilt Management Update

Dr. David Adams, Dr. David Riley, UGA, Entomology, Tifton, GA
and Dr. Hanu Pappu, UGA, Plant Pathology, Tifton, GA

Session #8 - Genetically Modified Organisms - Sloane Room

Moderator: Mr. Brad Mitchell
Mitchell County Extension Agent, Camilla, GA

1:30-2:00 - What are GMOs and What are the Advantages?

Ms. Debi Warnick, Novartis Rogers Brand Seeds, Boise, ID

2:00-2:30 - Commercializing Products of Biotechnology

Mr. David Tricoli, Seminis Vegetable Seeds, Woodland, CA

2:30-3:00 - GMOs From a Produce Buyer's Perspective

Industry Buyer

Session #9 - Improving Food Safety Practices on the Farm - Chatham Room

Moderator: Dr. Bill Hurst
UGA, Food Science & Technology, Athens, GA

1:30-1:50 - Introduction - Why Produce? Why Now?

Dr. Bill Hurst, UGA, Food Science & Technology, Athens, GA

1:50-2:10 - Getting the Message About Good Agricultural Practices (GAPs)

Dr. Betsy Bihn, Cornell Univ., Food Science, Geneva, NY

2:10-2:30 - Introduction to Good Agricultural Practices (GAPs)

Dr. Jim Rushing, Clemson Univ., Horticulture, Clemson, SC

2:30-2:50 - Third Party Inspections

Robert Stovicek, Ph..D., Primus Laboratories, Santa Maria, CA

2:50-3:10 - GAPs from a Grower/Packer Perspective: What Is and Isn't Possible?

Tim Mercier, Mercier Orchards, Blue Ridge, GA

3:10-3:30 - Extension Has a Key Role in Developing and Implementing Effective Farm Food Safety Programs

Dr. Darbie Granberry, UGA, Horticulture, Tifton, GA

3:45-5:15 p.m. Concurrent Sessions.

Session #10 - Methyl Bromide & Alternatives - Update - Sloane Room

Moderator: Mr. Keith Rucker
Tift County Extension Agent, Tifton, GA

3:45-4:10- Methyl Bromide Alternatives in Bell Pepper 2000

Dr. Alex Csinos, UGA, Plant Pathology, Tifton, GA

4:10-4:35 - Pending Legislation, Industry Efforts and Supply

Perry Fuller, Hendrix & Dail, Tifton, GA

4:35-5:00 - Herbicide Situation for Methyl Bromide Alternatives

Dr. Bill Stall, Univ. of FL, Horticulture, Gainesville, FL

5:00-5:15 - Bell Pepper Transplants Grown in Compost

Bill Brim, Lewis Taylor Farms, Tifton, GA

Session #11 - Grading and Packing - Chatham Room

Moderator: Mr. Glenn Beard
Colquitt County Extension Agent, Moultrie, GA

3:45-4:10 - Grades, Standards and Inspection of Fresh Vegetables

Ken Mizelle - USDA, Agricultural Marketing Division, Washington, DC

4:10-4:25 - Four Functions for Vegetable Packages

Dr. Stan Prussia, UGA, Ag Engineering, Griffin, GA

4:25-4:50 - Vegetable Packaging

Mike Brown - Willamette Industries, District Sales Manager

4:50-5:15 - Standardized Reusable Containers - the Next Step

William Anderson, IFCO Systems, Tampa, FL

Session #12 - Greenhouse Vegetable Production - Harborside West

Moderator: Dr. George Boyhan
UGA, Horticulture, Statesboro, GA

**3:45-4:30 - A New Direction for Florida Vegetable Producers
Greenhouse Production**

Dr. Dan Cantliffe, Univ. of FL, Horticulture, Gainesville, FL

4:30-5:00 - Lettuce Production in Tobacco Float Beds

Dr. George Boyhan/Dr. W. Terry Kelley/Mr. David Curry, UGA

Session #13 - Insect Issues and Tomato Yellow Leaf Curl Virus - Savannah Room

Moderator: Mr. Joel Hudgins
Decatur County Extension Agent, Bainbridge, GA

3:45-4:15 - Pollination in Vegetable Crops

Dr. William Terry Kelley, UGA, Horticulture, Tifton, GA

4:15-4:45 - Whiteflies

Dr. David Adams, UGA, Entomology, Tifton, GA

4:45-5:15 - Tomato Yellow Leaf Curl Virus Weed Hosts

Dr. M.J. Davis, Univ. of FL, Plant Pathology, Homestead, FL

**VEGETABLE
ABSTRACTS
AND
SUMMARIES**

Editor's Note: Those presentations whose summaries/ abstracts are not included in these proceedings were not available at press time.

Session #1

Pesticide Registration - Third Party and Section 18

Moderator: Dr. Stanley Culpepper

Obtaining Section 18 Labels in Florida

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Florida Fruit and Vegetable Association (FFVA) created its Environmental and Pest Management Division (EPM) in 1985. One of the significant responsibilities assumed by the EPM Division is to support FFVA producer members in obtaining specific and crisis exemptions under the Federal Insecticide, Fungicide, and Rodenticide Act's (FIFRA) Section 18. With continued pressure on agri chemicals through reregistration activities and the implementation of the Food Quality and Protection Act, in addition to the hesitancy exhibited by EPA for new product registration, FFVA is increasingly involved in these efforts. It is extremely important that all parties involved in the process - growers, the chemical industry and FFVA - have a common understanding of the process and requirements necessary to continue to meet the needs of the growers, while preserving the process for future use. Many of the procedures and justifications used in the past are no longer adequate to address the review required at the State and Federal regulatory level.

FFVA plays a major role in the Section 18 process for fruit and vegetable commodities. FFVA's EPM Division functions as the primary author of emergency exemption applications submitted to the Florida Department of Agriculture and Consumer Services (FDACS) in support of producer needs. The Section 18 process is highly complex and, in many aspects, can be subjective. To continue serving the system in this unique fashion, it is absolutely imperative that each and every request produced represents the best available option, with clear-cut evidence to support the data requirements of FDACS and EPA.

The policies and procedures FFVA's EPM follows for submission of a Section 18 registration are comprehensive. First and most important, a verified determination of need must be recognizable, i.e., an emergency situation must exist. All Section 18 activities are initially based on requests from grower members. Requests for pursuing a Section 18 petition are based on a need expressed by a commodity exchange, or on a need expressed by a significant number of growers producing the commodity in question. FFVA does not support requests solely based on the need to clean up misuse situations. These uses must be supported through the normal registration process.

Growers that request Section 18 activity by FFVA need to make available all

information necessary to document their economic or pest management activities that prompted the request. All efforts are made to identify potential Section 18 needs in a timely fashion in an effort to prevent the need for a crisis exemption.

Second, the selection of the pesticide(s) to proceed with the petition is established. Prior to initiating any Section 18 request, potential compounds are scrutinized to select the most appropriate compound(s) for the crop/pest situation. FFVA always solicits support and pertinent information from the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida in determining the most efficacious and cost effective product for use in resolving the pest problem(s). Criteria considered in the selection process are:

- 1) Status of the compound in federal registration process;
- 2) Availability of efficacy data on pest species (Florida data preferred);
- 3) Status of tolerance for the crop in question;
- 4) Health and safety considerations;
- 5) Support by the registrant for the Section 18, and a commitment to pursue full registration in an expeditious manner (within 3 years).

Every effort is made to clearly identify all candidate pesticides and review these criteria. Where possible, the product selected is the most cost effective candidate that represents the greatest potential for a successful petition.

Next comes the preparation of the actual emergency exemption petition. FFVA expects cooperation from all affected parties in the preparation of a Section 18 petition, that is, growers, the registrant, and IFAS personnel within the University of Florida identified by producers as knowledgeable experts. FFVA then contacts FDACS once a candidate compound is identified, to allow a preliminary review for any obvious potential concerns, such as Endangered Species sensitivities. Extra copies of completed petitions are provided to the registrant of the named chemical, and IFAS contacts. Following submission of the petition with FDACS, FFVA assists FDACS in developing the monitoring and enforcement programs required for the specific exemption.

Lastly, the use oversight and preparation of the final report issues must be addressed. As is customary, FFVA notifies the affected membership when a Section 18 use is granted to identify the use restrictions and reporting requirements for each Section 18. Where possible, FFVA also attempts to identify affected non-FFVA member commodity producers to make sure all affected producers have access to the emergency exemption. Nearing the expiration of an specific exemption, FFVA members are then expected to provide the EPM Division with all use information necessary to complete the final report as soon as possible, to foster completion of the final report. FFVA also serves as the focal point for collection of records necessary for either new food use chemicals granted specific exemptions, or for compounds used under the crisis provisions. We continue to work with registrants to ensure that all links in the distribution chain understand the restrictions and requirements of Section 18 exemptions, and as a matter of responsibility, FFVA immediately notifies FDACS of any

adverse impacts or misuse under a specific exemption granted after an FFVA request.

EPA attempts to adhere to their internal policy of reviewing all Section 18 requests, and to communicate Agency decisions on Section 18s within 50 calendar days of receipt. FFVA appreciates the Agency's position, and therefore understands the appropriateness of submitting the best information that helps to best utilize EPA's limited resources related to review of emergency exemption requests.

Obtaining Section 18 Registrations in Georgia

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Section 18 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) authorizes the Environmental Protection Agency (EPA) to permit the use of an unregistered pesticide for a limited time if EPA determines that emergency conditions exist. Usually, this arises when growers and others encounter a pest problem on a site for which there is either no registered pesticide available, or for which there is a registered pesticide that would be effective, but is not yet approved for the particular site (or for which no tolerance is established if the application will be made to a food crop). When this occurs, a state or federal agency applies to EPA on behalf of the growers for an emergency exemption. This particular type of emergency exemption is called a specific exemption due to the specificity of the request, which generally details one pesticide for use on a particular crop to control a specific pest. Typical justifications for specific exemptions include the introduction of a new pest; the expansion of the range of a pest; the cancellation or removal from the market of a previously registered and effective pesticide product, or the loss of efficacy in available products for any other reason. Additionally, an emergency situation is generally considered to exist when no other viable (chemical or non-chemical) means of control exist, and when the emergency situation will cause significant economic loss to affected individuals if the exemptions not granted. However, an emergency exemption is not designed to address the improvement of crop yields over what would normally be expected, to provide a more convenient method of pest control, to enhance profitability, to provide pest control for new crops (except when an emergency situation could not have been foreseen), or to get a pesticide on the market more quickly.

The process for obtaining a section 18 registration in Georgia is dictated by Federal Law as well as State policy. It is the policy of the Georgia Department of Agriculture that in the majority of cases the University of Georgia Cooperative Extension Service provides the petition for submittal to EPA and fully supports the section 18 application. The expertise for composing a petition lies primarily with the Extension Specialist for the particular crop in question, and we therefore defer to this person to provide the information required for a specific exemption as outlined in 40 CFR 166.20. We have never applied for a section 18 registration without the full support of the UGA Cooperative Extension Service, as well as the company that markets the particular pesticide product, and we will continue to work closely with extension in seeking these registrations. When the petition is complete, it is sent to the Georgia Department of

Agriculture for review, a process that generally takes no longer than a week. The petition is then forwarded to EPA for final review. EPA has set a 50 day target processing time for section 18 petitions, and in 2000 achieved a record average processing time of 44 days. The Commissioner of Agriculture has the authority to declare a crisis exemption, which allows for the immediate use of the pesticide, if there is not sufficient time to request a specific exemption and the timing of the pesticide application is critical. However, due to the uncertainty of tolerance issues, we are very conservative in declaring a crisis. Also, a crisis may not be declared for a first time food use. When the petition for the specific exemption is approved, we notify the Extension Specialist and issue a press release in order to notify growers in the State, and publish a notice in the Georgia Department of Agriculture Market Bulletin as well. We also notify the company which markets the pesticide product so that the product can be shipped to Georgia if not already available, along with a special section 18 label for the product. This label outlines the specific terms and conditions under which the exempted pesticide may be used, and must be adhered to by the grower who applies the product for the use specified in the approved emergency exemption.

How Extension Specialists Work with Industry in the Development of Third-Party Registrations

W.M. Stall

Extension Vegetable Specialist - Weed Science
Horticultural Sciences Department
University of Florida

Third-party registrations of pesticides on vegetables, for the most part, are for herbicides. This is due to the manufacturer not wishing to assume the liability for the low acreage use of the herbicide on an extremely high value crop. They maintain, and rightly so, that one litigation could negate any profit they might see on the sale of the material for years. This decision is most often made at corporate headquarters.

Extension specialists first become aware of potential herbicide uses on vegetables through communication with manufacturer research/development or sales representatives, or by communications with researchers or specialists from other states. In most cases, specialists become familiar with the product through their own trials or through associated research trials. During this period of time, the manufacturer has not yet made the decision not to label the product. Also, during the research period, problems that will affect the use of the potential herbicide, such as a narrow window of crop tolerance, an application timing problem, or a plant back restriction problem becomes evident.

When enough efficacy research has been done to warrant residue tolerance established for labeling, the decision is made by the manufacturer whether to go ahead or drop the product. In a great many cases, extension specialists have submitted a petition for the product to IR-4 for research on tolerance establishment. Labeling support of the product by the manufacturer must be present before IR-4 will proceed with the research. In many cases, this is the first time that there is a decision by the corporate headquarters to not support labeling of the product.

Growers and commodity groups have become aware of the herbicides through field days and grower meetings during the research process. If the product is important in the control of an important pest in one or more commodities, growers may petition a third-party registrant to try to establish an agreement with the manufacturer to obtain a third-party label. With a third-party registrant agreement, IR-4 can proceed with tolerance establishment.

Once a label is established, extension faculty, whether specialists or county faculty, communicate to growers that there is a label and the conditions of the label. I personally feel it is very important to impart to growers any precautions that should be followed when the product is used. These precautions are usually stated on the third-party label also. In many cases, third-party labels are use-at-your-own-risk labels. Growers

should be fully aware that there may be a narrow window of use and rate, or that the product should not be used under specific weather conditions.

Herbicide labels for vegetables are very few to begin with. Manufacturers are becoming more unwilling to label new chemistry on these minor acreage crops. Third-party labels will become more and more important in the coming years. Communication between growers and extension faculty, both ways, is very important in the establishment of labels for the commodities we grow.

Session #2

Vidalia Onions Part 1

Moderator: Mr. David Curry

**Chemigation with Metam Sodium and It's Effect
On Phoma Terrestris and Weed Control
In the Vidalia Onion Production Area**

Reid Torrance*, David Langston, and Don Sumner
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Evaluation of the use of fumigants on transplant production beds for control of damping off diseases in 1992 was the catalyst for the commercial use of metam sodium in the Vidalia onion production area. However, it was not the fungicidal properties of this fumigant that gained it favor. Rather it was the exceptional weed control that was evident in the metam sodium treatments in 1992. The standard herbicide used at the time on transplant seedlings in the area was Dacthal at the rate of 8 pounds per acre pre-emergence. Stunting of the plants from Dacthal was documented a few years earlier and weed control was typically inadequate. Growers would often spend over \$300 per acre for hand labor to clean up weed infestations left by Dacthal. Enhanced seedling vigor was evident where metam sodium was used even in comparison to untreated weed-free control plots. Thus the difference in plant growth was significant between metam sodium and Dacthal treatments, as was weed control.

The enhanced seedling vigor of metam sodium treated plots also eventually led to the elimination of fungicides traditionally used to address *Pythium*, *Rhizoctonia*, or *Sclerotinia* pathogens. Damping off due to these pathogens became less of a problem, because plants grew through the susceptible one to two leaf stage very quickly. This vigor also made plants less susceptible to dehydration. Weed control has been about 90% over all, with rates of 50 gallons per acre of 42% metam sodium. For all of these reasons, over 95% of the onion plant beds in Georgia today are treated with metam sodium.

