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William Terry Kelley
Editor

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Proceedings

2002 Georgia Vegetable Conference

January 11 - 13, 2002
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Editor
Dr. William Terry Kelley
Extension Horticulturist
University of Georgia
P.O. Box 1209
Tifton, Georgia 31793

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FORWARD

The continued success of the Georgia vegetable industry is dependent upon the dissemination of timely and appropriate information. The assimilation and distribution of technology beneficial to the industry 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 proceedings of this conference are provided to give our clientele an opportunity to evaluate recent information and developments that might concern them. 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

2002 Vegetable Conference Program

<u>Friday - January 11, 2002</u>

1:00-3:00 pm *Concurrent Sessions*

<u>Session #1 - What You Don't Know, Can Cost You - $$$ - Bryan Room</u>

Moderator: Dan Bremer
AG Works, Lake Park, GA

1:00-200 p.m. **Update on Wage and Hour, FICA Issues**
Dan Bremer, Ag Works, Lake Park, GA
2:00-3:00 p.m. **OSHA Requirements for Growers**
________________Phillip Moncrief, US Dept of Labor, Savannah, GA

<u>Session #2 - Vidalia Onions - Deveaux Room</u>

Moderator: Jeff Cook
UGA County Extension Agent, Reidsville, GA

1:00-1:20 p.m. **Onion Flavor**
Dr. Bill Randle, UGA - Athens, GA
1:20-1:40 p.m. **Influence of Mulches and Drip Irrigation on the Growth and Yield of Vidalia Onions**
Dr. Juan C. Diaz Perez, UGA - Tifton, GA
1:40-2:00 p.m. **Survey of Commercial Onion Seed Lots for *Botrytis Allii* and *Pantoea Ananatis* Causal Agents of Botrytis Neck Rot and Center Rot**
Dr. Ron Walcott, UGA - Athens, GA
2:00-2:20 p.m. **Onion Disease Update**
Dr. Ron Gitaitis, UGA - Tifton, GA
2:20-2:40 p.m. **Onion Insect Update**
Dr. David Riley, UGA - Tifton, GA
2:40-3:00 p.m. **Programmed Release Fertilizers for Vidalia Onion Production**
Dr. Jon R. Johnson, Helena Chemical Co.

1:00-3:00 pm *Concurrent Sessions*

<u>Session #3 - Commercial Organic Vegetable Production</u> - Musgrove Room

Moderator: Greg Hardison
UGA County Extension Coordinator, Mount Vernon, GA

1:00-1:20 p.m. **Cover Crops**
Dr. Sharad Phatak, UGA - Tifton, GA
1:20-1:40 p.m. **Producing Organic Vidalia Onions**
Dr. George E. Boyhan, UGA - Statesboro, GA
1:40-2:00 p.m. **Opportunities and Challenges in Organic Vegetable Production**
Dr. Jeanine M. Davis, N.C. State Univ. - Fletcher, NC
2:00-2:20 p.m. **Grower Prospective**
Andy Stocklinski - Watkinsville, GA
2:20-2:40 p.m. **Transitioning to Organic Process & Implication for the Grower**
Skip Glover - Douglasville, GA
2:40-3:00 p.m. **Composting**
Dr. Wayne McLaurin, UGA - Athens, GA

3:30-5:00 p.m. *Concurrent Sessions*

Session #4 - Food Safety Certification - Bryan Room

Moderator: David Curry
UGA County Extension Coordinator, Lyons, GA

3:30-4:00 p.m. **Risk Communication Associated with Produce**
Bob Howard, Centers for Disease Control and Prevention - Atlanta, GA
4:00-4:20 p.m. **The Good Agricultural Practices for Fruits and Vegetables**
Terry Hollified, Georgia Crop Improvement Assoc. - Athens, GA
4:20-5:00 p.m. **Developing an Effective Farm Food Safety Plan**
Dr. Darbie M. Granberry - UGA - Tifton, GA
Dr. Bill Hurst, UGA - Athens, GA

Session #5 - Emerging and Re-emerging Crops and Technologies - Deveaux Room

Moderator: Ben Tucker
UGA County Extension Coordinator, Adel, GA

3:30-3:50 p.m. **The Re-emerging Potential for Sweet Potatoes in Georgia**
Dr. Joe Kemble, Auburn Univ. - Auburn, AL
3:50-4:15 p.m. **Preventing Intentional Contamination of Fruits and Vegetables**
Drs. Darbie Granberry and Bill Hurst, UGA - Tifton, GA/Athens, GA
4:15-4:40 p.m. **Soil Organic Matter and Microorganisms**
Dr. Frank McKenna, Microgene, Australia
4:40-5:00 p.m. **Commercial Pumpkin Production in Georgia**
Dr. William Terry Kelley, UGA - Tifton, GA

Session #6 - Tactics for Control of Tomato Spotted Wilt Virus - Musgrove Room

Moderator: Keith Rucker

UGA County Extension Agent, Tifton, GA

3:30-3:45 p.m. **Role of Weeds as Sources for Spread of Tomato Spotted Wilt Virus**
Dr. George G. Kennedy, N.C. State Univ. - Raleigh, NC

3:45-4:00 p.m. **Insecticide Strategies for TSWV**
Dr. David Riley, UGA - Tifton, GA

4:00-4:20 p.m. **Updating Reflective Mulches for TSWV Control**
Dr. Steve Olson, Univ. of Florida - Quincy, FL

4:20-4:40 p.m. **Appearance of Symptoms of TSWV in Tomato as Affected by Colored Plastic Film Mulches**
Dr. Juan C. Diaz-Perez, UGA - Tifton, GA

Saturday - January 12, 2001

8:30-11:00 a.m. *General Session*

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

Session #7 - Sandea-A Potential New Herbicide for Use in Several Cucurbit and Fruiting Vegetables - Bryan Room

Moderator: Mr. Brad Mitchell

UGA County Extension Coordinator - Camilla, GA

1:00-1:10 p.m. **Historical Background on Sandea and Gowan Company**
Kenneth R. Muzyk, Gowan Chemical Co

1:10-1:24 p.m. **Weed Control and Watermelon Tolerance to Sandea**
Ken Lewis, UGA - Cordele, GA

1:24-1:38 p.m. **Purple Nutsedge Control and Cucumber Tolerance to Sandea**
Ginger K. Purdue, UGA - Ludowici, GA

1:38-1:52 p.m. **Weed Control and Cantaloupe Tolerance to Sandea**
Dr. W. C. Johnson, USDA - Tifton, GA

1:52-2:09 p.m. **Squash Tolerance to Sandea and Applying Sandea Through Drip Tape**
Dr. Theodore M. Webster, USDA - Tifton, GA

2:09-2:23 p.m. **Tolerance of Staked Tomatoes Grown on Plastic Mulch to Sandea (Halosulfuron)**
J. E. Hudgins, UGA - Bainbridge, GA

2:23-2:30 p.m. **Pepper Response to Sandea (Halosulfuron) Applied Under Plastic, Precision-Directed, and Topically**
Dr. A. Stanley Culpepper, UGA - Tifton, GA

2:30-2:37 p.m. **Eggplant Response to Topical and Precision-Directed Applications of Sandea (Halosulfuron)**
J. T. Flanders, UGA - Cairo, GA
2:37-2:45 p.m. **Sandea Data Summary and Conclusions**
Dr. Stanley Culpepper, UGA - Tifton, GA
2:45-3:00 p.m. **Sandea Label Update**
Ken Muzyk, Gowan Chemical Co.

<u>Session #8 - Technology Updates for Pepper, Tomatoes, etc. - Deveaux Room</u>

Moderator: Johnny Whiddon
UGA County Extension Coordinator, Quitman, GA

1:00-1:20 p.m. **Evaluation of Micro Irrigation Wetting Patterns in Polyethylene Film Mulch Bed**
Dr. Alex Csinos, UGA - Tifton, GA
1:20-1:40 p.m. **Effect of Selected Fumigants on Soilborne Fungi**
Dr. Kenneth W. Seebold, UGA - Tifton, GA
1:40-2:00 p.m. **Susceptibility of Vegetable Crops to Phytophtora Blight**
Dr. Gerald J. Holmes, N.C. State Univ. - Raleigh, NC
2:00-2:20 p.m. **Bell Pepper Yield and Incidence of Blossom-End Rot as Affected by Calcium Application and Irrigation Rates**
Dr. Juan C. Diaz-Perez, UGA - Tifton, GA
2:20-3:00 p.m. **The Effect of Plastic Mulch Color on the Incidence of Tomato Spotted Wilt Virus in Bell Pepper**
Mr. Glenn Beard, UGA - Moultrie, GA

<u>Session #9 - Marketing - Musgrove Room</u>

Moderator: Greg Peacock
Georgia Department of Agriculture, Eastman, GA

"Georgia Grown" Availability and Tools
Harvey Robertson, T&T Advertising - Atlanta, GA
"Georgia Grown Goes to Market"
The 2001 Kroger Pilot Programs
Dr. John McKissick, UGA - Athens, GA
Export Potential for Vegetable Growers
Dr. Greg Fonsah, UGA - Tifton, GA

Georgia Watermelon Association Annual Meeting

Friday, January 11, 2002
Simms Room

Moderator: Tom Jennings
UGA County Extension Coordinator, Rochelle, GA

1:00-1:30 p.m. **Watermelon Fruit Blotch Update**
Dr. Ron Walcott, UGA - Athens, GA

1:30- 2:00 p.m. **Resistance to Azoxystrobin (Quadris) in the Gummy Stem Blight Pathogen in Georgia**
Dr. Katherine L.Stevenson, UGA - Athens, GA

2:00-2:30 p.m. **Nutrient and Water Management for Watermelons**
Dr. Sal J. Locascio, Univ. of Florida - Gainesville, FL