Typically, soil is deep-turned during the summer and rotovated periodically to reduce weed debris, break up clods, and encourage weed seed germination. Plant beds in Georgia are sown in September, and transplants are set out in November and December. Conventional metam sodium treatments on plant beds, about 3-4 weeks prior to seeding, utilize a spray boom mounted on the front of the rotovator. The fumigant is incorporated to a depth of about eight inches and sealed in with a roller. Immediately following treatment, one-third to one half inch of irrigation is applied. It is irrigated every few days for a week in the absence of precipitation. This helps to seal the material in the soil, reducing volatilization in our sandy soils, and encourages weed seed germination. It is imperative that low levels of plant residue and good soil moisture, similar to that considered ideal for planting, is present at the time of treatment to allow for adequate mixing of the material in the soil and optimum sealing of the surface.

We are just beginning to use chemigation of metam sodium commercially. Last year a test was conducted at Dowdy Farms where the material was injected into a center pivot. Soil samples were taken August 3rd for determining *Phoma terrestris* levels in the soil from ten plots (6x10 feet). Five plots were covered with plastic prior to treatment to serve as a non-treated control. August 4th the field was treated with 60 gallons of 42% metam sodium applied in seven tenths inch of water per acre. An additional two tenths inch was applied immediately after treatment. August 5th the plastic was removed. Irrigation was applied on August 6th (one tenth inch) and August 7th (two tenths inch). On August 14th rainfall amounts of one inch and two tenths were recorded. On August 19th a second set of soil samples was collected for *P. terrestris* evaluation and plots were rated for weed control. Approximately 90% weed control was obtained.

On September 1st preplant fertilizer (1000 pounds of 5-10-15 per acre) was applied and beds were sown on September 13th. Subsequent fertilization resulted in total N-P-K levels of 139-164-180 respectively. On November 5th, the transplants were harvested, weighed and counted. They were also evaluated for the presence of *P. terrestris* based on the percentage of the root system exhibiting pink discoloration which is an indicative symptom of the pathogen. The treated plots averaged about 77 plants per foot of row versus 72 plants per foot in the untreated plots. Plant mass per five feet of row averaged 688 grams in the treated plots and 473 grams in the untreated plots. This translates into an increase in plant population of 7% and plant mass of 45% where metam sodium was applied. Additionally, only 2.5 % of the metam sodium treated plants had root discoloration of more than two percent while over 86% of the untreated plants had over two percent of their root systems discolored. None of the metam sodium treated plants exhibited 40% of the untreated plants.

This test was continued into the field production phase, as this area was transplanted back into onions on January 10th. The field had a crop history of onions in 1997, 1998, and 1999 followed by onion beds in 1999, and back to onions in 2000. These monoculture crop histories are not rare, and the lack of crop rotation is a big reason for increased concern about Pink Root Rot in Georgia and the effectiveness of metam sodium here. The fertility levels at this site for field production for the season in terms of N-P-K were 137-177-144, respectively. Onions were harvested on April 28th. The five treated plots produced a yield equivalent to 520 field bags per acre (60 lbs. per field bag) while the five untreated plots produced 480 field bags per acre. This data supports seven years of field production data gathered by Dr. Don Sumner from 1993-1999. His research shows a significant yield increase with the use of metam sodium in five of seven years, with an average yield increase over the control of 81 cwt. per acre.

In summary, chemigation with metam sodium significantly reduced the populations of *P. terrestris* and the severity of Pink Root Rot. Metam sodium was effective in improving seedling health and reducing weed populations on the plant bed, and resulted in improving final yield in field production. This study indicates that chemigation with metam sodium is a viable alternative to soil incorporation applications.

Bacterial Diseases In Onions

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Bacterial diseases of onion have caused significant losses in the Vidalia onion industry in recent years. Most losses have occurred due to bacterial streak (BS), sour skin (SS), and center rot (CR). Although there are some similarities among these diseases (e.g. all are caused by bacteria that are widespread and appear to be endemic to Georgia), there are also some important differences. BS, caused by *Pseudomonas viridiflava*, usually occurs under “cooler” conditions, and has been a problem anytime from December through the end of March or early April. On the other hand, CR, caused by *Pantoea ananatis*, occurs under warmer conditions. It has been a problem both in seedbeds in the early fall as well as in production fields from March through the end of harvest. SS, caused by *Burkholderia cepacia*, generally has been a problem very late in the season or during unusually warm spells. Both *P. viridiflava* and *P. ananatis*, which cause BS and CR, respectively, have been recovered as resident epiphytes from various weeds in Georgia and appear to be ubiquitous. *P. ananatis* also may be seedborne, as the bacterium was recovered from seed from plants that had bolted in field plots where CR was prevalent in 2000. *B. cepacia*, on the other hand, is soilborne and is very difficult to eradicate. All three bacterial species are represented by strains resistant to copper bactericides. At least one strain of *P. viridiflava* recovered from onion in 2000, was resistant to the combination of cupric hydroxide and maneb in an agar plate assay in the laboratory. Some levels of resistance occur in different onion varieties to either BS or CR, but there appears to be no correlation for resistance to both diseases. In preliminary tests in the 1999-2000 season, black plastic significantly increased CR incidence, wheat straw mulch significantly reduced CR incidence, and drip irrigation had no impact on CR incidence.

Action Thresholds for Insecticide Control of Thrips in Onions

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Thrips, specifically western flower thrips, *Frankliniella occidentalis*, tobacco thrips, *F. fusca* and (less frequently in Georgia) onion thrips, *Thrips tabaci*, cause damage to onions by feeding on the leaf surface by rasping plant cells and feeding on plant sap. If thrips occur in high enough numbers to noticeably injury leaf tissue prior to bulb formation, a significant reduction in onion bulb size can result. Also there have been reports of increased disease incidence, such as purple blotch, with high numbers of thrips. Thrips in onions in Tift county occur in low numbers in January to February (<0.1-1 per plant), begin to increase in early March (1-5 per plant), and continues increase in late March and early April (15-50 per plant). Based on recent studies at Tifton, two years out of four have resulted in significant thrips damage (25% yield loss), but this means also that half the years required no insecticide sprays for thrips. Thus, using a threshold for controlling thrips with insecticides is critical for determining the need for thrips control on a year by year basis. An action threshold that we have been developing is that a single spray of effective insecticide can be initiated when thrips occur at 1 thrips per plant, but that subsequent sprays should only be made when the thrips level reaches an average of 5 thrips per plant. We will be investigating this further in 2001 to more accurately describe this relationship.

In order to recommend an effective insecticide for thrips control, a trial was conducted in 2000 to evaluate various chemicals for the control of thrips in onions. Onions, var. Granex 33, were direct seeded on 15 Nov 1999 into four rows per bed at approximately 2-3 inches between plants and maintained with standard cultural practices. Total numbers of thrips per plant were counted on five plants per plot on a weekly basis beginning on 3 Feb 2000 and thrips samples were collected from onion tops during the test to determine species of thrips. Most of the thrips were collected from the plant at the time of bulb formation, April 17 and averaged about 4 thrips per plant in the untreated check. Six application of insecticide were applied beginning on February 3 and continuing weekly. Insecticide treatments were applied with a tractor mounted, compressed air sprayer delivering 61 GPA with three TX18 hollow cone tips per row. *Frankliniella fusca* and *F. occidentalis* were the dominant species in this test based on the onion top sample. In the scouting samples, the best treatment overall was the lower rate of Warrior (lambda cyhalothrin) plus Atrapa (malathion) followed by Spintor (spinosad), Lannate (methomyl), and Warrior alone at the high rate. In the onion top sample, the best treatments were the lower rate of Warrior plus Atrapa, the high rate of Warrior alone, and Spintor. Combining the high rate of Warrior with Atrapa did not improve efficacy over Warrior alone when evaluating total thrips, but did tend to improve efficacy of western flower thrips. The Spintor treatment tended to have a few more onion

thrips, but number of this species were too low to assess efficacy (a common situation in south Georgia onion fields). Yield was not significantly different between treatments in this test, because thrips numbers never reached an average of 5 per plant.

Sweet Onion Growth and Yield as Affected by Mulches And Drip Irrigation

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Dry onions represent the leading vegetable crop by value (\$75 million) in Georgia. During 1998, dry onions in Georgia were planted to over 15,000 acres. Onions are typically grown on bare soil and irrigated with high-pressure systems such as sprinklers or center-pivots. These irrigation methods apply water to the whole field, even though onion plants occupy a fraction of the field. Besides, in most onion-producing areas of Georgia, soils are sandy-loam with a low water-holding capacity. In this kind of soils, frequent irrigation is necessary during periods of high evaporative demand in order to maintain adequate soil moisture content.

Soil moisture levels may significantly affect the quality and yield of onions. Low moisture conditions in the soil are conducive to poor yields. However, excessive moisture conditions result in irrigation water waste, nutrient leaching, and often lead to rots and poor bulb quality. In drip irrigation, water is applied only next to the plants, which allows saving the water that otherwise would be applied to aisles between the beds. This water saving is particularly significant in crops with a shallow root system such as onion. Additionally, drip irrigation allows for frequent water applications, which result in less fluctuation in soil moisture content compared to sprinkler or center-pivot irrigation. Another advantage of drip irrigation is that it allows for the delivery of fertilizers and pesticides in the irrigation water, resulting in the placement of these chemicals close to the root zone.

Drip irrigation alone or in combination with plastic mulches is widely used for vegetable production, particularly for tomatoes, peppers and melons. However, drip irrigation and plastic mulches are not utilized for onion production in Georgia, and they are used only in a small scale in other parts of the USA. The benefits associated to the use of plastic mulches for vegetable production include higher yields, earlier harvests, improved weed control, cleaner fruit and increased efficiency in the use of water and fertilizers.

Materials and Methods

During the period 1999-2000, we started a research project with the objective of determining onion plant growth and yield as affected by mulch (black plastic film or wheat straw) and irrigation method (drip or sprinkler). The experiments were conducted at the Black Shank Farm (Tifton) and at the Vidalia Onion and Vegetable Research Farm (Reidsville). The experimental design was a split plot, where the main plot will be the irrigation system (sprinkler or drip) and the sub-plot was the type of mulch (bare soil, black plastic or wheat straw). Each sub-plot consisted of three 60-ft long beds and each bed had four rows nine inches apart, with a plant spacing of six inches. In drip-irrigated plots, there were two lines of drip tape per bed. Fertilization of sprinkler-irrigated plants was according to UGA extension recommendations. Pre-plant fertilizer (1000 lb 5-10-15 per acre) will be applied to the soil for all treatments. After transplanting drip-irrigated plants, N and K will be supplied weekly through the drip tape.

Results and Discussion

Plant growth measurements at the Black Shank indicated that plants over bare soil had a larger root system than the plants over straw or plastic mulch. Canopy size was similar under both irrigation systems, although drip-irrigated plants over plastic mulch tended to have a higher canopy size.

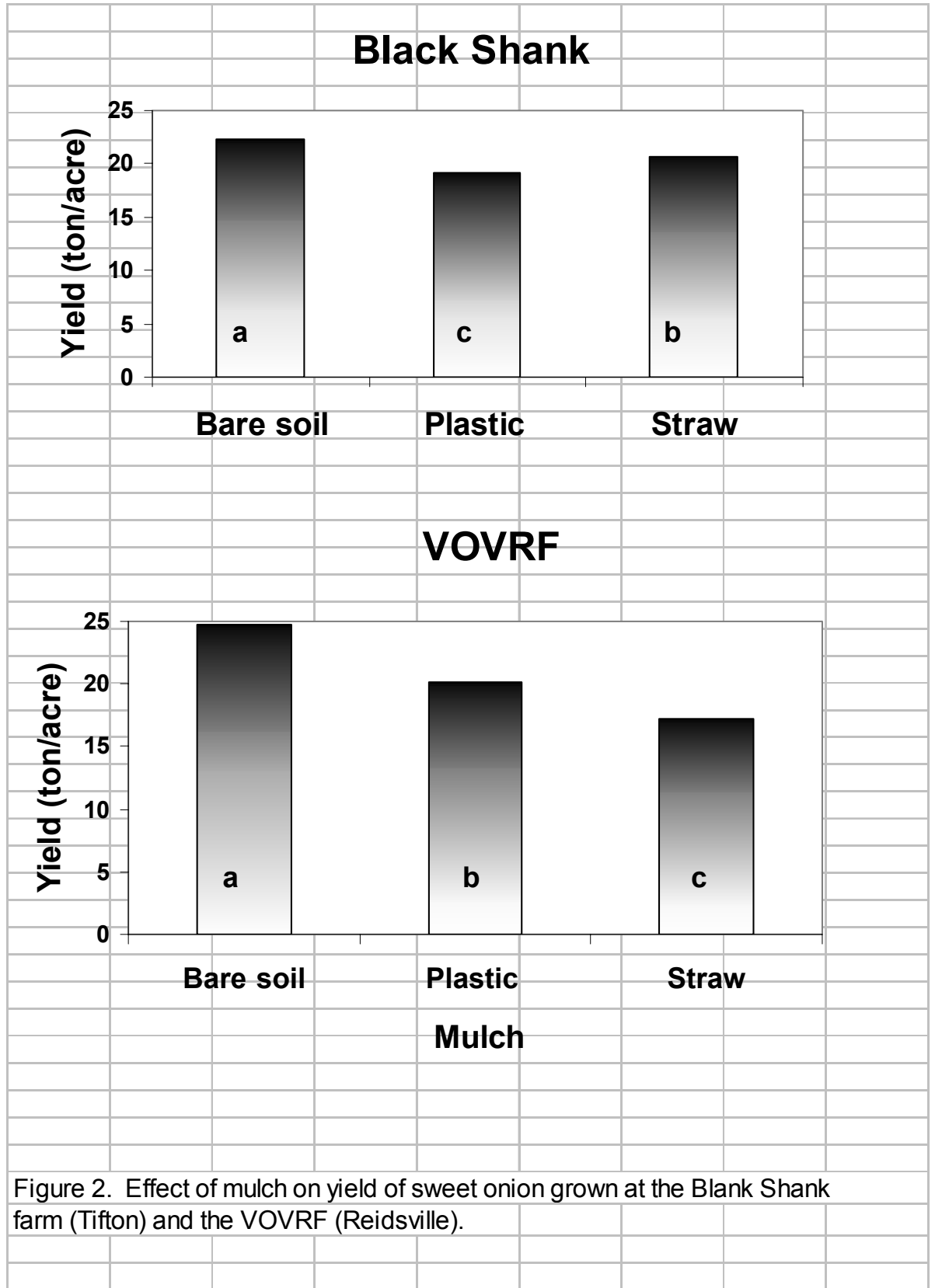
In the Black Shank, total yield was higher for plants grown under sprinkler irrigation than under drip irrigation (Fig. 1). In the VOVRF, total yield was similar under both irrigation methods, although there was a tendency for a higher yield under drip irrigation (Fig. 1). Plants grown over bare soil had the highest total yields both at the Black Shank farm and at the VOVRF (Fig. 2). The lowest yield was for plants over plastic (Black Shank) and straw (VOVRF).

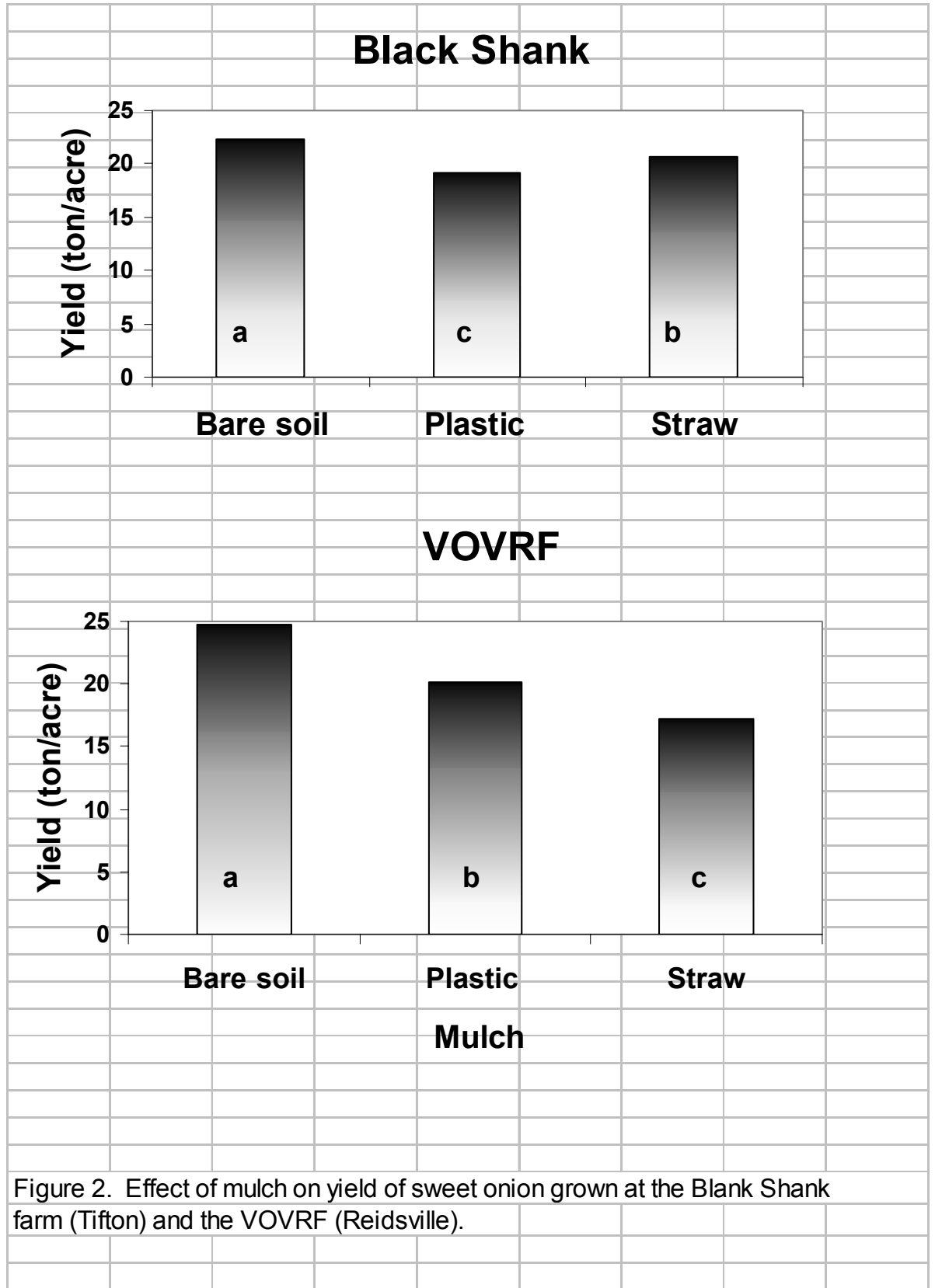
The last three weeks before harvest plants were exposed to high temperatures (90's) that affected canopy growth and possibly the yields. Plants grown over plastic mulch were the most affected by the high-temperature conditions. It is possible that this heat-stress period is associated with the reduced yield of plants over plastic. Plastic mulch has been previously shown to increase soil temperature up to 8-10 degrees F relative to bare soil. Excessive soil warming may be deleterious to plant growth, significantly reducing the yield.

This report includes data of only one year. Thus, no definite conclusions can still be drawn about the effect of the use of drip irrigation and mulches. However, our present results suggest that onions grown with drip irrigation over bare soil have yields similar to those of onions grown under conventional conditions (bare soil and sprinkler irrigation).

Acknowledgments

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Mechanization of Sweet Onions

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Sweet onions are, by nature, succulent tender, low in pungency and high in sugar. Those physiological characteristics lend sweet onions to be easily damaged and a haven for disease. Understanding the nature of the sweet onion is an important step on the road towards successful production and marketing.

The University of Georgia continues to provide support to the Vidalia Onion industry, studying all aspects of production and marketing. Concerning mechanization, once having a high labor requirement, sweet onions are now being handled more carefully and by mechanical means, curing is being taken more seriously and various storage techniques are being further explored.

Session #3

Water Issues Update

Moderator: Mr. Kerry Harrison

Note: There are no abstracts for this Session.

Session #4

Watermelon Fruit Blotch and Disease Management

Moderator: Mr. Ken Lewis

Bacterial Fruit Blotch Observations from Georgia

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In 1989 bacterial fruit blotch of watermelon (BFB) caused by *Acidovorax avenae* subsp. *citrulli* (7,11), appeared for the first time in commercial watermelon fields in the US (8). This was followed shortly by occurrences in many other states including Georgia(1,2,5). The seedborne nature of this disease combined with its ability to spread rapidly under conditions of high relative humidity and temperature resulted in significant yield losses. In addition, since it was clear that infested seed and seedlings represented the most significant sources of primary inoculum (6), many seed producers were found legally liable and had to compensate growers for their losses (4). This ultimately led to a restriction of seed sales by certain companies in some states. These early encounters with BFB demonstrated the vulnerability of the watermelon industry to plant diseases.

Fortunately, as a result of the episodes of the early 90's, seed industry and public university personnel developed management guidelines for this devastating disease. Adherence to these guidelines resulted in significant reductions in the numbers of BFB outbreaks in Georgia between 1995 and 1998. Since 1998 however, the incidences of BFB have sharply increased. In 1999 and 2000, BFB was confirmed on watermelons in transplant houses and commercial fields in eight counties in Georgia. Explanations for these outbreaks are currently being sought but it is believed that recent trends may be a result of overall relaxation in vigilance. More alarming however, were the recent observations of BFB in commercial plantings of cantaloupe and pumpkin (10,3).

Studies of the diversity of *A. avenae* subsp. *citrulli* populations indicated that at least two sub-groups of strains exist. In general, these groups represent strains that attack watermelon and those that attack cantaloupe and pumpkin (9). The latter may have been recently introduced into Georgia. Incidentally, while the natural occurrence of BFB in commercial pumpkins has only been reported in Georgia (3) it has occurred in the same locality in three consecutive years. At present the origins of these new strains are unknown, however, they can be distinguished from watermelon strains based on physiological and molecular characteristics (9).

Within the *A. avenae* subsp. *citrulli* strains routinely isolated from infected watermelons over the past two years, one DNA fingerprint pattern, dubbed haplotype C, was most prevalent. Preliminary host range studies indicate the two sub-groups demonstrate no host specificity. In these experiments many of the haplotypes incited disease on cantaloupe, watermelon, pumpkin and squash seedlings regardless of the host

from which they were originally isolated. One exception however, was a strain which represented haplotype C that caused disease only on watermelon seedlings suggesting that it may be host-specific. Further experiments have been initiated to determine the potential threat that watermelon strains pose to cantaloupe and pumpkin production and vice-versa. At present however, it is recommended that all strains have the potential to cause disease on all cucurbits and should be managed with equal diligence.

Literature Cited

1. Black, M. C., Isakeit, T., Barnes, L. W., Kucharek, T. A., Hoover, R. J., and Hodge, N. C. 1994. First report of bacterial fruit blotch of watermelon in Texas. *Plant Disease* 78:831
2. Hamm, P. B., Spink, D. S., Clough, G. H., and Mohan, K. S. 1997. First report of bacterial fruit blotch of watermelon in Oregon. *Plant Disease* 81:113
3. Langston, D. B. Jr., Walcott, R. R., Gitaitis, R. D., and Sanders, F. H. 2000. First report of a fruit rot of pumpkin caused by *Acidovorax avenae* subsp. *citrulli* in Georgia. *Plant Disease* 83:100
4. Latin, R. X. and Hopkins, D. L. 1995. Bacterial fruit blotch of watermelon - The hypothetical exam question becomes reality. *Plant Disease* 79:761-765.
5. Latin, R. X. and Rane, K. K. 1990. Bacterial fruit blotch of watermelon in Indiana. *Plant Disease* 74:331-331.
6. Rane, K. K. and Latin, R. X. 1992g. Bacterial fruit blotch of watermelon - Association of the pathogen with seed. *Plant Disease* 76:509-512.
7. Schaad, N. W., Sowell, G., Goth, R. W., Colwell, R. R., and Webb, R. E. 1978. *Pseudomonas pseudoalcaligenes* subsp. *citrulli* subsp. nov. *International Journal of Systematic Bacteriology* 28:117-125.
8. Somodi, G. C., Jones, J. B., Hopkins, D. L., Stall, R. E., Kucharek, T. A., Hodge, N. C., and Watterson, J. C. 1991c. Occurrence of a bacterial watermelon fruit blotch in Florida. *Plant Disease* 75:1053-1056.
9. Walcott, R. R., Langston, D. B., Sanders, F. H., and Gitaitis, R. D. 2000k. Investigating intraspecific variation of *Acidovorax avenae* subsp. *citrulli* using DNA fingerprinting and whole cell fatty acid analysis. *Phytopathology* 90:191-196.
10. Walcott, R. R., Langston, D. B. Jr., Sanders, F. H., Gitaitis, R. D., and Flanders, J. T. 2000i. Natural outbreak of a bacterial fruit rot of cantaloupe in Georgia caused by *Acidovorax avenae* subsp. *citrulli*. *Plant Disease* 84:372-372.

11. Willems, A., Goor, M., Thielemans, S., Gillis, M., Kersters, K., Ley, J. d., and De Ley, J. 1992b. Transfer of several phytopathogenic *Pseudomonas* species to *Acidovorax* as *Acidovorax avenae* subsp. *avenae* subsp. nov., comb. nov., *Acidovorax avenae* subsp. *citrulli*, *Acidovorax avenae* subsp. *cattleyae*, and *Acidovorax konjaci*. International Journal of Systematic Bacteriology 42:107-119.

Control of Watermelon Fruit Blotch

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In the spring of 1989, bacterial fruit blotch of watermelon first occurred in commercial watermelon fields in the U.S. and it has continued to be a threat to the watermelon industry. In most cases, the fruit blotch bacterium has been introduced into the field on infested seeds or infected transplants. The ideal control is to prevent the introduction of the bacterium (*Acidovorax avenae* subsp. *citrulli*) into the field. With a few isolated exceptions, the frequency with which the bacterium is introduced into watermelon fields has decreased over the last 4-5 seasons. This is due to efforts by the seed producers and the transplant growers to produce seeds and transplants free of the disease and by the growers to plant seeds only from seedlots that had been assayed negative for the presence of fruit blotch or to use transplants only from houses in which there were no fruit blotch symptoms.

In spite of the intensive efforts of the seed producers, transplant growers, and watermelon producers, the fruit blotch bacterium still gets into a few fields. In addition to infested seeds and infected transplants, the bacterium can be introduced into a field from contaminated volunteer watermelons, other cultivated cucurbits, and wild cucurbits. Once the bacterium is present in the field, it may be rapidly spread by wind-driven rain, by overhead irrigation, and on equipment.

If symptoms of fruit blotch are observed in the field, weekly applications of the highest recommended rate of copper-containing fungicides should begin as soon as possible, and no later than the time of first flower. If symptoms of fruit blotch are not present, biweekly applications of full rate of copper or weekly applications of half rate may be used as a protective treatment against the undetected introduction of the bacterium into the field. Our tests have indicated that Actigard (a plant defense activator that is not yet labeled for use on cucurbits) can contribute to the control of bacterial fruit blotch of watermelon when used in combinations with copper-containing fungicides/bactericides. In conclusion, bacterial fruit blotch of watermelon can be controlled with a disease management approach that includes the seed producers, transplant growers and watermelon growers.

Citations

Hopkins, D., T. Kucharek, R. Stall, D. Gay, R. Gitaitis, W. Cook, A. Keinath, and R. Latin. 1996. Guidelines for control of bacterial fruit blotch of watermelon. National Watermelon Association Bulletin, 2 p.

Management of Gummy Stem Blight and Powdery Mildew in Georgia

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Foliar disease of watermelon cause losses in yield and quality of marketable melons each year in Georgia. The cost of fungicides used to control foliar diseases also cuts into potential profits. Therefore, proper fungicide selection and timing are critical for cost effective disease management in watermelons. Gummy stem blight, caused by the fungus *Didymella bryoniae*, is the most widespread and destructive of the foliar diseases of watermelon in Georgia, causing millions of dollars in loss and cost of control to growers. Foliage exhibiting large, brown lesions with concentric circles and stems with tan cankers that split and ooze a reddish gummy exudate are characteristic symptoms of gummy stem blight. Small, dark pycnidia may sometimes be seen within stem cankers. Fungicides used to manage gummy stem blight are chlorothalonil products (Bravo, Echo, Equus), Benlate, Topsin M, EBDC's (Manzate, Maneb, Dithane, Penncozeb, Mancozeb), and Quadris. The standard recommendation for use of these materials calls for tank-mixing Benlate or Topsin M with the EBDC fungicides then rotating to a chlorothalonil product on a 7 - 14 day schedule. Quadris is applied up to four times a growing season and should be applied no more than twice consecutively before alternating to a different fungicide class. Tests conducted in 1998 and 1999 indicate that chlorothalonil products are the most essential fungicides used programs for gummy stem blight suppression. In 1999 a new disease surfaced in Georgia watermelons; powdery mildew. This disease caused losses again in the 2000 growing season. Symptoms and signs may or may not be as obvious as when powdery mildew is observed on other crops. In many cases the powdery sporulation of the fungus can be observed on both leaf surfaces. However, some outbreaks produce symptoms which are difficult to diagnose because sporulation is so sparse. This leads to incorrect diagnosis and control tactics. One inconspicuous symptom may be leaves that have pale, yellow spots on the top side of the leaves. With closer inspection can be seen very sparse sporulation of the fungus on the undersides of infected leaves. Conditions that favor powdery mildew are hot, dry weather and heavy fruit loads on vines. Quadris and Flint will provide good suppression of powdery mildew while Nova, a new product recently labeled in June 2000, is the material of choice for this disease on cucurbit crops in GA.