2:30-3:00 p.m. **Controlling Foliar Diseases on Watermelon with Fungicides**
Dr. Anthony P. Keinath, Clemson Univ.- Charleston, SC

Moderator: James Jacobs
UGA County Extension Agent, Nashville, GA

3:00-4:00 p.m. **Watermelon & Cantaloupe Trials**
Dr. George E. Boyhan, UGA - Statesboro, GA

4:00-4:30 p.m. **Control of Powdery Mildew and Anthracnose in Georgia Watermelons**
Dr. David B. Langston, UGA - Tifton, GA

4:30-5:00 p.m. **Economics of Watermelon Production**
Dr. Tim Hewitt, Univ. of Florida - Quincy, FL

POSTERS

Evaluation of Soil Fumigants and Nitrogen Fertilizer Rates on Vidalia Onions
Dr. George E. Boyhan, UGA - Statesboro, GA
Reid L. Torrance, Tattnall County Extension - Reidsville, GA

Grano Onion Trials
Dr. George E. Boyhan, UGA - Statesboro, GA
Robert T. Boland, Brantley County Extension - Nahunta, GA

On-Farm Evaluation of Plantbed Fertility
Dr. George E. Boyhan, UGA - Statesboro, GA
Greg Hardison, Montgomery County Extension - Mount Vernon, GA

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

What You Don't Know, Can Cost you - $$$

Moderator: Dan Bremer

Session #2

Vidalia Onions

Moderator: Jeff Cook

Further Studies Into How The Environment Affects Onion Flavor.

W.M. Randle, T. Coolong, P. Chang, and M. Pearce.
Department of Horticulture, University of Georgia, Athens, 30602-7273

While variety plays an important role in determining flavor quality and intensity, we are becoming increasingly aware of how environmental changes influence bulb pungency. Our program in Athens continues to investigate how environments that exist or have the potential to exist in the Vidalia area affect onion flavor. Recently we have investigated the effect temperatures ranging from 65 to 90 degrees F on bulb pungency and flavor quality. Confirming earlier studies, pungency increases as temperature increases over this range. Individual flavor precursors increased proportionately as temperature increased. Therefore, flavor quality should not change as temperature increase with the increase in flavor intensity. In another study we investigated the effects of salinity (salt) on flavor intensity. While the condition does not currently exist in any of the Vidalia growing areas, saltwater intrusion is a potential future threat to the production area. Onions were exposed to increasing levels of salt water, that at the highest level, approached ¾ strength seawater. Even at lower levels, salt decreased the growth of onion and would have a significant affect on bulb yield. In addition, salinity affected both onion pungency and the flavor quality of the bulbs.

Influence of Mulches and Drip Irrigation on the Growth and Yield of Vidalia Onion

Juan C. Diaz-Perez[1], Ron Gitaitis[2], William Randle[3], Terry Harrison[4], and Reid Torrence[5]
[1] Department of Horticulture, CPES, University of Georgia,
P.O. Box 748, Tifton, Georgia 31793. jcdiaz@tifton.cpes.peachnet.edu
[2] Department of Plant Pathology, CPES, University of Georgia,
P.O. Box 748, Tifton, Georgia 31793.
[3] Department of Horticulture, 1111 Plant Science Building, UGA, Athens, GA 30602
[4] Department of Agricultural and Biological Engineering, RDC, Tifton, GA 31794
[5] Cooperative Extension Service, UGA, Tattnall Co., 200 South Main St., Highway 23,
Reidsville, GA 30453.

Dry onions represent the leading vegetable crop by value ($75 million) in Georgia. During 2000, dry onions in Georgia were planted to about 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. One of the advantages of drip irrigation is that 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 with 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. The objective of this study was to evaluate the effect irrigation system and mulches on the yield and quality of sweet onions. In this report, we present the results of three trials conducted in Reidsville (2000) and Tifton (2000 and 2001).

Periodic measurements of plant growth for the entire season indicated that shoot and bulb dry weight of plants on plastic mulch were higher than those of plants on straw and at least similar compared to those of plants on bare soil. Plants on plastic reached the ripe stage (i.e., 15% necks were bent) 10 days earlier than the plants on bare soil or straw.

Yield was not consistently affected by irrigation method. Yield of plants under drip was higher, similar or lower compared to plants under sprinkler irrigation. Yield was highest in plants on bare soil and lowest in plants on straw. Yield on bare soil was higher than on plastic probably because plants on plastic were harvested 10 days earlier than plants on the other mulches. Our growth data indicated that bulb weight increased by about 25 % in 10 days, from the harvest day for plants on plastic to the harvest day for plants on bare soil.

The soluble solids content (SSC) and pungency of bulbs grown under drip irrigation was similar to that of bulbs under sprinkler irrigation. Soluble solids content (SSC) and pungency were not affected by mulch. However, mulches affected other quality attributes. Bulbs from plants on plastic mulch tended to have a higher incidence of bacterial diseases compared to bulbs from plants on bare soil or straw (Gitaitis, personal communication).

In conclusion, Vidalia onions grown under drip irrigation on bare soil had a similar yield and bulb quality compared to onions grown under sprinkler irrigation. Bulb quality from plants under drip irrigation was no significantly different compared to the quality of bulbs under sprinkler irrigation. Plants on bare soil had a higher yield than plants on plastic or straw.

Survey of Commercial Onion Seedlots for *Botrytis Allii* and *Pantoea Ananatis*, Causal Agents of Botrytis Neck Rot and Center Rot.

Ron. R. Walcott
Department of Plant Pathology
University of Georgia
4315 Miller Plant Sciences
Athens GA 30602

Two important plant diseases that threaten Georgia's onion production annually are Botrytis neck rot caused by *Botrytis allii* and center rot (*Pantoea ananatis*). Botrytis neck rot (BNR) is a perennial problem which manifests itself primarily after onions have been stored for 8 - 10 weeks. While symptoms may be absent in the field, BNR is capable of significantly reducing the yield of stored onions. Center rot was first observed in commercial onion fields in Georgia in 1997(5). Incidentally, the disease was also observed in Michigan and Colorado(4) the same year. Center rot causes foliar symptoms including tan lesions and blights, and a bulb rot. While an average of 25% yield loss was reported for center rot in commercial fields in Georgia in 1997, some fields experienced greater than 90% loss(5). Center rot has been observed in commercial and research plots each year since 1997 causing ca. 10% yield reductions.

In order to effectively manage these devastating diseases of onion, it is critical to know the primary sources of inoculum. In the case of Botrytis neck rot it is clear that *B. alli* can be seedborne and a strong correlation between seed infestation and BNR in storage has been demonstrated(3,2,1). In 2001, severe outbreaks of BNR occurred in onion in New York and it is suspected that the source of inoculum was onion seeds produced in France (A. Taylor, Cornel University pers. comm.). In Georgia, however, the significance of seedborne *B. allii* inoculum is unclear. To help clarify the role of seeds in BNR epidemiology, a survey was conducted to determine the prevalence of *B. allii*-infested seedlots in commercial seed sources in Georgia. Of 140 seedlots, none were infested with *B. allii* using a standard agar plate assay. Other important fungi including *Aspergillus niger* were detected at high frequencies. This survey indicates that seed are not a significant source of inoculum for *B. allii* in Georgia. Hence, other inoculum sources including soil and processing and storage equipment should be investigated to determine their roles in the epidemiology of neck rot.

Since center rot is a relatively new disease in Georgia, little is known about the possible inoculum sources for this pathogen. However, since the disease occurred suddenly and was simultaneously observed in Colorado and Michigan, we hypothesized that the bacterium was seedborne. Additionally we hypothesized that infested seedlots were responsible for introducing the bacterium into Georgia. To investigate the seedborne nature of this disease, a highly sensitive DNA-based detection assay (immunomagnetic separation and polymerase chain reaction(IMS-PCR)) was developed. This assay had a detection threshold of 10^3 -10^1 CFU/ml(5). Studies of seedlots harvested from research onion plots revealed that *P. ananatis* can naturally infest onion seeds. Additionally, the pathogen can be transmitted to seedlings from infested seedlots. To further explore the importance of infested seeds in center rot outbreaks, 72 samples of commercial onion seedlots were assayed for *P. ananas* by IMS-PCR and by grow-out in moist chambers (n=100 seeds). Of 72 seedlots 4 were found to be contaminated with *P. ananatis*. From these data it is concluded that infested seedlots are possible sources of inoculum for center rot outbreaks and efforts should be taken to ensure that *P. ananatis* -free seedlots are used for commercial onion production. This can be accomplished by the implementation of routine seed testing.

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Onion Disease Update

Ronald D. Gitaitis
University of Georgia
Plant Pathology
P.O. Box 748
Tifton, Georgia 31793

Several different bacterial diseases have continued to reduce yields and affect postharvest quality of Vidalia onions. Bacterial streak, caused by *Pseudomonas viridiflava*, first became a serious problem in 1990. In 1997, center rot, caused by *Pantoea ananatis*, was first observed and was particularly devastating on late-maturing onion varieties. In the fall of 2001, bacterial blight, caused by *Xanthomonas campestris* was detected for the first time in commercially-grown onions in Georgia. These three new diseases introduced within the last decade, along with long-time foes of sourskin, slippery skin, and soft rot, have continued to reduce yields and have a detrimental effect on onion quality. In regards to bacterial streak, we know that control of the disease requires a coordinated effort of: a) fertility management, b) well-timed copper sprays, and c) weed management. As for center rot, we have developed a PCR protcol for the rapid detection of *Pantoea ananatis*, causal agent of center rot of onion. We found that the pathogen is endemic to Georgia. To date, we have detected the bacterium on over 22 weed species and three crop plants (two of which are used in rotation with onion). Furthermore, we have detected the bacterium on weeds up to 150 miles from the Vidalia onion-growing region. We've also demonstrated that the bacterium can be seedborne and found the bacterium in some commercial onion seedlots. Most recently, we have detected the bacterium in thrips. This would be the first report ever of that insect vectoring a plant pathogenic bacterium. We are currently working on the population dynamics of *Pantoea ananatis* in thrips by using strains genetically-engineered and marked with green fluorescent protein from jellyfish.

Onion Insect Update

David Riley
University of Georgia
P.O. Box 748
Department of Entomology
Coastal Plain Experiment Station
Tifton, GA 31793

Insect pests of Vidalia onions are generally limited to seedcorn maggot, *Delia platura* and thrips, specifically western flower thrips, *Frankliniella occidentalis*, tobacco thrips, *F. fusca* and rarely onion thrips, *Thrips tabaci*. Seedcorn maggot was problematic last year (Jan.-Feb. 2001) following freeze damage to onion tops. However, a treatment threshold for seedcorn maggot has not been determined yet, so preventative treatments of Lorsban have been generally used. Based on recent studies at Tifton, two ye 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. The current action threshold being tested is a single spray of effective insecticide initiated when thrips occur at 1 thrips per plant and subsequent sprays when the thrips level reaches an average of 5 thrips per plant. This threshold and others are currently being evaluated experimentally and in commercial validations studies using a new commercial scouting tool: "EntoNet Scouting Program for Vidalia Onion". This program will use PDA, GPS and internet technologies to coordinate scouting data collection, management and reporting of recommendations. Plant disease and weeds will also be recorded in this new scouting program so that a Best Management Practice can be generated on a weekly basis. Scouting for onion fertility has not been developed yet, but could potentially be added to this program in the future.

The best thrips treatments (one of the following: Warrior [lambda cyhalothrin] plus Atrapa [malathion], Spintor [spinosad], possibly Lannate [methomyl], and Warrior alone at the high rate) will be recommended in weeks when the thrips thresholds are triggered. We suggest that onion yield will not be significantly improved with thrips treatments if thrips numbers never reached an average of 5 per plant. However, the 1 thrips per plant threshold can potential reduce the number of treatments needed in thrips intensive years as a preventative treatment. Scouting should limit the use of insecticide to a minimum number of sprays for thrips. This and other thresholds will be further evaluated in small plot tests this coming winter. ars out of four have resulted in significant thrips damage (25% yield loss), but this means also that half the years

Programmed Release Fertilizer for Vidalia Onion Production

Jon R. Johnson
Helena Chemical Company
120 King George Way
Columbia, SC 29210

Vidalia onions are grown primarily on sandy soils. This results in the use of high rates of fertilizer, especially nitrogen, applied in 5 to 8 applications to produce a high yield and quality crop of onions. Due to the sandy soil, large amounts of irrigation are needed to produce a high yield and quality crop of onions. This combination of factors results in a serious potential for nitrogen leaching out of the rooting profile of the crop and potentially leaching into the groundwater. Programmed release fertilizer can be utilized in the production of Vidalia onions to reduce the amount of fertilizer needed to produce the crop and to reduce the number of fertilizer applications.

Studies have been conducted on grower's farms for six years to develop methods to utilize Helena programmed release fertilizer in the production of Vidalia onions. The programmed release fertilizer is a 19-8-19 that includes polymer coated nitrogen and potassium. The programmed release fertilizer is applied in a single preplant application. The fertilizer is applied prior to the pegger being used to mark the location of the plants in the row. Fertilizer should be about 0.5 to 1 inch directly below the transplant after the crop is planted. Placement of the programmed release fertilizer is important in obtaining optimal results. This programmed release fertilizer has been applied at rates to supply from 118 to 160 lbs. N/ac to determine the best rate to use in onion production.

In the 1998 to 1999 study the programmed release fertilizer applied at 160 lbs. N/ac had a 32% higher yield of jumbo onions in comparison to the conventional fertilizer program with 210 lbs. N/ac (Table 1). This resulted in a $2028 increase in gross return for the programmed release fertilizer program compared to the conventional program. Colossal and jumbo yields were 51% and 25% higher, respectively for the programmed release fertilizer compared to the conventional program in a 1999 to 2000 study (Table 2). Gross return for the programmed release fertilizer program was $2225 higher than the conventional fertilizer program in this study. In the 2000 to 2001 study the gross return for the programmed release fertilizer program was at least $3312 higher than for the conventional fertilizer program (Table 3). Leaf nitrogen concentration was maintained within the sufficiency range for the entire season from a single application of 118 to 150 lbs. N/ac from the programmed release fertilizer (Table 4).

The use of programmed release fertilizer in the production of Vidalia onions consistently increases the yield of the high value colossal and jumbo onions, which results in a substantial increase in gross return compared to the conventional fertilizer program. Helena programmed release fertilizer is being commercially used in the production of Vidalia onions.

Table 1. Influence of programmed-release fertilizer on yield and gross return of Vidalia onions in 1998 to 1999 - Grower 1.

		Yield (boxes/ac)**		
Treatment*	Lbs. N/ac	Total	Jumbo	Gross Return/ac***
Program Release	160	636	528	$6336
Conventional	210	544	359	$4308

*Programmed release fertilizer was applied in one preplant application on December 15, 1998. The conventional fertilizer program was applied in 8 broadcast applications.

**40 lbs./box

***Gross return on jumbo

Table 2. Influence of programmed-release fertilizer on yield and gross return of Vidalia onions in 1999 to 2000, Grower 2.

Treatment*	Lbs. N/ac	Yield (boxes/ac)** Colossal	Jumbo	Medium	Gross Return/ac***
Program Release	160	74	1079	74	$14,650
Conventional	190	33	818	218	$12,425

*Programmed release fertilizer was applied in one preplant application on November 22, 1999. The conventional fertilizer programs was applied in 6 broadcast applications.

**40 lbs./box

***Onion prices/box: Colossal - $13, Jumbo - $12, and Medium - $10

Table 3. Influence of programmed-release fertilizer on yield and gross return of Vidalia onions in 2000 to 2001, Grower 3.

Treatment*	Lbs. N/ac	Yield (boxes/ac)** Colossal	Jumbo	Medium	Gross Return/ac***
Program Release	150	24	659	114	$9360
Program Release	134	51	505	266	$9383
Program Release	118	63	604	189	$9945
Conventional	150	0	223	341	$6086

*Programmed release fertilizer was applied in one preplant application on November 20, 2000. The conventional fertilizer program was applied in 5 broadcast applications.

**40 lbs./box

***Onion prices/box: Colossal - $13, Jumbo - $12, and Medium - $10.

Table 4. Influence of programmed-release fertilizer on leaf nitrogen concentration of Vidalia onions in 2000 to 2001, Grower 3.

		Leaf N concentration (%)		
Treatment*	Lbs. N/ac	February 1	March 1	April 1
Program Release	150	5.26	4.98	3.52
Program Release	134	5.52	4.37	3.24
Program Release	118	5.50	4.71	3.11
Conventional	150	4.55	4.40	2.53

*Programmed release fertilizer was applied in one preplant application on November 20, 2000. The conventional fertilizer program was applied in 5 broadcast applications.

Session #3

Commercial Organic Vegetable Production

Moderator: Greg Hardison

COVER CROPS

Sharad C. Phatak, J. Ron Dozier, Anthony G. Bateman, and Kathryn E. Brunson. Department of Horticulture, Tifton Campus, University of Georgia, Box 748, Tifton, GA 31793

E-mail: phatak@tifton.cpes.peachnet.edu

Cover crops are the crops planted to improve soil and not harvested. However, in recent years due to economic conditions it is not uncommon to graze a cover crop or harvest it. For example small grains like rye, wheat are grazed and/or are harvested. Every crop may be used as a cover crop. There is a cover crop to fit in every farming system. In a conventional tillage cover crops are plowed under and is called 'Green Manuring'. This provides rapid decomposition of residue with quick release of nutrients and improvement of soil structure throughout most of the plow layer. Unfortunately these benefits are short lived. The more rapid destruction of organic matter (OM) leads in time to a deterioration of soil quality.

Cover crops play an important role in maintaining soil productivity. Cover crops enhance benefits of 'Conservation Tillage' and thus, should be used together. Some of these benefits are immediate but others come later thru increase in OM. You'll reap dividends on your cover crop investment for years, because benefits accumulate over the long term. These long term benefits are achieved from increase soil OM associated with conservation tillage and cover crops.

Cover crops slow erosion, improve soil productivity, smother weeds, enhance nutrient and moisture availability, help control many pests and diseases. They reduce nutrient leaching and run-off

Billions of tons of top soil is lost from erosion and surface runoffs every year due to wind and rain. This eroded soil deposit in rivers, lakes and other sites. Along with soil pesticides and nutrients are also carried causing non-target pollution. Cover crops in conjunction with conservation tillage reduce or eliminate soil erosion and surface runoffs. Thus, cover crops help reduce this source of pollution.

Pesticides and nutrients applied in crop production are found in under ground water caused by leaching. Cover crops when left as mulch on soil surface in conservation tillage increase water holding capacity and reduce leaching. Nutrients and pesticides are also bound to soil OM and thus are not easily leached. Soil OM also support beneficial organisms which help decomposition of pesticides in soils. Cover crops also recycle nutrients from lower layers of soil and thus, these nutrients are not leached and become pollutants in under ground water.

Using Cover Crops-Conservation Tillage System cotton, peanuts, sorghum, soybeans, corn and sixteen different vegetables were raised in research studies. No fungicides, nematicides, and insecticides were needed or used. Only herbicides were needed and used. Fertilizer use was also reduced by up to 50%. Growers using Cover Crops-Conservation Tillage System were able to reduce use of pesticides and fertilizers. Reduction in use of pesticides and fertilizers reduces potential for air and water pollution from these chemicals.