Session #5

Vidalia Onions Part II

Moderator: Mr. Reid Torrance

Management of Foliar Diseases of Vidalia Onions

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Foliar diseases of *Vidalia* onions can cause severe losses by reducing yield and quality of marketable onions. Some of these diseases do not become evident until after onions have been placed in storage. The most common foliar diseases in the *Vidalia* onion growing area are Botrytis leaf blight (*Botrytis squamosa*), purple blotch (*Alternaria porri*), bacterial streak (*Pseudomonas viridaflava*), and center rot (*Pantoea ananatis*). Disease management practices such as avoidance of excessive fertilization, rotation, proper harvesting and handling and preventive fungicide/bactericide applications have been recommended to reduce disease losses but their implementation has been met with limited success. There are several fungicides and bactericides labeled to manage foliar onion diseases which are recommended for sequential and alternating applications of synthetic fungicides and copper compounds to suppress losses from both fungal and bacterial pathogens. However, many times sprays are not timed optimally or needless sprays are applied that cost growers effective disease control and money spent on disease control chemicals. Experiments were conducted at the *Vidalia* Onion and Vegetable Research Center to determine the most effective spray timing for currently available compounds for managing onion diseases. This data may lead to the development or implementation of more effective spray schedules that integrate specific fungicides and bactericide applications to optimize disease suppression. Four rows of the onion variety “Sweet *Vidalia*” were transplanted to 6-ft beds (panels) on 1 and 7 Dec for 1998 and 1999, respectively. The fertility program for these onions was consistent with University of Georgia Extension Service recommendations. Experimental design consisted of a randomized complete block with four replications. Fungicide/bactericide treatment plots were 25 ft. long (1998-99) and 15-ft long (1999-2000) and were separated by non-treated border panels. Fungicides were applied using a CO₂ pressurized backpack sprayer calibrated to deliver 40 gallons per acre at 75 psi using TX-18 hollow cone nozzles. Fungicides tested in 1998-99 were acibenzolar (Actigard), azoxystrobin (Quadris), chlorothalonil (Bravo Ultrex), cyprodinil-fludioxinil (Switch), and 62% EBDC + 16% Mn + 2% Zn/Cu(OH) (ManKocide). Fungicides tested in 1999-2000 were 75% EBDC + 15% Mn + 2% Zn (Dithane), chlorothalonil (Bravo Weather Stik), iprodione (Rovral), vinclozolin (Ronilan), harpin protein systemic acquired resistance activator (Messenger), *Bacillus subtilis* biological control (Serenade). Onions were harvested on 22 Apr (1999) and 2 May (2000) by digging the two center rows of each panel and allowing them to field dry until bagged. Onions were cured at approximately 98° F for 72 hours before weighing. Mean separation was achieved by analyzing data according to the Waller-

Duncan *k*-ratio *t*-test at *k*=100. Overall, the 1998/99 onion season was warm and dry with rainfall accumulations 9.24 inches below the fifty year average. These conditions were not favorable for the development of high levels of foliar disease. Botrytis leaf blight was first observed on 1 Feb while Purple blotch was not identified until 1 Mar. Plants infected with *Pantoea ananas* were not observed until 22 Apr. Botrytis leaf blight was first observed on 1 Feb while Purple blotch was not identified until 1 Mar. Plants infected with *Pantoea ananas* were not observed until 22 Apr. All fungicides and spray programs significantly reduced the percentage of Botrytis leaf blight compared to the non-treated check on the 2 Feb rating date, although ManKocide applied alone was less effective than other spray programs. ManKocide applied alone did not significantly suppress Botrytis leaf blight below the non-treated check by the 1 Mar rating. No significant differences in Botrytis leaf blight were detected between treatments on 22 Apr (Table 1). Significant differences in purple blotch were only detected on 22 Apr with Bravo Ultrex + ManKocide alternated with Quadris + ManKocide and Bravo Ultrex + Actigard alternated with Switch + Actigard demonstrating the greatest disease suppression compared to the non-treated check. The incidence of *Pantoea ananas* was not significantly reduced by any fungicide/bactericide spray program. Yield was significantly reduced below the non-treated check in spray programs containing Actigard. The 1999/2000 season was cooler and incurred 6.0 inches more rainfall than the previous season. Bacterial streak and purple blotch was observed at low levels on 20 Mar with no significant differences observed between treatments. Bacterial streak was not observed on the 12 Apr rating date. Center rot was also observed on the 12 Apr rating date with no significant differences noted between treatments. All fungicide treatments reduced purple blotch and Botrytis leaf blight below the non-treated check on 12 Apr. Full season applications of Bravo Weather Stik and late season applications of Switch, Quadris and Rovral demonstrated the most significant levels of purple blotch and Botrytis leaf suppression. All spray programs significantly improved yield over the non-treated check except *Bacillus subtilis* (Serenade). Spray programs with late season applications of Switch, Rovral, Quadris, vinclozolin (Ronilan) and full season Bravo Weather Stik provided the greatest yield increase. These studies indicated that influence of weather on disease pressure can play a major role in determining the need for fungicide/bactericide sprays on onions. Spray programs in 1998-99 did not improve yields due to low disease pressure indicating that several sprays could have been omitted without losses to disease. In 1999-2000, yield was improved significantly with most spray programs and indicated that non-labeled materials such as Switch and Quadris have potential in reducing losses to purple blotch and Botrytis leaf blight. Incidence of diseases caused by bacteria were too low to demonstrate the effectiveness of bactericide sprays. This information underscores the need for research that addresses the utility of weather-based spray advisories for the Vidalia onion growing region and the integration of compounds such as Switch and Quadris into spray programs.

What Happens to a Vidalia Onion When It Is Stored?

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There are about 5 million units (50-pound bags) of low pungency, sweet onions produced in the Vidalia onion growing area annually. Approximately half of them, 2.4 million units, are put in controlled atmosphere (CA) storage to extend the marketing period. Onions coming out of CA storage command a higher price, usually \$20 to \$24 per unit compared to \$10 to \$14 per unit (or less) on the fresh market. Losses during storage range from 10 to 20 percent in good years to 50 to 70 percent in poor years. The primary cause of storage losses is rots from infection by the fungus, *Botrytis allii*. Thus annual losses caused by *Botrytis allii* in storage can cost Vidalia onion growers from \$5 to \$25 million. The question most frequently asked is whether *Botrytis allii* spreads from infected onions to sound onions in storage.

Studies were conducted in the Vidalia Onion Research Laboratory at the Coastal Plain Experiment Station during the past onion growing season to determine whether *Botrytis allii* spreads from infected onions to sound onions during storage in air and controlled atmospheres (3% oxygen and 5% carbon dioxide).

Results indicate the primary infection of onions by *Botrytis allii* occurs in the field prior to or during the harvesting and curing operations prior to storage. The fungus grew in infected onions during storage at the recommended temperature of 34 °F (1 °C), but more slowly than at higher storage temperatures. The fungus spread from externally infected onions in contact with bruised and mechanically injured onions but not to sound onions in air or CA storage. Greater spread was found in air storage than in CA storage. Growth of the *Botrytis* fungus in culture was more slowly in CA than in air at 32 °F (0 °C). In culture, the fungus did not produce spores at 32 °F (0 °C), but did produce spores at 50 °F (10°C) and 70 °F (20 °C) in air, but not in CA.

Since spread of the fungus through the air is by spores, it is unlikely that *Botrytis allii* can spread to sound onions in CA storage. Sound and bruised onions, however, can become infected with *Botrytis allii* spores from contaminated pallet bins and packing line equipment. The spores will germinate when free moisture is present, such as in bruised and mechanically injured onions, and produce mycelia during storage of the onion. Therefore, Vidalia onion growers can reduce storage losses by following a rigorous fungicidal spray program to prevent infection of onions with *Botrytis allii* in the field

prior to harvest, sanitizing their equipment and pallet bins, and storing only sound onions in sanitized CA rooms.

Advancements in Understanding Flavor Development in Onion

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Vidalia onion flavor is influenced by a number of factors. Important among these is how much sulfur is applied made. The amount of nitrogen fertility will also influence bulb pungency. To improve the consistency of flavor in field production, pungency testing can be used to allow farmers a diagnostic tool for assessing their production practices. Initiating a successful testing program requires several procedures to be implemented. First, a valid pungency testing method must be used which represents established sensory experiences with the chemical analysis. Second, because flavor gradients exist within the bulb, tissue taken for analysis must represent the overall bulb pungency. And third, a statistically valid sampling procedure must be ascertained for production areas based on environmental conditions and varietal usage. If a field is properly tested, a pungency mean and standard deviation can be determined. At the farm level, pungency patterns can be determined by coupling field sampling with global position satellite systems. Precision farming techniques can then be employed to improve flavor quality and consistency.

Session #6

A Key to Fresh Produce Profitability - Marketing

Moderator: Mr. Howard McGlamory

Note: There are no Abstracts for this Session

Session #7

Tomato Spotted Wilt Virus

Moderator: Mr. Tim Flanders

Thrips and Tomato Spotted Wilt Management Update

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Fresh market tomato is a vital commodity in the Georgia, estimated in 1998 at 7,574 acres valued at \$73 million, respectively (www.nass.usda.gov:100/ipedb/ and Mizelle 1998 with value estimated using \$8/ctn and 25% loss) and less in 1999, \$61,322,170 (see <http://www.agecon.uga.edu/~caed/99farmtitle.htm>), most likely due to tomato spotted wilt damage. The cost of production for tomatoes on plastic is \$9,056 (total budgeted) per acre in Georgia (Westberry and Mizelle 1994). Thus, this commodity represents a small-acreage, high-value crop that is intensively managed and entails high economic risks relative to pests. Currently, the greatest threat to the tomato crop in Georgia is thrips-vectored tomato spotted wilt *Tospovirus* (TSWV). In Georgia, TSWV and thrips vectors can have tremendous negative impact on yield tomatoes (Greenough *et al.* 1985). The thrips species primarily responsible for vectoring this virus in tomatoes in north Florida are western flower thrips (*Frankliniella occidentalis*), tobacco thrips (*Frankliniella fusca*), *F. bispinosa*, and onion thrips (*Thrips tabaci*) (Salguero *et al.* 1991, Riley and Pappu 1999). *F. tritici* (Fitch) is an abundant species on staked tomatoes, but does not transmit TSWV or cause direct damage to the fruit (Cho *et al.* 1995).

A thrips-TSWV management program has been developed for tomatoes that offers both short-term and long term benefits to tomato growers in TSWV-affected production areas in Georgia and the southeastern USA. The rationale for this program is based on the discovery that, in the tomato crop, early-season virus transmission has a much greater impact on yield than if the virus is transmitted to the plant later in the growing season. Also, since transmission of the virus occurs through thrips feeding, the focus is on various tactics that prevent thrips feeding, kill thrips before they can feed, and/or reduce the attractiveness of the crop so that less thrips occur on the plant. The current best chemical treatment is imidacloprid soil drench plus lambda-cyhalothrin plus methamidophos foliar treatments

rotated weekly with spinosad treatments beginning as soon as the tomatoes were transplanted and continued weekly for 4 weeks. In addition, host plant resistance in the tomato cultivar BHN444, and silver reflective mulch can greatly improved yields. Commercial validation of the insecticide treatment was positive for the fields where the treatments were followed exactly, but did not do well when substitutions were made, e.g., spinosad alone instead of the rotation combination. A TSWV Risk Index needs to be developed in tomatoes as has been done in peanuts.

Session #8

Genetically Modified Organisms

Moderator: Mr. Brad Mitchell

Commercializing Products of Biotechnology.

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Considerable effort has been invested over the past thirty years to develop virus resistance in squash through conventional means, but the results have been disappointing. By using biotechnology, we have developed effective resistance to specific virus targets. The development of squash hybrids improved through biotechnology to resist three of the four major viruses that infect squash required a coordinated effort, involving discovery research, allele development and regulatory science. The process, which began in 1986, required the development of basic plant transformation and regenerating procedures that were not in place at the inception of this project. Once transformation protocols were established for squash, target genes for virus resistance were isolated and added to the genome of squash using a common soil born bacterium called *Agrobacterium tumefaciens*. The viral coat protein genes, which were used to develop resistant inbred lines, were cloned from the three major viruses that infect squash. These include, cucumber mosaic virus, (CMV), watermelon mosaic virus (WMV), and zucchini yellow mosaic virus (ZYMV). These viral genes were engineered so that they could be expressed in plants, stimulating the plant to produce small quantities of the coat protein. We first demonstrated the resistance using the coat protein gene from CMV. Initially only single coat protein genes were transformed into squash cells. Plants regenerated from these cells were found to be resistant to the virus from which the coat protein gene was isolated. Later we began stacking coat protein genes from two and three viruses together so that the *Agrobacterium* transferred two and then eventually all three genes into the squash cell as a single block. Plants regenerated from these cells were resistant to all three viruses from which the coat proteins were isolated. Furthermore, since the three coat protein genes are linked the multiple virus resistance can be moved from variety to variety as a single dominant trait.

Data packages were generated detailing the cloning and engineering of the coat protein genes and the molecular details of the insertion events. The efficacy and stability of the trait was demonstrated over numerous generations. The nutritional composition of the fruit was measured to ensure that the major nutrients in the resistant fruit did not differ from its non-improved counterpart. We also measured the level of coat protein in squash fruits improved through biotechnology verses levels found in conventional squash varieties collected from grocery store shelves. We found that levels of coat protein in the squash fruit produced through biotechnology were significantly lower than levels found in some samples of conventional fruits commonly consumed in the diet. The effect of the virus resistant trait on wild relatives of squash, as well as pollen flow studies were also conducted. This data package was thoroughly evaluated by the USDA, EPA, and FDA, which led to the approval of these improved squash hybrids for commercialization.

Based on numerous trials and commercial production data, these squash hybrids have been proven to afford a high level of resistance against these three viral pathogens.

Although these hybrids do not provide resistance against papaya ringspot virus (PRV), they do provide added "insurance" against losses from viral disease. We are currently investigating approaches using biotechnology as well as conventional resistance to find resistance to the last of the major viruses that infect squash.

Session #9

Improving Food Safety Practices on the Farm

Moderator: Dr. Bill Hurst

Getting the Message About Good Agricultural Practices (GAPs)

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In the past two decades, the incidence of foodborne illness associated with consumption of fruits and vegetables has doubled. Contamination of produce can occur at any point in the food system from farm to table. Once contamination with harmful microorganisms such as bacteria, viruses, and parasites has occurred, it is difficult to remove the pathogens. Therefore, preventing contamination is paramount. Our program on *Reducing Microbial Risks in Fruits and Vegetables with Good Agricultural Practices in the U.S.* is funded by the CSREES-USDA Food Safety and Quality Initiative and US-FDA. Our goal is to educate growers about the importance of produce safety and provide resources to assist in assessing and preventing microbial risks within each operation.

With collaborators from 16 states across the nation, the Good Agricultural Practices (GAPs) Program is developing a comprehensive education and extension program. The objectives are to develop educational materials about farm food safety and disseminate the information through Train-the-Trainer workshops. The booklet, entitled *Food Safety Begins on the Farm: A Grower's Guide*, is the first of several educational materials to be published as part of this project. This booklet gives background information on foodborne illnesses associated with fresh produce and suggestions on how growers can avoid microbial contamination of fruits and vegetables on the farm and in the packinghouse. The GAPs project is designed primarily for growers, farm managers, farm workers, packing house managers and workers, extension educators, and Department of Agriculture personnel, though we hope anyone who is interested in produce safety finds the GAPs information valuable.

Whether growers sell their commodities to grocery stores or market directly to consumers, produce food safety is an issue. Producers need to focus on good agricultural practices that reduce microbial risks on the farm. It is also important that they are prepared to answer food safety questions and that they have a farm readiness plan to deal with any food safety issues that arise. It is in the best interest of all growers to be prepared for questions and open about the farming practices they use to reduce microbial risks to their fresh fruits and vegetables.

Introduction to Good Agricultural Practices

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Good Manufacturing Practices (GMPs) for the safe storage and handling of food are found in the Federal Code of Regulations. In contrast, Good Agricultural Practices (GAPs) are not regulations. They are simply management practices based on common sense that are widely recognized to help ensure the safety of food, thus they are good for the for the profitability of agricultural enterprises. Implementation of GAPs is a voluntary process. Several federal agencies, including FDA, HHS, EPA, and USDA, have joined efforts with the land-grant University system and various state agencies to better define GAPs and develop programs for teaching principles of GAPs to food producers and handlers. An introductory overview of GAPs as they apply to fresh fruit and vegetable operations will be presented. Strategic management principles will be discussed with emphasis on the benefits of voluntary GAPs implementation.

Third Party Inspections

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Fresh produce's importance as a vector of human pathogens is well acknowledged by health professionals. Like pesticide residues, the issue is easily sensationalized and commonly taken out of perspective. Unlike pesticide residue issues, there have and will be identifiable victims.

So what has changed?

The following six developments are contributing to changing the way business is conducted in the fresh produce industry. They form the major thrust for the changing perspective of fresh produce and the basis of the request for inspections.

Faster microbiological tests (Welcome to genetic engineering's spin-offs.)

Testing specificity (DNA sequencing is used for more than murder and paternity cases.)

Inexpensive computing (Pentagon computing power on a county health official's budget.)

Improved telecommunications (CDC and PulseNet can "reach out and touch" local health officials.)

Growth of epidemiology (The medical field has found a use for computers and fiber optics.)

Changing torts (Societal expectation for zero error.)

What is the risk in produce?

With few exceptions, the final preparation of high protein foods (i.e. meats, seafood, etc.) involves the use of heat. Proper preparation of high protein foods can render a contaminated product harmless. There is no similar "kill step" for preparation of fresh produce. Although your customers may view your product as a low risk item, with fresh produce, a buyer has few ways to control the safety of the product.

What is the buyers perspective?

Each of the buying sectors (retail, food service, etc.) recognizes their lack of control over produce safety, but historically have dealt with food safety differently. The difference in perspective between the retail and food service sectors is reflected in language. Major restaurant chains do not use the phrase "category killer". The removal of lettuce, onions, pickles or tomatoes from hamburger is not a viable option. As a result, safe production practices are more likely to be of greater significance in the food service sector than for a retail operation.

Why the big deal?