Producing Organic Vidalia Onions

George E. Boyhan[1] and C. Randy Hill[2]
[1]University of Georgia, Department of Horticulture
East Georgia Extension Center, PO Box 8112, GSU, Statesboro, GA 30460
[2]Vidalia Onion and Vegetable Research Center,
8163 Hwy 178, Lyons, GA 30436

Vidalia onions have been extremely success in Georgia. There was over 15,000 acres of Vidalia onions produced with an estimated value over $90,000,000 in 2000. Organic vegetable production has also seen many successes in the last several years. It is considered the fastest growing segment of U.S. agriculture. Recently the USDA adopted national standards for certified organic production. These standards went into effect on April 21, 2001 and are to be fully implemented by October 21, 2002. This should help organic growers particularly as they engage in interstate sales. With the rapidly expanding opportunities in organic production and the success of Vidalia onions there has been some interest in producing organic Vidalia onions. This study was undertaken to evaluate the feasibility of producing organic Vidalia onions.

During the 2000-2001 growing season, we grew Vidalia onions at the Vidalia Onion and Vegetable Research Center in Lyons, GA. We started with compost from the Georgia Department of Corrections, which we applied 4 inches deep. We then obtained poultry litter that was analyzed with 60 pounds of nitrogen per ton. Based on these results we applied enough litter to supply half of the needed amount of nitrogen for the crop, about 75 pounds. The compost and poultry litter were worked into the soil with a rotovator. Onions were transplanted in a conventional manner as to spacing and depth and the variety used was PS 7292. The transplants were produced conventionally. Approximately 2 months prior to harvest the onions were topdressed with additional poultry manure to make up the needed nitrogen. The onions were irrigated as needed from an overhead portable pipe irrigation system and weeds were controlled by hand weeding. The conventionally grown onions followed soil test recommendations for fertility with conventional production methods for weed, insect, and disease control.

The results of the study are shown in the Table 1. As you might expect, the total yield and jumbo (>3 inches) yields were lower with the organically produced onions compared to the conventionally produced onions while the yield of mediums was higher. The total yield of cured organic onions was 343 50-lb bags per acre which is not bad considering an average yield is about 400 50-lb bags per acre produced conventionally. Organic growers should expect a premium price for organic onions even above the premiums paid for Vidalia onions. Finally, this was the first year at this site trying to grow organic onions and research has shown that land in transition to organic production often sees substantial reductions in yield that is often recovered once the site has been in organic production for a period of years.

<u>Literature Cited</u>

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Table 1. Comparison of conventional to organic Vidalia onion production.

Variety	Field Yield (50 lb bags/acre)	Cured Yield (50 lb bags/acre	Jumbo (>3 in.) (50 lbs bags/acre)	Medium (<2 in.) (50 lb bags/acre)

Conventional	811	749	630	45
Organic	367	343	204	82

Opportunities and Challenges in Organic Vegetable Production

Jeanine M. Davis
Department of Horticultural Science, North Carolina State University
Mountain Horticultural Crops Research and Extension Center
455 Research Drive, Fletcher, NC 28732

The organic industry is growing at a phenomenal rate. Retail sales are projected to reach $9.35 billion this year, up from $6 billion in 2000. According to a recent survey, 82% of shoppers said they bought organically grown vegetables in the six months before the survey. A 1999 survey in North Carolina revealed that produce buyers import more than 90% of the organic products they sell; even though many of those products can be grown in North Carolina. The buyers said that they would prefer to buy local produce when it is available. These figures give producers the impression that growing organic produce is almost guaranteed to be profitable!

For many growers organic production is profitable, but it is not easy money. An organic grower needs to be an above average manager. Organic production requires that detailed records be kept on all aspects of production for certification purposes. An organic grower must make long-range plans for the entire farm to accommodate crop rotations, soil building practices, and cover cropping. Organic growers must be keen observers of the weather, plants, and insects. And contrary to popular belief, an organic grower must spend just as much time marketing as a conventional grower.

Opportunities:

Organic produce sells for more than conventional produce because, for most items, demand far exceeds supply. This price premium makes the transition into organics fairly painless for many growers. The demand for locally-grown organic produce is also rising rapidly. Because of food safety and security concerns, consumers want to know who grows their food. Another "local" opportunity that has hardly been touched is that of organically grown, regional favorites such as pole beans, greens, and sweet potatoes.

Challenges:

Most organic vegetable growers in the Southeast will say that their biggest challenge is weed control. Conventional growers don't realize just how big a problem weeds can be without herbicides! Marketing will become a greater challenge for organic growers in the coming years. As more growers transition to organics, the market will stabilize, competition will build, and prices will drop. Organic vegetable growers will have to constantly work to improve efficiency in production and maintain product quality to stay competitive.

Citations

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Composting

Dr. Wayne McLaurin
Department of Horticulture
University of Georgia
Athens, GA 30602

The latest standards for organic production for using composting will be discussed. Compost utilization and application rates for differing Georgia soils will be covered. Also, adapting inorganic soil test recommendations into useable organic products will be discussed.

Session #4

Food Safety Certification

Moderator: David Curry

The Good Agricultural Practices Program For Fruits and Vegetables

Terry Hollifield
Executive Director
Georgia Crop Improvement Association
2425 S. Milledge Ave.
Athens, Georgia 30605
706-542-2351

Food safety is a constant concern of consumers, producers, wholesalers, retailers and those agencies responsible for the consumer s health. Consumers in the United States have benefitted by the diligent efforts of federal and state food safety programs. However, recent outbreaks of food born illness and the perception that imported fruit and vegetables may not be properly inspected for safety has created an awareness for additional food safety programs.

The goal of The Good Agricultural Practices Program for Fruits and Vegetables (GAP) is to provide consumers with food produced and packed to minimize microbial contamination. Additional objectives of the program are:

To minimize or eliminate damaging practices to the environment

Protect worker health

Educate consumers and producers

The GAP program is a joint effort of the Georgia Crop Improvement Association, the Georgia Fruit and Vegetable Growers Association, the Georgia Department of Agriculture, and the University of Georgia Departments of Food Science and Horticulture. Each agency or association has a unique responsibility to the program.

The Georgia Crop Improvement Association (GCIA) is responsible for the inspections of production sites and packaging facilities and auditing records.

The Georgia Fruit and Vegetable Growers Association (GFVGA) is responsible for promoting the GAP program to consumers, wholesale and retail buyers, establishing fees for the program, receiving applications, and publishing a list of GAP participants.

The Georgia Department of Agriculture is responsible for collecting target samples of fruit and vegetables and testing for residual pesticides

The University of Georgia Departments of Food Science and Horticulture has the responsibility to provide technical assistance to the GAP program, train producers, county agents, etc. in the implementation of Good Agricultural Practices.

Developing an Effective Farm Food Safety Plan

Darbie M. Granberry[1] and William C. Hurst[2]
Department of Horticulture
University of Georgia

Major wholesalers and retailers continue to insist that growers and packers utilize prudent practices in the growing, harvesting, handling and shipping of fresh produce to minimize food safety hazards (microbiological, chemical or physical properties that cause a food product to be unsafe for human consumption). Growers and packers in the United States maintain that we already have one of the safest food supplies of any country in the world and most consumers agree.

Considering the quantity of fresh produce consumed in the U.S., the occurrences of foodborne illnesses caused by microbial contamination is relatively low. However, that is little consolation to someone who has a family member suffer serious illness or die from eating contaminated produce. Nutritionists, other health professionals, the U.S. Dietary Guidelines, the Food Guide Pyramid and the National Cancer Institute's Five a Day Program, all promote increased consumption of fruits and vegetables. This has helped foster acceptance of the notion that produce is inherently "good for you." That such a product could cause serious illness or death, is generally perceived as unacceptable.

No one would knowingly grow/pack/ship produce that is contaminated and unsafe for consumption. Furthermore, most growers and packers can not afford the tremendous costs and economic losses incurred from an outbreak caused by microbial contamination at their farm or packing house. To help ensure a safe food supply and to reduce the likelihood of litigation, exercising all "due diligence" is critical. An essential element in demonstrating due diligence is the implementation of an effective on-farm food safety program. A good food safety program, based on a sound food safety plan, is crucial to minimizing the possibility of accidental contamination of produce with human pathogens.

A "food safety plan" is a written policy giving in detail the procedures and practices that are to be used to help insure produce safety. Although many food safety principles can be somewhat generalized, an effective food safety plan must address specific commodities and the production, harvesting, packing and transportation practices associated with those commodities. Also, each plan must clearly address the essential elements of the specific production, packing, and/or shipping operation for which it is written.

A good farm food safety plan must include recognized practices that realistically reduce the potential for microbial contamination of fresh produce. The FDA-USDA food safety publication *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables* categorizes these practices into Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs). *Food Safety Begins on the Farm: A Grower's Guide* further defines GAPs as good agricultural practices used on the farm to reduce microbial risks and GMPs as good manufacturing practices used in packing facilities to reduce microbial risks.

GAPs and GMPs in an effective farm food safety plan must be based on established principles of microbial food safety related to the growing, harvesting, packing and transporting of fresh produce. The *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables* lists eight basic principles that should be considered in developing a farm food safety plan.

Basic Principles of Farm Food Safety

(1) Prevention of microbial contamination is favored over reliance on corrective action after contamination has occurred.

(2) To minimize microbial food safety hazards in fresh produce, growers, packers, and shippers should use Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs).

(3) Fresh produce can become microbiologically contaminated at any point along the farm-to-table food chain. The major sources of microbial contamination are associated with human or animal feces.

(4) Whenever water comes in contact with produce, its quality dictates the potential for contamination. GAPs and GMPs should minimize the potential for microbial contamination from water.

(5) The use of animal manure or municipal biosolid wastes should be managed closely to minimize their potential for microbial contamination of produce.

(6) Good worker hygiene and proper sanitation practices should be used during production, harvesting, sorting, packing and transport to minimize the potential for microbial contamination.

(7) All applicable local, state, and federal laws and regulations must be followed in the production, harvesting, sorting, packing and transporting of fresh produce.

(8) Accountability at all levels (farm, packing facility, distribution facility and transportation system) is essential to a successful food safety program. There must be qualified personnel and effective monitoring to ensure that all elements function correctly and that produce can be effectively "traced-back" through the distribution channels to the producer.

An effective farm food safety plan must include GAPs and GMPs based on basic principles of farm food safety and related Standard Operating Procedures (SOPs). For example, a common GMP for a packing line is – Clean Packing Line Daily To Reduce Microbial Cross-Contamination. The standard operating procedure that is to be used to clean the line daily, the SOP, must also be an integral component of the plan. This particular SOP should clearly define, in proper sequence, the procedures to follow and the tools/materials to be used to clean the packing line daily. As a rule of thumb, GAPs and GMPs define WHAT should be done and SOPs describe HOW it should be done.

An effective on-farm food safety program must adhere to a scientifically sound, clearly written, easily understood farm food safety plan and adherence to the plan should be confirmed periodically (every six-to-twelve months) by farm food safety audits. Considering the current emphasis on on-farm food safety and the ever increasing demands from buyers for food safety assurance, every produce farmer/packer should develop and implement a good food safety plan and, maintain on file, farm audit records documenting adherence to the plan.

Session #5

Emerging
and Re-emerging Crops and Technologies

Moderator: Ben Tucker

Prevention of Terrorist Contamination of Fresh Produce

William C. Hurst, Ph.D., Extension Food Scientist
and Darbie Granberry, Ph.D., Extension Horticulturist

In light of the recent anthrax attacks, there is widespread concern that the nation's food supply is a potential target for terrorists. Particularly vulnerable are fresh fruits and vegetables, which are eaten raw and subject to little inspection and cleaning. To protect Georgia's fresh produce from incidental contamination with harmful microbial or chemical agents, the University of Georgia has an effective "on-farm food safety" educational program in place. This program provides county extension agents, produce growers, packers and shippers with the knowledge and skills needed to protect fresh produce from unintentional contamination. However, guessing when and where terrorist attacks could sabotage produce with a microbial or chemical agent is a threat that must be addressed by preventive measures.

What can Georgia growers, packers and shippers of fresh produce do? Each grower or packing/shipping company must evaluate its unique situation, on a case-by-case basis, to determine where it is most at risk. Some specific recommendations to consider in putting together a food security plan, are as follows:

1. Facility and personnel security is a must, with background checks on your employees, if possible. There should be no access to finished products by any unauthorized personnel.

2. Know who is delivering raw product and who is transporting your finished product. What security precautions are they taking to protect the product?

3. Develop an anti-tampering plan, if one doesn't exist in your operation.

4. Evaluate or re-evaluate your GAPs (Good Agricultural Practices), GMPs (Good Manufacturing Practices), and other food safety plans to confirm that they ensure the integrity of raw materials, as well as washing, packing, storage and transportation activities.

5. Develop and test by mock recall your product's traceability to customers and consumers.

6. Enhance employee preparedness with training and drills.

7. Develop a crisis management plan and procedures for handling unforeseen incidents.

8. Keep hazardous materials under lock and key, with limited worker access.

By developing, implementing and monitoring a food security plan, the business owner can reduce the risk of contamination, whether accidental or intentional, to their product.

Commercial Pumpkin Production in Georgia

William Terry Kelley
Department of Horticulture
University of Georgia
P O Box 1209
Tifton, GA 31793

Georgia is a net importer of pumpkins-meaning there are more sold in the state than are grown here. Pumpkin acreage in Georgia has been fairly steady over the past five to seven years with about 300-400 acres produced annually in the state. Primary production is in the northern part of the state. Disease and insect problems have prevented pumpkin production in the southern portion of Georgia except where stringent disease and insect control programs are provided.

Recent technological developments in chemical pesticides and in varietal resistance have opened up some options for growers throughout Georgia regarding pumpkin production. The impending release of virus-resistant lines and the labeling of some new insecticides have expanded the options for control of viruses and silverleaf. These are the most difficult problems in production of pumpkins in south Georgia and have also become an increasing problem in north Georgia.

Pumpkin prices can vary widely as with most any other vegetable crop. The primary marketing method in Georgia is through retail sales, although there have been more wholesale pumpkins produced in the last two years. Adding value through retail marketing or through entertainment farming has been one method to sustain profits in Georgia pumpkins. Demand for pumpkins continues to grow as the public has an increasing interest in fall decorations and harvest displays. Primary producers of pumpkins in the Unites States include Ohio, Tennessee and Indiana. Many of the pumpkins sold in Georgia come from these states.

Other than the disease and insect problems, pumpkins are not extraordinarily difficult to produce. Without the new technologies, high-pressure oil sprays are needed for virus and silverleaf control in south Georgia. This can become expensive. The new technologies have the potential to reduce production costs.

Pumpkins are in the same family as squash, cucumbers and gourds. Often, gourd production is a good companion to pumpkins since they are marketed in much the same way. Pumpkins come in a variety of sizes and shapes. The primary outlet is still the jack-o-lantern market, although the miniature pumpkins are quite popular. There is also a market for a limited number of giant pumpkins.

Fertilizer management is very similar to squash. Plant spacing will differ according to vine type. Vining types require much more space than bush types. Irrigation is required to ensure successful production. Pumpkins must be planted so that they can be harvested beginning at about the middle of September to the first of October. Pumpkins do not store well and must be harvested close to the time for marketing. Planting dates will range from May in the north to July in the south.

Numerous varieties have been shown to perform well in north Georgia and many of these same varieties will work under the proper production methods in south Georgia. Pumpkins can work as a minimum tilled crop with the right equipment. Weed control is a challenge where nutsedge is present. Small-seeded broadleaf weeds and grasses are usually fairly easy controlled under standard cultural practices with the proper herbicides.

Insect and disease problems other than the ones previously mentioned can usually be managed with effective fungicides and insecticides. Nematodes are a problem for pumpkins and fumigation would be required where they are present.

Pumpkins can be grown on plastic mulch with drip irrigation. This provides an effective production combination especially for the early planted pumpkins in north Georgia. In the south, there could be some benefit to using plasticulture, however, in either case it would most economically be accomplished when the pumpkins are planted as a second crop on previously used plastic.

Session #6

Tactics for Control of Tomato Spotted Wilt Virus

Moderator: Keith Rucker

Role of Weeds as Sources for Spread of Tomato Spotted Wilt Virus

George G. Kennedy
Department of Entomology
North Carolina State University
Box 7630, Raleigh, NC 27695-7630
george_kennedy@ncsu.edu

Tomato spotted wilt virus (TSWV) now occurs consistently throughout the pepper and tomato production areas of North Carolina and Georgia, where it commonly infects 20% or more of the plants in individual fields. The tobacco thrips, Frankliniella fusca, is the principal vector responsible for spread of TSWV into susceptible crops in NC, although the western flower thrips, F. occidentalis, is locally important at times. Although TSWV is spread by adult thrips, it must be acquired by first instar thrips feeding on infected host plants. Wild plant species are important

In a field experiment conducted near Kinston, NC, common chickweed (Stellaria media) plants infected with TSWV in October remained infected until they senesced in late May and June of the following year. Beginning in March and continuing into June, TSWV spread from the infected chickweed into surrounding plots of uninfected buttercup (Runuculus sardous). The incidence of TSWV-infected buttercup plants was 0% in February, 1% in March, 14% in April, and 42% in June.

Weed surveys in North Carolina over 2 years, at locations having a history TSWV, characterized the incidence of TSWV and the populations of immature TSWV vectors on differed dramatically in their ability to support populations of immature vectors and the frequency common weed species to serve as sources for spread of TSWV based on the following information for each species: percentage of sites in which at least one infected plant was found; percentage of plants infected across all sites; and proportion of total F. fusca encountered in the survey that occurred on the weed species in question. The results indicate that the potential of each weed species to serve as a source for spread of TSWV in the spring could be readily classified as High, Moderate, or Low. Weed species in each category are: High - dandelion, sowthistle, smallflower buttercup, Rugel's plantain, mouseear chickweed, and common chickweed; Moderate - prickly lettuce, and purple cudweed; Low - Curly dock, oldfield toadflax, swine cress, wild radish, henbit, ribgrass (Plantago lanceolata), horseweed, white clover, and cutleaf evening primrose. The relative importance of individual weed species and any given location will be determined by its abundance as well as its susceptibility to infection and ability to support reproducing populations of vectors. A number of other weed species included in the survey were not found to be infected with TSWV or did not support reproducing populations of vectors.

Insecticide Strategies for TSWV

David Riley
University of Georgia
P.O. Box 748
Department of Entomology
Coastal Plain Experiment Station
Tifton, GA 31793

Based on GA Cooperative Extension estimates for 2000, the tomato crop in Georgia is planted on 6,206 acres and has an estimated annual value of $83 million with an estimated $2.5 million spent on pesticide costs annually. Tomatoes are affected by various insect pests, including various armyworms, tomato fruit worm, tobacco hornworm, stinkbugs, aphids, whiteflies, thrips, and others, but the most severe constraint to production is currently thrips-vectored tomato spotted wilt virus (TSWV). The thrips species primarily responsible for spreading the virus in tomatoes are *Frankliniella occidentalis* and *F. fusca*, and recent work on thrips feeding suggests that *F. fusca*, tobacco thrips, may be more important in early season transmission of the virus which could lead to greater yield loss. Thrips-vectored TSWV and thrips vectors can have tremendous negative impact on yield of tomatoes and reduce quality through irregular ripening. The current recommended management program that has been developed in recent years consists of early season insecticides, silver reflective plastic mulch, and the use of resistant cultivars, e.g. BHN444 or BHN555, where the incidence of TSWV has been high. The perceived risk to tomato production is still high, but tactics are available to reduce this risk. The source of TSWV prior to the tomato season (e.g. weed hosts) is still not clearly understood.