Fresh produce presents a buyer with low risk but virtually no control. This makes the grower's practices critical in ensuring the safety of fresh produce. The buyer is

relying on the supplier's ability to eliminate or minimize contamination in the production, harvesting and transportation of fresh produce. This is the crucial role played by today's emerging field programs, such as Good Agricultural Practices, or GAPs.

How to respond?

Developing Safe Production Manuals. At no charge, Good Agricultural Practices (GAP) manuals can be developed for farms, harvest crews, etc. The manuals are customized for the user's operation and contain Good Manufacturing Practices, Standard Operating Procedures and Monitoring Logs where appropriate. The steps to access this program are listed below:

- Log onto PrimusLabs.com's Internet site at www.primuslabs.com,
- Click on "document development",
- Click on "DOCUMENT DEVELOPMENT PROGRAM *ENGLISH VERSION*" (or move the cursor to the top, right hand corner and click on the yellow "Spanish" for a Spanish version)
- Review the TERMS AND CONDITIONS, click the "accept" icon,
- Click on register to input your Company Information Profile,
- Type in your password and you will be given an access code. Record both the access code and password for future use and click "continue",
- Select and click on "Manual of Terminal Markets & Distribution Centers Operations and food safety issues",
- Answer questions related to your operation and
- Review the manual that you just developed by navigating through the different sections.
- Once you have reviewed your manual, the program will lead you to the printing option.

Conducting Self Audits. At no charge, growers or field representatives can perform self audits of each of your ranch operation(s), harvest crew operation(s), cooler operation(s), and packinghouse operation(s). These audits will help to give you or your grower an idea of where improvements should be made and will also help to prepare for a third party audit. If done "On-line", you will get results of your self-audit and a corrective actions letter emailed back to you.

- Log onto PrimusLabs.com's Internet site at www.primuslabs.com,
- Click on "Food Safety Programs",
- Click on "Self Audits",
- Scroll down to option number one and click on "Online format",
- We strongly recommend you have a paper copy of the audit that you will be using to conduct the audit itself. To download a paper copy, click on the hyperlink "Field Auditing Page" and follow the instructions.
- Once you are ready to enter your audit responses online, click on "Click Here if you are a Self Auditor". Remember your password and you can use this in the future. You DO NOT have to re-register every time you go back to do a new audit, just click on "Returning users".

Use the pull down menus, etc. and highlight the self-audit that you wish to use.
Any audit results are for your own use.

**Remember to input your e-mail address and you will automatically receive a
corrective measures letter with the results of your audit.**

**Extension Has a Key Role in Developing and Implementing Effective Farm Food
Safety Program**

Darbie M. Granberry ¹ and William C. Hurst ².

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During the previous decade several successful programs such as the U. S. Dietary Guidelines, the Food Guide Pyramid and the National Cancer Institute's Five A Day Program have stressed the importance of eating fruits and vegetables. Consumers have responded by eating more fruits and vegetables. In fact, the consumption of fresh fruits and vegetables has increased by 25% since 1970. Today, U. S. consumers have convenient access to the most nutritious and diverse array of fresh fruits and vegetables available anywhere.

The production of fresh fruits and vegetables has increased substantially in the Southeast, including Alabama. Produce production, packing and marketing is a notably viable, highly valuable contributor to the economic strength and stability of many counties in many rural counties. These vegetable and fruit growers must remain very competitive with produce growers and packers in other major producing regions of the United States and, indeed, throughout the world.

Historically, growers and produce leaders have increased the scope and value of the fresh market fruit and vegetable industry by focusing on crucial opportunities and overcoming many challenges. Overall, the future appears to hold additional promising opportunities for our southern growers and packers. However, for our them to be able to capitalize on these new opportunities, they must continue to be highly competitive in both the production and marketing of produce.

In addition to the variety and the year-round availability of fresh produce in the U.S., we have one of the safest food supplies in the world. However, producers, packers, shippers and retailers can not be complacent. Reports of foodborne illnesses associated with consumption of raw fruits and vegetables have increased dramatically in recent years. Commodities that have been implicated as carriers of microbiological contamination include lettuce, tomatoes, cabbage, sprouts, radishes, melons, strawberries, raspberries and others. In recent years, recurrent outbreaks of human illnesses in the United States have been linked to consumption of fresh produce contaminated with human pathogens including *Salmonella*, *E. coli 0157:H7*, *Shigella* etc, and with parasites such as *Cryptosporidium* and *Cyclospora*.

Outbreaks of human illnesses attributed to consumption of fresh produce contaminated with pathogens/parasites are unfortunate for those who get sick and potentially devastating to producers, shippers, retailers or other handlers who are found to be responsible for the contamination. Moreover, the fresh produce industry has an ethical responsibility to ensure that our produce is absolutely as safe as it can be.

In response to consumer concerns, **Food Safety** has emerged as a crucial national

issue. Currently, this issue poses a formidable challenge that could potentially jeopardize the ability of growers to market fresh produce. Some wholesale buyers and major retailers of fresh produce have already begun requiring producers and packers they buy from to provide documentation/certification that specific practices have been followed to prevent or minimize contamination of fresh produce with pathogens or parasites. Unless our growers and packers can assure produce buyers and the consuming public that the produce they grow and sell meets these criteria, they will likely be unable to competitively market their produce and will ultimately lose market share.

To encourage and promote Food Safety, the FDA and USDA recently published the ***Guide to Minimize Microbial Food Safety Hazards for Fresh Fruit and Vegetables***. This guide identifies the broad microbial hazards associated with each area of concern, the scientific basis of that concern and good agricultural and management practices for reducing the risk of microbial contamination in fresh produce.

As it relates to Food Safety, *Good Management Practices* refers to general practices that help reduce food safety hazards. The term may include both “good agricultural practices” used in growing, harvesting, sorting, packing and storage operations and “good manufacturing practices” used in sorting, packing, storage and transportation operations. Major sources of potential contaminants include (1) water used during production, harvesting and packing, (2) animal manure, (3) inadequate hygiene of field and packing house workers, (4) contaminated harvest/transport containers, (5) contaminated equipment, containers, transport vehicles, packing or cooling facilities and (6) improper storage conditions.

Food Safety is not just the responsibility of growers and packers. It is the responsibility of everyone who plays a role in the production, packing, distribution, storage, marketing or preparation of fresh produce. We all must do our part to ensure that the American consumer has ready access to a wholesome, nutritious and SAFE food supply. The Cooperative Extension as a vital role in providing sound, effective Food Safety programming to growers, packers, workers, and related industry personnel.

Session #10

Methyl Bromide & Alternative Update

Moderator: Mr. Keith Rucker

Methyl Bromide Alternatives in Bell Pepper 2000

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Introduction

Methyl bromide is a broad-spectrum biocide and is an important management tool for controlling nematodes, soilborne diseases and other pests in a wide range of crops including vegetables crops. The developing vegetable industry in Georgia is valued at over \$450 million. By the year 2005 all uses of methyl bromide in the United states are scheduled to be terminated. Methyl bromide production and importation will be reduced from 1991 levels as follows: 25% in 1999, 50% in 2001, 70% in 2003, and 100% in 2005. Therefore, alternative pest management strategies must be developed before year 2005. The objective of this study was to determine the effects of soil chemical treatments on a susceptible cultivar of bell pepper on yield of pepper, root-knot nematodes (Meloidogyne incognita), weeds, and residual effects on cucumber in a pepper-cucumber cropping system.

Materials and Methods

Field plots were established in March 2000 and maintained through September 2000 on a Tifton loamy sand (fine-loamy, siliceous thermic Plinthic Kandiodults: 85% sand, 10% silt, 5% clay; 0.5% organic matter; pH 7.0). The plots were naturally infested with Meloidogyne incognita, Patatrachodorus minor, Helicotylenchus dihystrera, Pythium spp. and weeds.

The first of the two experiments was a split-plot design with soil chemical treatments on Camelot Bell pepper sub-plots, replicated four times. Initially, the soil was disc-harrowed, plowed 12 to 15 inches deep with a moldboard plow and shaped into beds 6 feet wide and 3-5 inches high. Five hundred pounds of 4-8-24 fertilizer and 2,000 lbs. per acres of dolomitic limestone were applied broadcast to all plots and incorporated approximately four inches deep with a tractor-powered rototiller. Whole-plots were 24 feet wide and 35 feet long and consisted of four subplots each 6 feet wide and 35 feet long. Soil chemical treatments were applied as follows; March 7 applied Telone C-35 (17.5 gal/A) chisel injected to designated plots, March 13 applied Methyl Bromide (89.5 %, 200 ai/A). Immediately after Methyl Bromide treatments were applied to their designated plots, beds were shaped to 30 inches wide, and 6 to 8 inches high. Irrigation drip tubing was placed in the center of all beds as they were covered with 0.006 mil black polyethylene. Nontreated plots served as controls. Seven days after treatment, March 20, holes (2 inches diam.) were cut 12 inches apart in single row plots to allow aeration. Three days after holes were cut in the plastic, a single greenhouse-grown Camelot Bell

pepper plant was planted in each hole on March 23rd. At time of planting, the toxic gas level in Telone and Methyl bromide-treated plots averaged 8 to 10 ppm (safe for planting) according to the Gastec® System. All plots were sprayed with Manex + Zinc (1.8 qts./A) and Kocide LF (0.5 gal./A) on a 7- to 10- day schedule for foliage disease control. Insecticide sprays were applied weekly alternating Ambush 2EC (10 oz./A), and Asana .66EC (6 oz./A), starting May 26th thru July 17th. All plots received 2 to 4 lbs of liquid fertilizer (15-30-15) injected through the irrigation tubing every three days during the growing season.

Twelve cores of soil, 2.5-cm-diam. × 25-cm-deep, were collected from each row of each subplot on March 3rd, May 9th, and July 28th, 2000. Soil cores were mixed, and nematodes were extracted from a 150-cm³ sub-sample with centrifugal flotation. After harvest on July 31st, ten plants were dug from each row and rated for root galling by *M. incognita* on a 1 to 5 scale: 1 = 0%, 2 = 1% to 25%, 3 = 26% to 50%, 4 = 51% to 75%, 5 = 76% to 100% roots galled. The total number of living plants per plot was recorded on April 12th.

All plots were hand-harvested, separated into marketable and cull, counted, and weighed. There were a total of eight harvests, they were as follows; June 1st, 8th, 15th, 22nd, 29th, and July 6th, 13th, and a final on July 25th. After final harvest, all pepper plants were cut near the soil surface and removed from the plots. All weeds growing from the hole in the plastic and those penetrating through the plastic were then identified and counted. After weeds were counted and identified, all plots were sprayed with Round-up on July 31st, to kill all weeds in plot area.

Results and Discussion

Meloidogyne incognita populations and root gall indices were higher in the nontreated control than the Telone C-35 or Methyl bromide treated plots by the end of the season (table 1). Methyl bromide consistently reduced weed pressure over the nontreated and the Telone C-35 plots for all weeds encountered in the test plot (table 2).

The total number of weight of marketable peppers were not different among treatments. However, Methyl bromide treated plots higher numbers and weight of cull peppers.

Although no significant difference were noted among treatment in the first crop, we anticipate larger differences between treatments in the second crop (cucumbers).

Table 1. Effects of soil chemical treatments on nematode population densities in Camelot Bell

Pepper 2000^a

Treatment	Rate	Nematodes per 150-cm ³ soil						Root Gall Index c July 31
		March 3		May 9		July 28		
		M.i. ^b	M.i.	P.m.	B.s.	M.i.	P.m.	
1. Telone C-35	17.5 gal/A	24	11 ab	8 a	0 b	1298 b	18	1.8b
2. Methyl bromide 89.5 %	200 lbs ai/A	49	2 b	2 b	0 b	2039 b	18	1.8b
3. Untreated	no treatment	32	20 a	3 ab	4 a	4769 a	9	3.4a

^a Data are means of four replications of plots equaling 140 ft of row. Means followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant. Plot size = 4 rows 35 feet in length, plant spacing 12 inches.

^bM.i. = Meloidogyne incognita, P.m. = Paratrichodorus minor, C.o. = Criconemoides ornatum, H.d. = Helicotylenchus dihystra, and B.s. = Belonolaimus sp. Some nematodes on certain dates were low in numbers or non-existent and were not significant on those dates.

^c 1-5 scale: 1=no galls, 2=1% to 25%, 3=26% to 50%, 4=51% to 75%, and 5=76% to 100% of roots galled.

Table 2. Effects of soil chemical treatments on weed population densities in Camelot Bell Pepper, 2000

Treatment	Rate	<u>Number of weeds per plot^a (10.7 m row)</u>											
		<u>Penetrated^b plastic</u>		<u>Through Nutsedge</u>		<u>Cutleaf Eveningprimrose</u>		<u>Weeds growing Through holes in plastic</u>		<u>Crabgrass</u>		<u>All Other weeds^d</u>	
		May 23	July 25	May 23	July 25	May 23	July 25	May 23	July 25	May 23	July 25	May 23	July 25
1. Telone C-35	164 l/ ha	20	86	0.06	2.6	1.6 a	1.8 a	1.6	5.9 a	1.0 a	2.1 a	7.6 a	14 a
2. Methyl bromide 89%	224 kg ai/ ha	1	11	0	0.5	0.3 b	0.4 b	0.6	2.5 b	0.2 b	0.1 b	1.4 b	4 b
3. Nontreated control	-----	17	86	0.5	3.6	2.9 a	3.8 a	1.8	6.5 a	0.9 a	2.1 a	7.9 a	17 a
P Value ^c		0.062	0.144	0.52	0.062	0.004	0.0004	0.154	0.012	0.0206	0.006	0.0002	0.0001

^a Data are means of four replications of plots equaling 42.3 m of row.

^b Number of nutsedge, a combination of purple nutsedge (cypress rotundus) and yellow nutsedge (cypress esculentus), based on plot size = 4 rows 10.7 m in length, bell pepper spaced 30 cm apart.

^c Means followed by the same letter are not different according to Fisher's Protected LSD at and alpha level of 0.05.

^d All other weeds include: cutleaf eveningprimrose, crowfootgrass, Bermudagrass, Texas panicum, carpetweed, crabgrass, smallflower morningglory, Florida Pusley, and jimsonweed.

Table 3. Effect of soil chemical treatments on marketable yield of Camelot Bell Pepper -2000^a

Treatment	Rate	<u>Number of marketable bell pepper per plot (35 lin. ft. row)</u>								
		<u>June</u>			<u>July</u>			Total		
		1	8	15	22	29	6	13	25	Total
1. Telone C-35	17.5 gal/A	19 b	39	41	39	33	32 b	21	81	305
2. Methyl bromide 89%	200 lbs ai/A	12 c	42	29	37	41	45 a	31	65	302
3. Untreated	no treatment	28 a	49	33	38	39	30 b	28	64	309

^a Data are means of four replications of plots equaling 140 ft of row. Means followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant. Plot size = 4 rows 35 feet in length, plant spacing 12 inches.

Table 4. Effect of soil chemical treatments on marketable yield of Camelot Bell Pepper - 2000^a

Treatment	Rate	<u>Weight (lbs.) of marketable bell pepper per plot (35 lin. ft. row)</u>								
		<u>June</u>			<u>July</u>			Total		
		1	8	15	22	29	6	13	25	Total
1. Telone C-35	17.5 gal/A	4.9 b	10.5	12.3 a	9.8	9.0	8.3 b	4.6	15.0	74.4
2. Methyl bromide 89%	200 lbs ai/A	2.6 c	11.0	8.3 b	10.4	11.3	12.2 a	6.9	12.4	75.1
3. Untreated	no treatment	7.9 a	12.6	9.9 ab	11.0	10.7	7.9 b	6.2	11.4	77.6

^a Data are means of four replications of plots equaling 140 ft of row. Means followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant. Plot size = 4 rows 35 feet in length, plant spacing 12 inches.