A thrips vector control program has been developed for tomatoes that offers short-term benefits to tomato growers in TSWV-affected production areas. 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 and kill thrips before they can feed. Imidacloprid (Admire) is a systemic insecticide that has been shown to reduce thrips feeding enough to prevent visible feeding scars for days after the thrips are introduced to the treated leaf tissue. In addition, lambda-cyhalothrin plus methamidophos (Warrior plus Monitor) and spinosad (Spintor) have been shown effective in killing Frankliniella spp. 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 at least four weeks. 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. Insecticide resistance will be the major drawback of this tactic in the near future if excessive calendar treatments are continued commercially. For this reason, an early season treatment program that incorporates insecticide rotation is currently recommended with different treatments between early and late season to avoid consecutive selection pressure.

Appearance of Symptoms of TSWV in Tomato as Affected by Colored Plastic Film Mulches

Juan C. Díaz-Pérez
Department of Horticulture
Coastal Plain Experiment Station
University of Georgia
P.O. Box 748
Tifton, Georgia 31793
jcdiaz@tifton.cpes.peachnet.edu

Tomato spotted wilt is one of the most important diseases in tomato and pepper in Georgia. Annual losses due to spotted wilt in tomato, pepper, peanut and tobacco exceed $100 million in Georgia alone. Tomato spotted wilt disease is incited by *Tomato spotted wilt virus* (TSWV) and is transmitted by several species of thrips, of which western flower thrips is the predominant vector (Cho et al., 1998). The use of pesticides to control thrips is usually ineffective for management of TSWV (Brown et al., 1989; Helyer and Brobyn, 1992; Cho et al., 1998).

As a complement to chemical control, cultural control measures such as the use of silver reflective mulches may be considered as part of a TSWV management strategy (Brown et al., 1989). Plastic film mulches have been found to affect the populations of thrips and other insect vectors (Csizinszky et al., 1995; Farias-Larios and Orozco-Santos, 1997; Schalk et al., 1979). Recent reports indicate that silver mulch in combination with intensive insecticide applications and resistant cultivars reduces thrips populations and TSWV incidence in tomato (Riley and Pappu, 2000).

Plants infected at early stages of development show severe TSWV symptoms and may die (Francki and Hatta, 1981). However, it is unclear how TSWV affects plant growth and yield as plants develop. Our results indicate that plant growth and fruit yield (total and marketable) were directly proportional to the time of appearance of TSWV symptoms. There was increasing reduction of plant weight and fruit yield with increasingly earlier expression of TSWV symptoms during tomato plant development. Tomato fruit yield was reduced even when plants showed symptoms late in plant development. Relative to plants free from TSWV symptoms, fruit yield decreased about 2.5 % for each day prior to harvest that plants exhibited TSWV symptoms.

In conclusion, delayed appearance of symptoms of TSWV results in higher tomato yields. Use of TSWV-resistant cultivars and utilization of colored mulches may be useful in the management of tomato spotted wilt disease.

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Session #7

Sandea-A Potential New Herbicide for Use in Several Cucurbit and Fruiting Vegetables

Moderator: Mr. Brad Mitchell

Historical Background on Sandea™ and the Gowan Company

Kenneth R. Muzyk
Development Representative
Gowan Company
408 Larrie Ellen Way
Brandon, Florida 33511
kmuzyk@gowanco.com

The Gowan Company was established in 1963 and is headquartered in Yuma, Arizona. Gowan is a marketer/registrant of crop protection products in the U.S., Mexico and Internationally. The product line consists of over twenty-five products including Imidan, Prefar®, Savey®, Botran® and Sandea™**.**

Gowan has the exclusive rights to develop and market Sandea in the U.S. vegetable market. Sandea, common name halosulfuron-methyl, is formulated as a 75%DF and carries a caution label. Sandea can be applied either preemergence or postemergence, depending on the conditions, and provides excellent nutsedge and selected broadleaf weed control. Currently Sandea has 24(c) registrations for use in cucumbers & winter squash and expects tolerances soon in fruiting vegetables, melons and asparagus. Sandea will be an important part of the methyl bromide replacement strategy in vegetables.

Botran® is a registered trademark of Gowan Company L.L.C.

Prefar® is a registered trademark of Syngenta Crop Protection Inc.

Sandea™ is a trademark of Gowan Company L.L.C.

Savey® is a registered trademark of Nippon Soda

Weed Control and Watermelon Tolerance to Sandea

Ken Lewis and A. Stanley Culpepper
Cooperative Extension Service, 110 West 13th Ave., Cordele, GA 31015
Cooperative Extension Service, PO Box 1209, 15 RDC Road, Tifton, GA 31793

Seven herbicides are recommended for use in watermelon by the Georgia Cooperative Extension Service. Of these herbicide options, none have any effect on nutsedge (*Cyperus* sp.). Nutsedge can be particularly troublesome in plasticulture production systems as it will emerge though the plastic. Cultivation is an effective tool in managing nutsedge but has limited application as it can only be utilized between beds in plasticulture systems and while runners are relatively short. Pigweed (*Amaranth* sp.) is another troublesome species for watermelon growers. While currently recommended herbicides will offer effective control, pigweed continues to be a major problem for farmers in the Central Georgia area.

Sandea (halosulfuron) gives acceptable levels of control of yellow nutsedge, purple nutsedge and pigweeds. Investigations were initiated in 1999 to evaluate the effectiveness of Sandea as a watermelon herbicide. Field studies were conducted near Cordele, Vidalia and Attapulgus, Georgia. Watermelons were grown according to normal bare ground production practices with melons being direct seeded. Sandea was applied at 0.5, 0.75 and 1.0 oz product per acre. Application timings included preemergence, early post-emergence (1 to 2 leaf), and late post-emergence (12 to 15 inch runners) treatments. The treatments were arranged factorially and experimental design was a randomized complete block design with each block replicated 3 or 4 times. Observations were made over a 3 year period from 1999 until 2001. Injury ratings , weed control ratings and final yields were recorded for studies in 2000 and 2001.

Sandea applied preemergence resulted in minimal injury. Minor stunting (less than 5%) was noted in one test at the 0.5 and 0.75 oz product/acre rates. Treatments receiving 1 oz/acre resulted in minor stunting in all trials. Four to 17% reduced growth, as compared to the untreated check, was noted soon after emergence. Injury symptoms persisted for less than 5 days.

Sandea was noted to cause yellowing and stunting when applied post-emergence. The severity of symptoms was related to plant age at application. Symptoms were the most severe on younger plants. Applications during the 1 to 2 leaf stage resulted in damage ratings of 38 to 77% approximately 7 days after application. Injury symptoms persisted for 3 to 4 weeks. Applications during the 12 to 15 inch runner stage resulted in damage ratings of 9 to 32% seven days after application. Injury symptoms persisted for 2 to 3 weeks.

Weed-free yield data is available for the 2001 season at one location. Preemergence applications of Sandea resulted in a slight decrease in early harvest but did not result in any significant total yield differences from untreated, weed-free checks. Applications at the 1-2 leaf stage resulted in early yield decreases of 84 to 95% with total yield decreases of 26 to 35%. Applications during the 12 to 15 inch runner stage resulted in early yield reductions of 89 to 95% with total yield decreases of 12 to 44%.

Purple Nutsedge Control and Cucumber Tolerance to Sandea (Halosulfuron)

Ginger K. Perdue
Long County Cooperative Extension Service
PO Box 549
Ludowici, GA 31316
perdue@uga.edu

A. Stanley Culpepper
Extension Agronomist - Weed Science

PO Box 1209
Tifton, GA 3193

Vegetable production in the northern part of Long County is hampered by severe purple nutsedge infestations. This difficult to control weed reduces yields, raises input costs and limits conversion to water efficient plasticulture systems of vegetable production. A herbicide experiment was conducted at Daniel Dreggors Farm. Our objectives were to determine the most effective and economical use rate of Sandea on nutsedge and to determine the optimum application timing for Sandea in cucumber.

Daytona cucumbers were planted with conventional tillage on a 38 inch row spacing in the fall of 2001. Plots were two rows by 25 feet. The trial was a randomized complete block with treatments replicated four times. Treatments included Sandea (0.5, 0.75, or 1 oz/A) applied preemergence, applied topically to 1- to 3-leaf cucumber, or applied topically to cucumber with 14 inch runners. Three additional treatments included a non-treated control, Sandea at 0.5 oz/A applied PRE followed by an additional application when cucumber had 1- to 3-leaves, and Sandea at 0.5 oz/A applied when cucumber had 1- to 3-leaves followed by an additional application when cucumber had 14 inch runners. Crop tolerance, purple nutsedge control, and cucumber yield were measured.

No herbicide treatment injured cucumber greater than 16% throughout the season. Sandea applied PRE at 0.5 or 0.75 oz/A only suppressed nutsedge (51 to 74% at 12 days after treatment). Increasing the rate of Sandea to 1 oz/A when making preemergence applications improved control to 81% at 12 days after treatment but control was not sustained as control was only 56% by 4 weeks after treatment. Postemergence applications of Sandea were more effective. When applied to 1- to 3- inch cucumber (approximately 2 weeks after planting), late-season control ranged from 81 to 92%. Delaying the application of Sandea until cucumber runners were 14 inches was unacceptable as early-season nutsedge competition to cucumbers was tremendous. Sequential applications of Sandea provided 88% purple nutsedge control by late-season.

Yields followed similar trends noted with purple nutsedge control. Greatest yields tended to be observed with sequential applications of Sandea, with Sandea (at any rate) applied to 1- to 3- inch cucumber, and with 1 oz of Sandea applied preemergence.

Weed Control and Cantaloupe Tolerance to Sandea®

W. C. Johnson, III
Research Agronomist - Weed Science
USDA-ARS
Coastal Plain Experiment Station
P. O. Box 748
Tifton, GA 31793
cjohnson@tifton.cpes.peachnet.edu

Studies were conducted from 1998 to 2001 at the Coastal Plain Experiment Station Ponder Farm in Tifton, GA on weed management systems in transplanted cantaloupe on polyethylene covered seedbeds. Soil fumigants were Vapam HL® (80 gal./A) and a nonfumigated control. Herbicide treatments were Curbit® (0.75 lb ai/A) PRE, Curbit® plus Sandea® (0.032 lb ai/A) PRE, Curbit® PRE followed by Roundup Ultra® (1.0 lb ai/A) POST-SHIELDED, Curbit® plus Sandea® PRE followed by Roundup Ultra® POST-SHIELDED, and a nontreated control. PRE herbicides were directed to row middles not covered in polyethylene, with none contacting cucurbit transplants. Roundup Ultra® was applied to row middles using a hooded sprayer, just prior to vine running. Overall weed control was not improved with soil fumigation in cantaloupe and there was no yield response. Herbicide systems that included Sandea® PRE or Roundup Ultra® applied with a hooded sprayer improved control of yellow nutsedge and several broadleaf weed species.

Complimentary trials were conducted at the Ponder Farm in 2000 and 2001 to study the effects of herbicide placement on weed control and transplanted cantaloupe injury. Herbicides evaluated were Sandea® (0.032 lb ai/A), Command® (0.5 lb ai/A), Spartan® (0.125 lb ai/A and 0.25 lb ai/A), and a nontreated control. Herbicide placements evaluated were surface applied under the polyethylene tarp before transplanting, over-the-top after transplanting, and semi-directed after transplanting. Semi-directed after transplanting applications were made using TeeJet® OC-03 spray tips onto the shoulders of polyethylene covered seedbeds and into the row middles, without direct contact with cantaloupe transplants. Across all herbicide treatments, semi-directed applications were the least injurious to cantaloupe and applications under the polyethylene tarp most injurious. In general, Spartan® (0.25 lb ai/A) was the most injurious herbicide and Sandea® the least injurious, regardless of herbicide placement. Sandea® effectively controlled many broadleaf weeds and yellow nutsedge, regardless of placement.

Squash Tolerance to Sandea and Applying Sandea through Drip Tape

Theodore M. Webster
Crop Protection and Management Research Unit
USDA-Agricultural Research Service
Tifton, GA
Twebster@tifton.cpes.peachnet.edu

County Extension Agents in Georgia ranked nutsedges as the most troublesome weeds in vegetables (Webster and MacDonald 2001). Sandea® (common name halosulfuron) has potential as a herbicide in several vegetable crops, including some cucurbits. Greenhouse and field studies were conducted from 1999 to 2001 to evaluate 1) potential injury of Sandea® to squash, 2) the relation between application method and squash injury, and 3) the level of nutsedge control that can be expected from Sandea® applied PRE and through the drip tape.

Greenhouse studies revealed that Sandea® can cause significant early season injury to squash (up to 35%). When applied PRE to direct seeded squash, injury increased with rate of Sandea®. Squash injury did occur when Sandea® was applied to transplants (12-17%), but there were no differences among application method (PRE vs. POST) or Sandea® rate (up to 0.75 oz/A). There did not appear to be any consistent trends among squash types; six cultivars were tested, including three zucchini (z), two yellow crookneck (cn), and a yellow straightneck (sn). There were no differences in crop injury between direct seeded and transplants of 'Dixie'(cn) and 'Senator'(z). All other hybrids, 'Lemondrop'(sn), 'Spineless Beauty'(z), 'Supersett'(cn), and 'Tigress'(z), had lower crop injury from halosulfuron when applied to transplants, relative to direct seeded plants.

Field studies in 2000 and 2001 found there to be no difference in crop or weed response to Sandea® application method (PRE vs. drip tape). However, relative to Sandea® PRE, Sandea® applied through the drip tape had numerically higher crop yields (neither were different from the nontreated control) and numerically lower nutsedge populations at the conclusion of the season (both were lower than the nontreated control). Included in this study were two nontreated controls, one with and one without black plastic mulch. Early season nutsedge counts revealed that the nontreated control with the black plastic mulch had 80% fewer nutsedge shoots than the nontreated control without black plastic mulch.

Fall applications of Sandea® at high rates were found to reduce nutsedge shoot populations that emerged the following spring. Sandea® was applied to actively growing purple nutsedge populations in November at 1, 2, 4, and 8 oz/A. The number of nutsedge shoots at the time of crop planting in April was reduced, relative to the nontreated control, 48, 85, 91, and 98% from 1, 2, 4, and 8 oz/A of Sandea®, respectively. Cumulative squash yields from 12 harvest between May and July indicated no injury, relative to the nontreated control, from 1, 2, or 4 oz/A of Sandea®. The highest rate tested, Sandea® 8 oz/A, did reduce squash yields relative to 1 and 2 oz/A. Caution: results are very preliminary and application of Sandea® in the fall is not registered.

Tolerance of Staked Tomatoes Grown on Plastic Mulch to Sandea (Halosulfuron)

Hudgins, J. E.[1], A. S. Culpepper[2], L. M. May[1],and D. E. McGriff[1]
[1]Decatur County Cooperative Extension Service, University of Georgia, Bainbridge, GA 31717
[2]University of Georgia, Tifton, GA 31793

Methyl bromide is currently the fumigant of choice for production of staked tomatoes on plastic mulch for control of weeds, nematodes and soilborne diseases. Methyl bromide has been targeted as a culprit in the depletion of the atmosphere ozone layer. As a result, the use of methyl bromide is being phased out. Under the current protocol, growers experienced a 25% reduction in methyl bromide use in 1999 and an additional 25% reduction in 2001. By 2005, methyl bromide will no longer be available for use in the U. S.

The soil fumigant Telone C35 has potential as a replacement for methyl bromide. Telone C35 provides good control of nematodes and soilborne diseases. Weed control has been variable and is often inadequate especially for yellow and purple nutsedge. Sandea has excellent activity on both yellow and purple nutsedge.

Three randomized complete block tests with four reps per treatment were conducted in 2000 and 2001 to evaluate the tolerance of staked tomatoes grown on plastic mulch to Sandea. Post-emergence, over-the-top applications of Sandea were applied to tomatoes previously treated with Telone C35 or methyl bromide. Post emergence treatments were applied at the vegetative (2 test) and reproductive (1 test) stage of growth at a rate of 0.5 and 1.0 ounce per acre. Plots were visually rated for plant phytotoxic response and yield data was collected.

Tomato plants exhibited excellent visual tolerance to both rates of Sandea.Visual phytotoxic responses were not discernable at any stage of plant growth after application. Total tomato yields were not significantly different (P= .05) with Telone C35 or methyl bromide alone or followed by either rate of Sandea applied post-emergence over-the-top. Data indicates tomato plants have excellent tolerance to Sandea. IR4 label for use of Sandea on tomatoes in Georgia has been requested.

Pepper Response to Sandea (Halosulfuron) Applied under Plastic, Precision-directed, and Topically

A. Stanley Culpepper
University of Georgia, Tifton, 31793

Each year, over 45 million pounds of methyl bromide are applied as a soil fumigant before planting over 100 crops. Methyl bromide controls most weeds, nematodes, and pathogens. With the certain loss of methyl bromide, pepper production is threatened. To date, there is no single alternative fumigant or labeled herbicide that can substitute for methyl bromide in controlling weeds, especially nutsedge species, in pepper. Sandea, a very efficacious nutsedge herbicide, is in the developmental stages for several cucurbit and fruiting vegetable crops. This experiment was conducted to evaluate the potential use of Sandea in pepper grown on plastic.

A field experiment was established on farm in the spring of 2001 near Tifton, GA. The experimental design was a randomized complete block with each block replicated four times. Five herbicide programs were evaluated including Sandea (0.5, 0.75, or 1 oz/A) applied just prior to laying plastic, Sandea (0.5 oz/A) applied topically to pepper, and Sandea (0.5 oz/A) precision-directed to pepper. The precision-directed application was applied with spray reaching no higher than the bottom 3 inches of 12 inch plants. A non-treated control was included and Telone C-35 was applied over the entire trial. Injury ratings were taken throughout the season and pepper (large and jumbo size) was harvested three times.

Applying Sandea under plastic stunted pepper growth 19 to 44% at 7 weeks after transplanting (Table 1). Pepper was more tolerant to Sandea applied under plastic than applied topically (63% stunting with chlorosis). Precision-directed applications caused less stunting that topical applications but injury was still severe at 36%.

Pepper yield followed similar trends noted by visual injury ratings. Sandea (0.5 to 0.75 oz/A) applied under plastic or Sandea (0.5 oz/A) precision-directed to pepper did not affect fruit number or weight compared to the non-treated control at the first harvest (Table 1). However, reductions in fruit number and weight were noted when Sandea at 1 oz/A was applied under plastic and when Sandea at 0.5 oz/A was applied topically. By seasons end, Sandea applied overtop of pepper was the only herbicide system reducing total fruit number and weight.

Sandea will not be labeled for topical application to pepper. Significant pepper injury from the directed application and applications under plastic is of great concern and additional work must be done before deciding the fate of Sandea for these use patterns.

Table 1. Pepper response to Sandea applied under plastic, precision-directed, and topically.