Table 5. Effect of soil chemical treatment on cull yield of Camelot Bell Pepper - 2000^a

Treatment	Rate	Number of cull bell pepper per plot (35 lin. ft. row)								
		June					July			
		1	8	15	22	29	6	13	25	Total
1.Telone C-35	17.5 gal/A	8	14 a	15	10	8	9 b	6 b	21 b	91 b
2. Methyl bromide 89%	200 lbs ai/A	7	16 a	14	15	11	15 a	13 a	29 a	120 a
3.Untreated	no treatment	8	8 b	9	12	8	7 b	6 b	22 b	80 b

^a Data are means of four replications of plots equaling 140 ft of row. Means followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant.

Plot size = 4 rows 35 feet in length, plant spacing 12 inches.

Table 6. Effect of soil chemical treatment on cull yield of Camelot Bell Pepper - 2000^a

Treatment	Rate	Weight (lbs.) of cull bell pepper per plot (35 lin. ft. row)								
		June					July			
		1	8	15	22	29	6	13	25	Total
1.Telone C-35	17.5 gal/A	1.7	3.0 a	3.1	1.8	1.4	1.5 ab	0.7 b	3.3 b	16.5 b
2. Methyl bromide 89%	200 lbs ai/A	1.5	3.6 a	2.7	2.2	1.9	2.1 a	1.8 a	4.6 a	20.4 a
3.Untreated	no treatment	1.9	1.6 b	1.9	1.8	1.3	1.0 b	1.0 b	3.1 b	13.6 b

^a Data are means of four replications of plots equaling 140 ft of row. Means followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant.

Plot size = 4 rows 35 feet in length, plant spacing 12 inches.

Table 7. Effect of soil chemical treatment on total yield of Camelot Bell Pepper per 35 linear feet of row - 2000^a

Treatment	Rate	<u>Marketable</u>		<u>Cull</u>		<u>Total</u>		<u>% marketable</u>	
		Number	Weight (lbs.)	Number	Weight (lbs.)	Number	Weight (lbs.)	Number	Weight (lbs.)
1.Telone C-35	17.5 gal/A	1218	297.6	363 b	66.2 b	1581 b	363.8	77	82
2. Methyl bromide 89%	200 lbs ai/A	1212	300.0	481 a	81.3 a	1693 a	381.3	72	79
3.Untreated	no treatment	1235	310.0	311 b	53.8 b	1546 b	363.8	80	85

^a Data are means of four replications of plots equaling 140 ft of row. Means followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant.

Plot size = 4 rows 35 feet in length, plant spacing 12 inches.

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Herbicide Situation for Methyl Bromide Alternatives

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The alternative fumigants now labeled for use in vegetables are 1, 3-D, metam Na, metam K, and cloropicrin have a degree of herbicidal activity. The degree of activity depends on rate and application method. Herbicides will be needed as a production component in mulch culture with the alternative fumigants.

At the present time, only two herbicides have labels for use under mulch. These are napropamide (Devrinol) and pebulate (Tillam). The pebulate label is a new supplemental label that can also be used with hand transplanted tomatoes.

Other herbicides such as trifluralin (Treflan, Trilin), bensulide (Prefar), naptalam (Alanap) are labeled on several crops, and do not prohibit use under mulch. Ethalflurlin (Curbit) prohibits its application under mulch culture.

Application methodology of herbicides is important in safety and control. The safest and most effective method of herbicide application is to apply the herbicide to the bed surface and rotatille incorporate before mulch application. Spraying the herbicide broadcast and incorporating before bed formation can be used if the herbicide is incorporated deep enough to ensure no non-treated soil is pulled into the bed. This will allow weeds to germinate and grow in the non-treated soil. We have also seen pebulate being concentrated under the plant holes and causing damage to tomatoes when it is not incorporated properly.

Research on a number of new herbicides is now in progress. The new herbicides, or new uses of old herbicides include: halosulfuron (Permit, Sempra, Sandea), clopyralid (Stinger), pendimethalin (Prowl), sulfentrazone (Authority, Spartan) s-metolachlor (Dual Magnum), carfentrazone (Aim) and terbacil (Sinbar).

Hopefully, these can be labeled to increase the weed management needed for mulch culture of vegetable crops.

Bell Pepper Transplants Grown in Compost-Amended Media Out-Yield

Transplants Grown in Conventional Media

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In the spring of 2000, a SARE Producer Grant was obtained to investigate the use of on-farm-produced compost in commercial production of Bell Pepper in South Georgia. The producer-cooperator in this on-farm research project was Lewis Taylor Farms, a Tift county farm that grows and markets fresh produce, transplants, and agronomic crops. University of Georgia, College of Agricultural and Environmental Sciences cooperators included research and extension faculty in the Departments of Horticulture, Plant Pathology and Entomology and the Tift County Extension Office.

Composting agricultural wastes or by-products such as chicken litter, gin trash, peanut hulls, cull produce, and old hay as well as municipal solid wastes such as lawn, shrub and tree trimmings transforms potential environmental liabilities into a value-enhanced product. In addition, it also promotes the use of high quality compost to improve the sustainability and profitability of vegetable production in the region.

It has been well known for many years that high quality compost is a good organic source of “slow release” plant nutrients. In addition, compost improves soil physical properties including increasing the organic matter content of sandy soils, reducing soil compaction, increasing water infiltration and water holding capacity of sandy soils, and increasing the cation exchange capacity of sandy soils.

I. Effects of Compost Amended Media on Transplant Growth in the Greenhouse

Seed of Bell pepper cultivar *X3R Wizard* were planted in styrofoam flats (two-hundred 1.25 inch cells per flat) on June 24, 2000. Seed were germinated and transplants grown in a greenhouse using current commercial transplant recommendations for production of Bell pepper transplants. The two treatments were: (1) Commercial transplant growing media routinely used by Lewis Taylor farms to grow Bell pepper transplants and (2) The same media amended with 20% by volume on-farm-produced high quality compost.

Plant heights and stem diameters were measured fifteen, twenty-four and fifty-one days after seeding. Compost-amended media significantly increased plant height and stem diameter. In addition, at fifty-one days after seeding, leaf area, leaf dry weight, stem dry weight, shoot dry weight, root dry weight and plant height were significantly greater for transplants grown in compost-amended media.

II. Effects of Compost Amended Transplant Media on Yield

Transplants were transplanted to the field on August 10th. Beds were on five foot

centers and plants were transplanted in double rows in 15 foot plots. Preplant fertilizer and lime were applied and incorporated according to soil test recommendations and normal cultural practices. Just prior to transplanting, raised beds were prepared and white plastic and drip tape were installed according to normal production practices.

Early Fruit Yield Seventy Days After Transplanting

Seventy DAT plots were harvested and fruit were counted and weighed. Only Jumbo and Extra Large fruit were harvested and there were no defective or cull fruit. Plants grown in non-compost amended media produced an average of 5.46 fruit per plot whereas plants grown in compost amended media produced an average of 12.8 fruit per plot. Average weights per plot were 2.8 pounds for plants grown in non-compost amended media and 6.6 pounds for transplants grown in compost amended media. Differences in both number of fruit per plot and weight of harvested fruit per plot were highly significant.

Total Yield

The peppers were harvested four times. The final harvest of marketable fruit was on November 15th. On November 20th a hard frost destroyed the plots, although there were still many fruit on the plants. When all four harvests were combined, plants grown in compost-amended media yielded approximately 20% more pepper by weight.

Session #11

Grading and Packing

Moderator: Mr. Glenn Beard

U.S. Grade Standards, and Inspection of Fresh Fruits and Vegetable

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The American consumer enjoys one of the most plentiful, affordable, and wholesome supplies of fruits, vegetables, and nuts in the world. To ensure that consumers receive their billions of pounds of fruits, vegetables, and nuts economically and with quality assurance, producers, wholesalers, processors, retailers, and numerous others must maintain an efficient, equitable, and reliable distribution system. The Fruit and Vegetable Programs of the Agricultural Marketing Service (AMS), U.S. Department of Agriculture, helps to maintain this system. The wide-ranging services provided by the Fruit and Vegetable Programs are unlike most government programs because approximately 80 percent of the Programs' funds are derived from fees paid by users.

If you are part of the vast U.S. fruit and vegetable market, U.S. Department of Agriculture (USDA) grade standards and official grading services can make your job easier and your farm or company more profitable. For sellers, these services ensure that their products meet specified grade or contract requirements; for buyers, grading services ensure that they get the quality that they expect.

Grading may be conducted at shipping point locations as the produce is being packed for shipment to market. A produce shipment also maybe graded at its destination, either for the receiver's use in handling the lot or to settle questions that may arise between the shipper and the receiver.

To provide grading service nationwide, USDA maintains cooperative agreements in 49 States and Puerto Rico. Under these Federal-State agreements, Federally licensed graders perform their work throughout the country at points of origin, often working in the field as crops are being harvested. In addition, grading services are provided at 38 Federal terminal markets and approximately 100 Federal-State terminal markets. As a basis for its fresh products grading and commerce, USDA has developed 158 official grade standards for 85 fresh fruits, vegetables, tree nuts, peanuts, and related commodities. These standards provide a common language for buying and selling by establishing grade requirements (U.S. Fancy, U.S. No. 1, U.S. No. 2, etc.) for the commodity. USDA has also developed a number of visual aids and guides to ensure that

the standards are uniformly applied throughout the country.

Certification, performed by highly trained graders, provides buyers and sellers with an objective, third-party evaluation of a product's quality and condition. Anyone who has a financial interest in a product may request the grading service.

The U.S. grade standards are also used by the Market News Service to provide the timely exchange of information among growers, shippers, wholesalers, and others with prices to aid buyers and sellers in making purchasing and sales decisions.

A list and description of USDA grade standards can be found on the Internet at www.ams.usda.gov/standards.

For further information on fresh fruit and vegetable grade standards, or grading services, contact the Fresh Products Branch, Fruit and Vegetable Programs, Agricultural Marketing Service, U. S. Department of Agriculture, 1400 Independence Avenue, SW, Room 2049-S, Stop Code 0240, Washington, DC 20250-0240. Telephone: (202) 720-5870. FAX: (202) 720-5136. Internet: <http://www.ams.usda.gov/fv/fvstand.htm>. E-mail: Larry.Lace@usda.gov. Information is also available from the Federal or Federal-State grading office nearest to you.

Four Functions for Vegetable Packages

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Packages are essential for delivering high quality vegetables from farm to consumer. Four functions for packages in general were defined by Kelsey (1978) and more recently by the School of Packaging at Michigan State University (Anon, 2000). The following applications of the four functions to vegetables was made from experience conducting postharvest research and from information available from Boyette, et al. 2000.

Protect Packaging can be designed to protect vegetables from crushing, shock, vibration, abrasion, heat, cold, desiccation, vermin, contaminants, harmful gases.

Contain Vegetables are contained in a desired unit volume, usually in a size suitable for lifting by humans. Containers can be used for measuring count or volume.

Inform Packages can give the vegetable name, brand, size, grade, variety, net weight, count, grower, shipper, country of origin, best storage temperature, nutritional information, recipes, and trace-back or history of contents including cultural practices and timing. Universal Product Codes (bar codes) on containers facilitate distribution operations while Price Look Up (PLU) numbers help retailers correctly identify vegetables at checkout.

Enhance Utility Vents for improved cooling, re-closeable cartons to enable inspection, sizes that allow palletizing, shipping containers designed for retail display, returnable and biodegradable materials for environmental responsibility. Containers can also show evidence of handling abuse and be designed to prevent pilferage.

Citations

Anon. 2000. General Information, School of Packaging, Michigan State University. http://www.pkg.msu.edu/what_is_packaging.html (12/4/00)

Boyette, M.D., D.C. Sanders, and G.A. Rutledge. 2000. Packaging Requirements for Fresh Fruits and Vegetables. North Carolina Agricultural Extension Service. <http://www.bae.ncsu.edu/programs/extension/publicat/postharv/ag-414-8/index.html> (12/4/00).

Kelsey, R.L.. 1978. Packaging in Today's Society. St. Regis Paper Company.

Standardized Reusable Containers – The Next Step

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Just after WWII, corrugated containers came into widespread use as shipping containers for produce, challenging the traditional wood crate. Corrugated was not new. Patents on corrugating equipment date back to the 1800's, but a revolution was afoot. Many resisted it. They were unsure whether cardboard could meet the industry's needs, and they were uncomfortable with change, in general.

Looking back from today, corrugated has been the dominant produce package for 50 years. Corrugated is strong and versatile, and the tooling to effect change is relatively inexpensive. Every commodity has developed a package that fits their needs very well. The feeling today is much the same as it was 50 years ago: "The current package works fine. Why change?" The answer is: because this is a stronger container that protects your product better, is capable of withstanding long trips, and most importantly, removes cost from the supply chain.

It is true that the greatest share of cost savings that have been experienced to date have been at the retail level. They see much lower shrinkage in the D.C.'s, much lower shrinkage shipping from the D.C. to the retail store, and at the store level itself. In addition, by merchandising in these containers, the retailer saves a great deal in labor in handling in the store. But what are the potential advantages to the grower? First, by adopting a standardized footprint, whether corrugated or plastic, packinghouse efficiencies can be increased. In open grid plastic containers, wet product can be handled with no concern about degrading the container; even hydro cooling can be used. Conventional precooling is accomplished very efficiently. Also, because the container bears the load of the product above (not the product in the container), damage during shipping to the customer is greatly reduced.

What does the future bring? Our goal is to continue to improve the ease of use and rugged performance of our containers, and to continue to drive the cost to the grower down. To do this, we are investing in an entirely new set of molds for all sizes of our containers, thereby incorporating design improvements in all sizes. In the area of cost, we continue to find ways to reduce our operating costs. In Europe, where our business is about 10 years old, the average rental cost to the grower is about half of what it is here. I believe we have plenty of room to improve.

We have already proven that we can reduce cost at the retail level. If we are

successful in reducing cost to the grower, as well, while improving the basic function of the produce container, we will have indeed taken the Next Step in produce packaging.

Session #12

Greenhouse Vegetable Production

Moderator: Dr. George Boyhan

A New Direction for Florida Vegetable Producers Greenhouse Production

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There were 150,000 ha of vegetables produced in Florida valued at 1.8 billion for the production season of 1998-1999. The major crops of tomato, watermelon, pepper, cucumber, and strawberry accounted for 56% of the total statewide vegetable crop value. Vegetable culture in Florida is a very technological business involving several high-cost inputs including polyethylene mulch, drip irrigation, fertilizer, and pesticides. Currently, almost one-third of Florida vegetables, including all tomatoes, strawberries, peppers, eggplants, and most melons, are produced on polyethylene-mulch. Nearly 50% of the polyethylene-mulched crops are grown with drip irrigation.

Although Florida vegetable culture involves intensive production practices, there are major challenges in front of the vegetable industry. These challenges are 1.) increased regulation of water, fertilizer, and pesticide inputs, 2.) loss of a major soil fumigant, methyl bromide, 3.) increased urbanization and loss of some of the more desirable (warmer) production land in southern Florida, and 4.) continued challenges from weather, including freezes, winds and rain. Add to these challenges, the increasing problems associated with regional and global market competition. The added protection by plasticulture could lead to production of higher quality crops that will make Florida growers more competitive against imports from other vegetable production areas in the world. It is evident that for the vegetable industry in Florida to prosper and grow, there is a need to develop new cultural technologies.

Plasticulture systems, including greenhouses, could provide a means to deal with the challenges listed above. Currently, there is a small greenhouse (hydroponic) vegetable industry in Florida, but these special greenhouses represent a substantial investment due to heating and cooling system costs. An alternative might be the use of greenhouse structures with passive venting and heating. Greenhouse vegetable culture can provide protection from the weather, a major production challenge faced by vegetable growers. The serious potential loss of crops due to freezes and rain or wind is a major challenge and concern for all vegetable growers in climates such as Florida. These could more easily be controlled in greenhouse culture. Greenhouse structures can protect the crop from wind and rain, but also can protect from insects when fitted with insect exclusion screens. Therefore, plasticulture systems could reduce the use of pesticides.

Plasticulture systems could include the use of soilless culture for crop production. One example would be bag or container production using an inert media such as perlite, vermiculite, peat, or coconut fiber. Soilless culture has been used successfully for vegetable production in Florida. Soilless culture would address the current challenges of urbanization because with soilless culture in greenhouses, winter vegetable production would not depend on warm, sandy soils of southern, coastal Florida. In addition, the loss of methyl bromide would be less troublesome if a portion of the vegetables could be grown in soilless culture.

Lettuce Production in Tobacco Float Beds

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Tobacco production has been an important part of the agricultural economy of Georgia; however, has been decreasing over the past several years. Crop value has dropped from \$197 million in 1996 to \$1 representing a 25% reduction in value. Many tobacco growers produce their own transplants in float greenhouses for tobacco production is going down with reductions in tobacco allotments. In addition, the empty through the summer and fall when tobacco transplants are not being produced. This study was und greenhouses could be used for lettuce float production.

Many vegetables have been shown to grow quite well under hydroponic conditions and lettuce, in particular, can be produced where the roots are in constant contact with water.

Polystyrene 4' x 8' insulation sheets which were 1 inch thick were used as the floating media. Double rows of one-inch holes were drilled in these sheets with a 4-inch in-row and between-row spacing. Four sets of double rows with a between double row spacing of 7 inches were drilled in each sheet. One inch Oasis horticubes® were inserted in each hole. A single coated lettuce seed was placed in each horticube.

Six varieties, Ithaca, Nevada, Athena, Green Day, New Red Fire, and Arizona were seeded in this experiment. Each variety was planted in a replicated trial with four replications arranged in a randomized complete block design. Each plot consisted of one set of double rows (47 plants). Plants were seeded on 21 Sept. 2000 and 10 Oct. 2000.

The polystyrene sheets were floated on water maintained at 120-ppm nitrogen. The fertilizer used was water soluble 20-20-20 with micronutrients. The first harvest was on 3 Nov. 2000 and the second harvest 1 Dec. 2000. Data collected included the total weight of the harvested lettuce, number of marketable head, and the diameter of three representative heads. The average head weight was calculated by dividing the total yield by the number of marketable heads.

The results of the first planting are listed in Table 1. All the varieties in the first planting except 'Ithaca' were ready 43 days after planting. 'Ithaca' was not harvested until 1 Dec. 2000, which was somewhat later than optimum. The later harvest was required to allow 'Ithaca', a crisp head type, to develop sufficiently. 'Ithaca' also had the highest yield with 9.9 lbs per plot. The percent of marketable heads was low overall with

'Athena' having the highest percent marketable with 56%. The extremely low percent marketable for 'Nevada' and 'New Red Fire' represents low germination and stand establishment. This may have been partially due to the high temperatures in the greenhouse at this time of year. The large head diameter and weight of 'Nevada' represents a lack of competition from surrounding plants.

A second planting was made of 10 Oct 2000 with a harvest date of 1 Dec. 2000 (Table 2). 'Ithaca' had not been harvested as of this writing. The highest yielding variety in the second planting was 'Arizona' with 6 pounds per plot. In addition, the percent marketable heads was higher overall with the second planting. The highest percent marketable heads was with 'Green Day' at 82% followed by 'Arizona' at 68%. The number of days to harvest for the second planting was 52 days. This reflects the cooler temperatures and shorter days in late fall.

Although these are preliminary results, we have gained some insight into producing lettuce in tobacco float houses. Tobacco does not require aeration of the water while we believe germination and growth of the lettuce could have been improved with adequate aeration. In addition, the in-row spacing of four inches was probably too close and should be extended to eight inches for maximum development. We also experienced problems with algae growth in the float water. More aggressive efforts to control algae growth should have been undertaken. The crisp head type, 'Ithaca' did not seem appropriate for this type of production requiring more time to produce. In addition, the heads did not get very large which may be reflective of spacing. The loose leaf, romaine, and bibb types seemed to do quite well. Finally, with the second planting we have seen interveinal chlorosis with several varieties which may be due to magnesium deficiency. Improving germination, allowing more space between plants, and controlling algae would improve the crop. We did not experience any disease or insect problems other than fungus gnats, which seemed to be related to the algae growth.

Doherty, B.A., R.J. Teasley, J.C. McKissick, and B. Givan. 2000. 1999 Georgia Farmgate Value Report. Center for Agribusiness & Econ. Devel. Center Staff Report No. 6.

Session #13

Insect Issues and Tomato Yellow Leaf Curl Virus

Moderator: Mr. Joel Hudgins

Pollination in Vegetable Crops

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Yield and quality of many vegetable crops can be reduced by incomplete pollination. This is especially true in most of the cucurbit crops, which include watermelon, cantaloupe, squash, cucumber, pumpkin and gourds. Incomplete pollination in these crops can cause aborted or misshapen fruit which ultimately results in lost yield. For many years, it has been a standard recommendation to supply adequate pollenizers in the form of honey bee colonies to enhance and ensure pollination.

Although initial recommendations for honey bee colonies were on the order of one hive for every two or three acres, depending on the crop, more current recommendations call for a substantially higher population of bees. This has become increasingly important with the reduction of native bee populations. Destruction of natural habitat due to land clearing and urban sprawl is one reason for the decrease in native bee populations. Increased pesticide use, infestation by insects and diseases that infect bees are also primary reasons that native bees are less prevalent. Other factors that have entered into increasing recommendations for supplemental bee density include the more intensive plantings of cucurbit crops which have resulted in much greater plant populations. Also the use of hybrid cultivars, which produce a heavier fruit load, require more pollenizers to maximize yield. Current recommendations call for one to two hives per acre, depending upon the crop.

One of the more critical factors in supplying bee colonies for pollination is the quality of the hive. Recommendations currently in place assume that the hives used are healthy and active colonies. Unfortunately, there has been a shortage of bees for pollination over the last few years. This has caused an increase in the rental price charged for pollinator hives and has also resulted in some inferior colonies being used. A substandard or inactive colony will be much less effective in completing the task of pollination. It may take as many as two to three of these less active colonies to do the work that one strong, healthy colony would.

Rental from reputable beekeepers as well as knowing what to look for in a strong, healthy colony will allow the grower to provide adequate pollination more efficiently. Single chamber hives do not provide enough room for the colony to grow and work and should be discouraged. At least one super should be on each hive. Colonies should have been re-queened within the last year and inspection should reveal a pattern of active egg

laying by the queen. At least five frames should contain brood. Colonies should be treated with a prophylactic treatment for mites and diseases. Expect to pay a premium for superior quality colonies, however, the increased pollination efficiency will be worth the cost in most cases.

References

- Delaplane, K.S. 1991 Honey Bees and Beekeeping. University of Georgia Cooperative Extension Service Bulletin No.1 1045.
- Delaplane, K.S. P.A. Thomas and W.J. McLaurin. 1994. Bee Pollination of Georgia Crop Plants. University of Georgia Cooperative Extension Service Bulletin No. 1106.

Whiteflies

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Several species of whitefly are present in Georgia's agricultural systems. The most destructive to vegetables is the silverleaf whitefly (SLWF), *Bemisia argentifolii*. At present SLWF is a problem on summer and fall plantings of tomato, eggplant, collards, cabbage, summer squashes, cucumber, cantaloupe and snap beans. Each of these crops may exhibit various symptoms from SLWF infestations and each crop has different treatment thresholds.

Management of SLWF in each of the aforementioned crops has significant associated costs and in most cases includes preemptive prevention in combination with more conventional curative applications of contact insecticide. In all cases the potential for SLWF infestations and resulting economic damage must be anticipated for implementation of adequate control.

The SLWF is conditioned for arid climates, and is therefore, a greater potential problem during seasons of high temperature and drought with low humidity. These conditions are optimum for high reproductive potentials in SLWF populations, while negatively impacting natural control factors such as parasitic fungi. Other factors that exacerbate SLWF potentials is the large acreages of cotton and peanuts in the vegetable production region. These crops are in developmental decline as summer and fall vegetables are being planted so that SLWF can quickly migrate to these more suitable food hosts. Initially, the migrations can be mitigated with conventional insecticides. However, when the migrations continue at high levels over a period of two months on crops that have a short growing season, SLWF can overcome the effects of our very best management strategies. Furthermore, vegetable crops have exceedingly low tolerances for SLWF. Population levels that are economically disastrous in vegetables are only termed low to moderate populations when they occur in agronomic crops such as cotton and peanuts.

Tomato Yellow Leaf Curl Virus Weed Hosts

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Tomato yellow leaf curl virus (TYLCV) is a whitefly-transmitted gemini virus that was first found in the United States in July of 1997 in Florida (Polston et al., 1999b). TYLCV was introduced into the Western Hemisphere from the eastern Mediterranean in the early 1990's and by 1995 was found in the Dominican Republic, Cuba, and Jamaica (McGlashan et al., 1994; Nakhla et al., 1994; Polston et al., 1994; Ramos et al., 1996). The DNA sequence of the TYLCV found in Florida and elsewhere in the Western Hemisphere is nearly identical to that of a severe strain of TYLCV from Israel (Ying and Davis, in press). TYLCV causes leaf distortion and chlorosis, stunting of the plant, and a high rate of flower abscission. Two years after the introduction of TYLCV in the Dominican Republic in 1991, the disease destroyed approximately 90% of the tomato production.

Tomatoes are produced commercially from August through June in Florida. An essentially tomato-free period exists in the summer months, except for home gardens and nurseries. TYLCV spread rapidly in Florida during the 1997/1998-production season and was even more widespread the next season. Where the virus persisted during the intervening summer months is unknown. In studies conducted in Israel and the Dominican Republic, TYLCV was found to have a broad host range, including at least 17 species in nine families of plants (Cohen and Nitzany, 1966; Serra et al., 1995). Some weeds are reservoirs for the virus during periods when tomatoes are not in production and from which the virus can spread to new tomato plantings (Cohen and Nitzany, 1966; Zeidan and Czosnek, 1991). Host-free periods have been used to eliminate or substantially reduce the incidence of the disease in these countries (Cohen and Nitzany, 1966; Cohen et al., 1988; Cohen and Antignus, 1994; Serra et al., 1995).

In the present study, the natural host range of TYLCV in Florida was investigated using a polymerase chain reaction (PCR) procedure to detect TYLCV DNA in leaf tissues (Ying and Davis, in press). Plants were sampled within or immediately adjacent to tomato plantings with TYLCV. Disks of leaf tissue, approximately 8 mm in diameter, were cut from a leaf of each plant. DNA was extracted from leaf disks by a modified Dellaporta maize mini-preparation procedure. In most cases, four single leaf disks from four individual plants of the same species were pooled for each DNA extraction.

A pair of degenerate PCR primers based on PAL1v1978 and PAR1c496 (Rojas, et al., 1993) were designed to more closely match the target DNA sequence in TYLCV from Florida. These were designated PALv1978N (5'GCCACATYGTYYTTSCCTGT) and PARc496N (5'GGCTTYCKGTACATGGG). These new degenerate primers proved

useful for the general detection (annealing at 50°C) of several gemini viruses especially TYLCV, and a size polymorphism among the amplification products helped to differentiate TYLCV from other gemini viruses. To verify the detection of TYLCV by PCR with the degenerate primers, a second pair of non-degenerate primers was designed specifically for detection of TYLCV and each was designated TYLCV-F1 (5'GAATGTTTCGGATGGAAATGTG) and TYLCV-R1 (5'GTGGAAATGATTATATCGCCTG). Under stringent reaction conditions (annealing at 58°C), these primers directed amplification of a diagnostic DNA fragment (776 bp) for TYLCV but not most other gemini viruses tested. The identities of PCR fragments were further confirmed with restriction enzyme digestion profiles when necessary.

A total of 1862 plants of more than 76 species in at least 35 families were sampled primarily in eight of 14 locations where commercial tomato production was affected by TYLCV in south Florida. Most locations were sampled periodically throughout the winter of 1998-1999. A total of 482 DNA extracts were processed and tested by PCR. Besides tomato, the PCR tests were positive with both degenerate and non-degenerate primer pairs for some samples of the following plant species: *Amaranthus retroflexus* (Amaranthaceae), *Acalypha virginica* (Euphorbiaceae), *Begonia* sp. (Begoniaceae), *Macroptillum lathyroides* (Fabaceae), *Nicotiana tabacum* (Solanaceae) and *Sonchus oleraceus* (Asteraceae). All were identified in at least two locations by two or more separate PCR assays. None of these plants had symptoms that could be consistently associated with the presence of the virus. Except for *S. oleraceus* and *N. tabacum*, these are all newly identified potential natural hosts for TYLCV.

Despite the apparent wide host range of TYLCV in Florida, none of the species identified in the present study as possible hosts other than tomato itself appeared to be of obvious importance from an epidemiological point of view. In general, plants testing positive for TYLCV were found late in the tomato production season and in close proximity to tomato plantings with a high incidence of TYLCV and a high population of whiteflies, except for the samples of *Begonia* sp. which were from commercial nursery operations. The same species, when sampled earlier in the season when the incidence of TYLCV was low, were negative for the virus.

Because TYLCV does not cause symptoms in most plant hosts other than tomato, the procedures used in this study were designed to permit sampling of a large number of plants to determine if any might be natural hosts of the virus regardless of the presence or absence of symptoms. PCR has an advantage in this respect due to its sensitivity. However, PCR detection of TYLCV only indicates that the virus was present and not that the plant was infected by the virus. For example, the virus might have been present in whitefly excrement on leaf surfaces and have been detected there by PCR. The fact that only a few of the many plant species tested were positive for the virus and that more than one sample from these species were positive suggests that these plants are hosts of the virus. Another approach to investigating the host range of TYLCV was taken by Polston, et. al (1999a). They tested over 50 plant species to determine if the virus could be

experimentally transmitted to them by whiteflies and found that *Arabidopsis thaliana*, petunia (*Petunia hybrida*), bean (*Phaseolus vulgaris*), browallia, red current tomato (*Lycopersicon pimpinellifolium*), tomatillo (*Physalis ixocarpa*), cossack pineapple (*Physalis prunosa*), red tropical soda apple (*Solanum capsicoides*), and silver night shade (*Solanum eleagnifolium*) were hosts of TYLCV. However, whether or not these hosts become infected in nature was not determined. Nevertheless, these host range studies should help to identify natural hosts of TYLCV that might play a role in the epidemiology of the disease.

Citations

- Cohen, S., and Antignus, Y. 1994. Tomato yellow leaf curl virus, a whitefly-borne geminivirus of tomatoes. In "Advances in Disease Vector Research", Vol. 10, pp. 259-288. Springer-Verlag, New York.
- Cohen, S., Kern, J., Harpaz, I., and Ben-Joseph, R. 1988. Epidemiological studies of the tomato yellow leaf curl virus (TYLCV) in the Jordan Valley, Israel. *Phytoparasitica* 16:259-270.
- Cohen, S., and Nitzany, F. E. 1966. Transmission and host range of the tomato yellow leaf curl virus. *Phytopathology* 56:1127-1131.
- McGlashan, D., Polston, J. E., and Bois, D. 1994. Tomato yellow leaf curl geminivirus in Jamaica. *Plant Disease* 78:1219.
- Nakhla, M. K., Maxwell, D. P., Martinez, R. T., Carvalho, M. G., and Gilbertson, R. L. 1994. Widespread occurrence of the eastern Mediterranean strain of tomato yellow leaf curl geminivirus in tomatoes in the Dominican Republic. *Plant Disease* 78:926.
- Polston, J. E., Bois, D., Serra, C. A., and Concepcion, S. 1994. First report of a tomato yellow leaf curl-like geminivirus from tomato in the Western Hemisphere. *Plant Disease* 78:831.
- Polston, J. E., Foley, M., Reif, P., and McGovern, R. J. 1999a. Host range of tomato yellow leaf curl virus in Florida. University of Florida, Gulf Coast Research and Education Center Research Report, BRA-1999-7.
- Polston, J.E., R.J. McGovern, and L.G. Brown. 1999b. Introduction of tomato yellow leaf curl virus in Florida and implications for the spread of this other geminiviruses of tomato. *Plant Dis.* 83:984-988
- Ramos, P. L., Guerra, O., Dorestes, V., Ramirez, N., Rivera-Bustamante, R., and Oramas, P. 1996. Detection of TYLCV in Cuba. *Plant Disease* 80:1208.
- Rojas, M.R., R.L. Gilbertson, A.R. Russell, and A.P Maxwell. 1993. Use of degenerate primers in the polymerase chain reaction to detect whitefly-transmitted geminivirus. *Plant Dis.* 77:340-347

Serra, C. A., Polston, J. E., Concepcion, S. , Ortiz, M., Nunez, J. B., and Benoit, P. F. 1995. Host range of TYLCV-DR and its vectors and strategies to reduce damages in northwestern Dominican Republic. pp. 15 In: Proceedings of Symposium on Biology and Molecular Biology Epidemiology of Geminiviruses, Tucson, AZ, June 3-8, 1995, (Abstr.).

Posters

Vidalia Onion Variety Trials 2000

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Vidalia onion variety trials were held at the Vidalia Onion and Vegetable Research Center (VOVRC) location in Tattnall County. Data collected from these trials included field yield, post-cure and graded yield, disease, and pungency. Onions were harvested on two different dates with the first harvest date representing the early harvest date. Some varieties were placed in controlled atmosphere (CA) storage for 4.5 months and evaluated for pre-storage yield and marketable yield. The percent marketable yield was calculated by dividing the market yield by the pre-storage yield.

Post-cure yields at the VOVRC ranged from 879 50-lb bags per acre to 15 50-lb bags per acre (Table 1). Some varieties had lower yields due to infection with sour skin. Early harvested varieties particularly the Japanese varieties are resistant to bacterial disease, however, they are considered more pungent.

Yields at Bland Farm ranged from 916 50-lb bags per acre to 0 50-lb bags per acre. Overall the yields at Bland Farm location were lower than at the VOVRC. The soil at the VOVRC site is somewhat heavier than at Bland Farm. It is known that higher pungencies occur on heavier soils.

The percent marketable onions after 4.5 months of CA storage ranged from 39% to 77% (Table 3). The best storing variety of the first harvested onions with 77% marketable onions after 4.5 months of CA storage was the variety 'Japan'. The variety 'Japan' is resistant to bacterial disease and is considered more pungent.

Table 1. Vidalia Onion Variety Trial - VOVRC 2000

Entry	Seed Source	Field Yield	Post Cure Yield	Large	Jumbo	Harvest Date	Bacterial Diseases	Pungency
		50 lb bags/acre	50 lb bags/acre	≤3.5 in.	>3.5 in.		Number/50 ft plot	um/gfw
Savannah Sweet	Petoseed	1107	879	184	654	5/4/2000	32	3.4
SXO 1519	Sunseeds	1064	861	233	487	4/26/2000	26	4.5
DPS 1032	D. Palmer Seed	956	821	519	79	4/19/2000	42	4.8
WI-609	Wannamaker Intern.	882	783	339	291	4/6/2000	13	4.4
DPS 1039	D. Palmer Seed	850	755	481	124	4/19/2000	29	4.5
Sweet Vidalia	Rio Colorado	916	749	292	328	4/26/2000	17	4.6
Sweet Success	Sunseeds	1014	720	159	486	5/4/2000	56	4.0
SSC 6371 F1	Shamrock	764	688	339	89	4/12/2000	20	4.9
Granex 1035	Seedway	849	670	423	85	4/26/2000	47	4.7
WI-3115	Wannamaker Intern.	746	658	344	91	4/6/2000	28	5.2
Yellow Granex Imp. (Sun F1)	Sunseeds	858	657	339	239	4/26/2000	29	4.4
Sweet Melody	Rio Colorado	860	656	342	190	4/26/2000	42	3.9
DPS 1033	D. Palmer Seed	1020	647	254	302	5/11/2000	50	4.1
PS 7092	Petoseed	752	631	316	88	4/19/2000	58	4.3
Granex 33 (Y33)	Asgrow	891	612	291	244	5/4/2000	77	3.5
SSC 6436 F1	Shamrock	711	606	287	36	4/12/2000	55	5.1
XP 6995	Asgrow	953	579	228	265	5/4/2000	74	3.1
Georgia Pride F1	Shamrock	663	563	252	83	4/6/2000	18	5.4
RCS 1919	Rio Colorado	622	556	243	12	4/12/2000	70	5.0
DPS 1058	D. Palmer Seed	611	547	199	21	4/12/2000	30	4.7
SSC 6372 F1	Shamrock	554	481	169	17	4/12/2000	33	5.0
Sweet Sun	Sunseeds	697	472	243	64	5/4/2000	71	2.4
Nikita	Rio Colorado	560	362	135	107	5/4/2000	187	3.7
1015Y	Asgrow	815	204	78	83	5/11/2000	50	3.1
Pegasus	Asgrow	967	197	93	74	5/11/2000	131	2.5
Evita F1	Shamrock	1045	160	54	66	5/11/2000	41	4.3
Centaur	Asgrow	880	15	10	4	5/11/2000	131	3.3
	R ²	0.769	0.865				0.720	0.741
	CV	21%	41%				90%	23%
	LSD	140	142				42.4	0.8

Table 2. Vidalia Onion Variety Trial - Bland Farm 2000

Entry	Seed Source	Yield 50 lb. bags/acre	Post Cure Yield 50 lb bags/acre	First Harvest Date	Large ≤3.5 in.	Jumbo >3.5 in.	Bacterial Disease No./50 ft plot	Pungency um/gfw
DPS 1033	D. Palmer Seed	1164	916	5/3/2000	194	660	10	3.2
DPS 1039	D. Palmer Seed	1027	880	4/20/2000	348	444	13	3.5
Sweet Vidalia	Rio Colorado	972	813	4/20/2000	234	483	11	3.0
Sweet Success	Sunseeds	973	787	4/27/2000	240	471	11	3.5
SSC 6436 F1	Shamrock	818	715	4/13/2000	380	191	12	3.4
WI-609	Wannamaker Intern.	735	688	4/6/2000	220	327	4	3.5
Granex 33 (Y33)	Asgrow	955	682	5/3/2000	193	428	38	3.4
SXO 1519	Sunseeds	1034	679	4/27/2000	190	370	6	3.2
WI-3115	Wannamaker Intern.	740	650	4/6/2000	275	260	3	3.2
Granex 1035	Seedway	838	638	4/27/2000	318	184	11	3.5
Savannah Sweet	Petoseed	1015	623	4/27/2000	251	325	20	3.1
XP 6995	Asgrow	1013	621	5/3/2000	159	427	15	3.0
SSC 6371 F1	Shamrock	711	610	4/13/2000	271	191	4	3.5
SSC 6372 F1	Shamrock	726	605	4/13/2000	325	90	19	3.9
Yellow Granex Imp. (Sun F1)	Sunseeds	896	568	4/27/2000	198	281	18	3.4
PS 7092	Petoseed	888	557	4/27/2000	234	232	17	3.2
Georgia Pride F1	Shamrock	591	483	4/6/2000	203	137	8	3.5
Sweet Melody	Rio Colorado	921	451	5/3/2000	118	284	27	3.2
DPS 1058	D. Palmer Seed	508	432	4/13/2000	135	37	7	2.9
Pegasus	Asgrow	979	64	5/10/2000	14	42	20	3.1
Evita F1	Shamrock	717	9	5/10/2000	2	3	13	4.0
Centaur	Asgrow	914	0	5/10/2000	0	0	45	2.1
	R ²	0.786	0.818				0.710	0.407
	CV	21%	49%				84%	18%
	LSD	139	197				11	0.8

Watermelon Variety Trial 2000

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A watermelon trial was held at the Vidalia Onion and Vegetable Research Center (VOVRC) during 2000. Twenty-nine varieties were evaluated in the trial (Table 1). Yields ranged from 48,627 lbs per acre for St. Anthony per acre for WX57. Of the 29 varieties tested seven were triploid or seedless varieties. This reflects the increasing use of triploid varieties among growers and buyers. In addition, 11 of the varieties were Allsweet types which are seedless. These varieties are medium sized oblong melons with a dark green rind and a light yellow rind. All but one have red flesh. Yellow fleshed varieties generally have the same quality and taste of red varieties but have not been popular with consumers.

Table 1. Watermelon variety trial at the VOVRC harvested 7/24/00, 7/27/00, and 8/2/00.

Variety	Seed Source	Yield		Sugar Content		Fruit Length		Fruit Width		Rind Thickness	Fruit Weight
		lb/acre	(%)	(in)	(in)	(in)	(lbs)	Melon Type	Flesh Color		
Stars n Stripes	Asgrow	48,627	9.9	17.4	8.2	1.0	15.6	Jubilee	Red		
WX22	Willhite Seed Red	47,956	10.4	14.1	9.4	0.7	17.9	Blocky	Crimson Sweet		
AU-Jubilant	Hollar Seed Co.	43,549	9.4	16.9	8.4	0.9	19.4	Jubilee	Red		
EX 4203337	Asgrow	39,229	9.8	10.8	8.7	0.9	11.7	Crimson Sweet	Seedless	Red	
W 5036	Sunseeds Red	39,160	10.1	15.5	8.2	0.9	15.6	Crimson Sweet	Seedless		
EX 4510759	Asgrow	38,434	10.6	11.5	8.9	0.9	13.9	Crimson Sweet	Seedless	Red	
Dumara	Sunseeds	38,355	10.3	14.0	9.2	0.8	16.0	Allsweet	Red		
EX 4569319	Asgrow	37,981	10.0	15.3	8.5	0.9	16.9	Allsweet	Red		
AU-Golden Producer	Hollar Seed Co.	37,552	10.7	11.1	9.6	0.9	15.0	Crimson Sweet			
	Yellow										
WX15	Willhite Seed	37,175	10.0	12.6	9.3	0.8	15.8	Allsweet	Red		
AU Producer ZYMV	Auburn Univ.	37,066	9.7	11.0	9.7	0.8	14.4	Crimson Sweet			
	Red										
AU Sweet Scarlet	Hollar Seed Co.	35,465	10.3	11.3	9.8	0.6	14.6	Crimson Sweet	Red		
Legacy	Willhite Seed	35,044	9.7	16.2	8.6	0.8	19.3	Allsweet	Red		
Athens (5025)	Sunseeds	34,478	10.0	14.2	8.9	0.9	15.8	Allsweet	Red		
Lady	Sunseeds	34,129	9.6	12.3	8.9	0.9	15.4	Blocky	Jubilee	Red	
Festival	Willhite Seed	32,975	9.6	13.8	8.2	0.8	17.1	Allsweet	Red		
WX30	Southwestern	32,176	9.9	13.4	9.0	0.9	15.0	Blocky	Jubilee	Red	
Piñata	Willhite Seed	31,704	9.1	15.1	9.2	0.8	16.8	Allsweet	Red		

WX8	Willhite Seed	31,164	10.1	14.5	8.9	0.8	15.9	AllsweetRed
WX55	Willhite Seed	30,242	10.7	10.3	9.2	0.9	12.6	Jubilee Red
SXW 5023	Sunseeds	29,138	10.7	15.3	8.9	0.9	15.1	AllsweetRed
Slice N Serve 830 Red	Southwestern	27,824	10.3	10.7	8.5	0.9	11.8	Crimson Sweet Seedless
W 5052	Sunseeds Red	26,169	10.4	10.7	8.5	0.8	12.6	Crimson Sweet Seedless
Freedom (3022)	Sunseeds	23,512	11.1	12.5	8.2	0.9	17.5	Seedless Jubilee Red
Premiere F1	Southwestern Red	22,800	10.6	10.9	8.5	0.7	10.8	Crimson Sweet Seedless
XP 452547	Asgrow	20,441	10.5	16.1	8.0	0.6	13.1	Smokey Jubilee Red
AU-Allsweet BL	Auburn Univ.	19,947	10.6	15.1	9.7	0.8	16.2	AllsweetRed
W 5051	Sunseeds	15,863	10.3	12.5	8.2	0.9	13.2	AllsweetRed
WX57	Willhite Seed Red	12,828	9.9	11.6	8.7	0.9	13.1	Crimson Sweet Seedless
	R ²	0.429	0.371					
	CV	44%	8%					
	LSD	17,910	NS					

Table 3. Vidalia Onion and Vegetable Research Center, 2000

First Harvest Controlled Atmosphere Storage Results

Removed from Storage October 11, 2000 after 4.5 months storage

Entry	Pre-Stored (lbs)	Post-Stored (lbs)	Marketable (lbs)	Percent Marketable
1015Y	23.6	20.8	9.1	39%
SSC 6371 F1	19.7	17.4	7.7	39%
Pegasus	17.7	15.7	7.0	40%
DPS 1033	25.5	22.6	11.4	45%
WI-609	21.4	19.7	9.9	46%
WI-3115	21.3	19.7	10.9	51%
PS 7092	20.9	19.2	11.0	52%
Sweet Melody	28.6	27.2	15.2	53%
DPS 1032	22.9	15.6	12.3	54%
Georgia Pride F1	18.9	17.4	10.2	54%
Sweet Success	29.0	24.1	16.0	55%
Nikita	19.4	17.4	10.7	55%
SXO 1519	26.0	23.4	14.8	57%
DPS 1039	23.1	21.4	13.3	58%
Sweet Sun	25.0	23.1	15.3	61%
Yellow Granex Imp. (Sun F1)	24.4	22.5	15.2	62%
Evita F1	20.6	18.8	12.8	62%
SSC 6436 F1	20.6	18.3	12.8	62%
Granex 1035	24.8	23.0	15.5	62%
RCS 1919	19.2	17.4	12.5	65%
Sweet Vidalia	25.3	23.4	16.6	65%
Granex 33 (Y33)	25.6	23.8	16.9	66%
XP 6995	25.2	23.0	16.7	66%
SSC 6372 F1	18.5	17.2	12.9	70%
DPS 1058	18.7	19.0	14.1	75%
Savannah Sweet	26.9	24.9	20.8	77%
		R2	0.460	0.358
		CV	35%	30%

Consumer Preferences Among Standard and Supersweet Corn Varieties

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Local or roadside sales of sweet corn in north Georgia still tend to be of the older standard types of varieties. Consumers often buy primarily on name recognition of a variety. “Silver Queen” is a standard variety that has wide name recognition and has been known for years as a superior sweet corn. However, many of the newer sh², or supersweet, varieties have a higher sugar content and will maintain their sweetness much longer than “Silver Queen”.

Five supersweet corn varieties (“Variety 8102BC”-bicolor, “Variety 8101W”-white, “Variety 7630”-yellow, “GSS 0966”-yellow, “Sensor Bicolor”) and “Silver Queen” were harvested and frozen on the cob in July 2000. On August 20, 2000 the culinary arts personnel at North Georgia Technical College prepared the corn by boiling it on the cob in an identical fashion for all varieties. A collection of buyers and consumers each tasted four of the varieties and evaluated various flavor and preference components for each of the varieties they tasted. The varieties were coded by letter to prevent participants from knowing the name of each variety prior to the test.

After the panel had completed their taste evaluations a straw poll was conducted to determine their initial reaction. The straw poll revealed that most participants preferred “Silver Queen” over the other varieties based on first impressions. However, upon analysis of the evaluations, the participants had rated “GSS 0966” as the most preferable in most categories.

The “Silver Queen” variety was a little more mature (fuller) than the other corns and could have biased participants in favor of it to some degree. Also, most people familiar with sweet corns could easily identify the “Silver Queen” by its appearance. Therefore, “Silver Queen” may have been rated higher due to some bias in the test. However, the ratings revealed that their preference clearly rated one of the supersweet

varieties above the rest. Interestingly enough, the particular variety that achieved the highest rating was also a variety that contained the Bt gene for insect control. Since many consumers are fearful of genetically modified varieties, the fact that this one was rated the best was even more striking.

In conclusion, without regard to variety name, consumers would more likely prefer a supersweet corn variety to a standard variety. The challenge to growers and sellers is to familiarize customers with the names of the more preferable tasting corn varieties in order to increase sales of these varieties.