Treatment/rate	Application method	Stunting (%)	1st harvest (lbs/acre)	Total harvest (lbs/acre)
Sandea 0.5 oz/A	under plastic	18.8 b	8228 a	22748 a
Sandea 0.75 oz/A	under plastic	18.8 b	9196 a	21780 a
Sandea 1.0 oz/A	under plastic	43.8 c	5808 b	22264 a
Sandea 0.5 oz/A	precision-directed	36.3 c	9196 a	22748 a
Sandea 0.5 oz/A	overtop of pepper	62.5 d	3872 b	15488 b
Non-treated	none	0 a	9801 a	26445 a

Eggplant Response to Topical and Precision-directed Applications of Sandea (Halosulfuron)

J. T. Flanders, Grady County Cooperative Extension, University of Georgia, Cairo, GA
A. S. Culpepper, University of Georgia, Tifton, GA

Each year, over 45 million pounds of methyl bromide are applied as a soil fumigant before planting over 100 crops. Methyl bromide controls most weeds, nematodes, and pathogens. With the certain loss of methyl bromide, eggplant production is threatened. To date, there is no single alternative fumigant or labeled herbicide that can substitute for methyl bromide in controlling weeds, especially nutsedge species, in eggplant. Sandea, a very efficacious nutsedge herbicide, is in the developmental stages for several cucurbit and fruiting vegetable crops. This experiment was conducted to evaluate the potential use of Sandea in eggplant grown on plastic.

A field experiment was conducted on farm in Grady County, Georgia during the spring of 2001 to determine the tolerance of eggplant to Sandea. The experiment was a randomized complete block design with each block replicated four times. Treatments included Sandea applied at 0.5 and 1.0 oz/A topically and precision-directed to eggplant. Precision-directed treatments were applied with spray contacting no higher than 25% up the plant. All treatments included a non-ionic surfactant at 0.25% by volume. Percent visual stunting was estimated seven and twelve days after treatment.

All herbicide treatments significantly (P = 0.05) reduced plant growth compared to the non-treated control (Table 1). Sandea applied topically stunted eggplant 51 to 66% at twelve days after treatment. Less stunting was noted with the precision-directed treatment but reduction in plant growth was still 21 to 29% and unacceptable. Further research is needed to determine eggplant tolerance to Sandea when applied to the soil surface between bed forming and plastic laying operations.

Table 1. Eggplant tolerance to Sandea applied topically and precision-directed

		Visual injury	
Treatment/rate	Application method	7 d after treatment	12 d after treatment
Sandea 0.5 oz/A	topical	49 a	51 b
Sandea 1.0 oz/A	topical	54 a	66 a
Sandea 0.5 oz/A	precision-directed	17 b	21 c
Sandea 1.0 oz/A	precision-directed	24 b	29 c
Non-treated	none	0 c	0 d

Session #8

Technology Updates for Pepper, Tomatoes, etc.

Moderator: Johnny Whiddon

Evaluation of Micro Irrigation Wetting Patterns in Polyethylene Film Mulch Beds

Alex Csinos[1], James E. Laska[1], Ken Seebold[1]
CPES Department of Plant Pathology,
[1]University of Georgia
P.O. Box 748
Tifton, Georgia 31793
Joe Eger[2]
[2]Dow AgroSciences,
2606 S. Dundee Blvd.
Tampa, Fl 33629.

Introduction

As methyl bromide is phased out of agricultural use more interest will be generated in the use of micro irrigation systems to deliver plant heath products. This will be even more acute in multiple cropped plasticulture. Multiple crop use of polyethylene film mulched beds presents unique problems in pest control within the soil beds.

The research was conducted to investigate the parameters of water movement from micro irrigation drip tapes that are commonly used in the Southeast for vegetable production. The water patterns in soil beds may dictate the usefulness of the micro irrigation systems for plant health products delivery and define its delivery to the target.

Materials and Methods

This test was conducted at the University of Georgia's Coastal Plain Experiment Station, Tifton, Georgia. Soil type was a fuquay loamy sand (loamy, siliceous thermic Arenic Plinthic Paleudults, 88 % sand, 9.0% silt and 3.0% clay, 0.74 % organic water and pH 6.0). Soil beds (76 cm wide) were formed using a commercial tractor drawn bed shaper. Drip tape was installed just below the soil surface in the center of the bed as the polyethylene film mulch was applied.

Six different drip tapes were evaluated to determine the wetting pattern they produced in the soil beds. Tape specifications, pressure of operation and time of operation are outlined in table 1. Each of the treatments were allowed to operate so they each delivered 726.7 l/30.5m of bed.

A blue spray indicator dye (Hi light[R]) was injected into the system using a Milton injection pump at the beginning of the test and irrigated with water for the specified period of time. The beds were sliced open immediately below the emitter and half way between two emitters to expose the soil faces and areas encompassed by the dye, calculated using a grid scribed on a sheet of plexiglass. Four sites were excavated for each treatment of both below and between emitter, and the test was repeated three times.

Result and Discussions

Bed width covered and areas of bed cross sections encompassed by dye are presented in table 2. Maximum bed width covered on emitter was recorded for the 45.7 cm spaced emitters delivering 1.36 lph. However, that treatment had the least bed width coverage when measured between emitters. The greatest bed uniformity occurred with the 30 cm spaced emitters flowing 0.61 lph.

All of the tapes except the 10.2cm spaced emitters delivering 0.1067 lph/emitter were similar in cross sectional area of bed encompassed by the dye on the emitter. The areas encompassed by the dye between emitters were similar for all treatments except the tape with 45.7 cm spaced emitters delivering 1.36 lph, which was significantly less.

The least amount of uniformity of wetting occurred for the tapes with the 40.6 cm and 45.7 cm spaced drippers. There was a trend of uniformity to increase as the flow rate decreased and time of irrigation increased for the three 30 cm spaced dripper tapes.

The 726.7l/30.5m (192 gal/100ft) equates to about 2.9 cm of water and thus may represent the limit of water that a commercial grower may deliver through this irrigation system. Since this test was conducted on a 76 cm bed even the best scenarios only treated about 60% of the bed. Since lateral movement of water is limited on sandy soils, the use of two tapes, or the use of narrow beds may be required to get thorough and uniform bed coverage.

Table 1. Selected drip tapes used to evaluate soil wetting patterns

Treatment Number	Dripper Spacing (cm)	Flow rate (lph/emitter)	Pressure (bar)	Irrigation Time (hrs)
1	45.7	1.36	0.83	7.9
2	40.1	0.91	0.83	10.5
3	30.5	0.60	0.83	12.0
4	30.5	0.90	0.83	7.9
5	10.2	0.40	0.69	6.0
6	30.5	1.14	0.69	6.5

(a) All tapes were operated at manufacture's recommended pressure. All treatments were operated to deliver water at 726.7l/30.5m (192 gal/100ft). One bar pressure = 14.5 psi.

Table 2. Evaluation of drip tapes for uniformity of water movement in soil beds as defined by dye injection

Treatment[1] Number	Bed width[2] covered (cm) On Emitter	Between Emitter	Difference in bed width coverage	Area of Bed cross sections cm^2 On Emitter	Between Emitter	Difference in cross section area
1	56[a]	38[c]	18	1361[a]	1006[b]	355
2	53[a]	41[bc]	12	1368[a]	1155[a]	213
3	53[a]	48[a]	5	1297[a]	1265[a]	32
4	53[ab]	46[ab]	7	1348[a]	1168[a]	180
5	48[bc]	46[ab]	2	1226[b]	1161[a]	65
6	46[c]	41[bc]	5	1316[a]	1168[a]	148

(1) Each scenario delivered water at 726.7ℓ/30.5m (192 gal/100 ft) of bed.

(2) Width's or areas reported are defined by the movement of the dye in the soil. Each mean represents four sites for each treatment repeated 3 times.

(3) Means followed by the same letter are not significantly different from each other according to Duncan's Multiple Range test (P=0.05).

Effect of Selected Fumigants on Soilborne Fungi

Kenneth W. Seebold, Jr. and Alexander S. Csinos
University of Georgia, Department of Plant Pathology
Coastal Plain Experiment Station,
Tifton GA, 31793

Introduction

The scheduled withdrawal of methyl bromide from use as an agricultural fumigant in 2005 has prompted the identification of alternative fumigants, including chloropicrin and metam sodium, that reduce diseases caused by soilborne plant-pathogenic fungi on several crops. Researchers have found that combination applications of metam sodium and chloropicrin or 1,3-dichloropropene plus chloropicrin (1,3-DC) provide good control of soilborne fungal pathogens, nematodes, and weeds in vegetables grown under plastic mulch on raised beds. These materials must be applied to raised beds 3-4 weeks prior to planting to avoid the risk of phytotoxicity; however, the optimum interval between treatment and planting for maximum suppression of fungal pathogens and weed propagules is not clear.

The purpose of this study was to evaluate the effects of metam sodium and 83% 1,3-dichloropropene plus 17% chloropicrin on the survival of *Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp., and yellow nutsedge (*Cyperus esculentus*) when applied in combination to raised, plastic-mulched plant beds, and to determine the optimum interval between application and planting for maximum suppression of these organisms.

Materials And Methods

The experiment was conducted in March and April at the Coastal Plain Experiment Station in Tifton, GA on a Fuquay loamy sand (loamy, siliceous, thermic Arenic Plinthic Paleudults). Applications of 1,3-dichloropropene (83% v/v) plus chloropicrin (17% v/v) in combination with metam sodium (42%) were made at rates of 93 l/ha and 349 l/ha, respectively, to raised beds at intervals of 4 weeks, 3 weeks, 2 weeks, and 4 days prior to transplanting of yellow crookneck squash. The materials were applied with a chisel injection rig mounted behind a rototiller with toolbar-mounted spray nozzles. This permitted chisel injection of 1,3-DC at a depth of 20 cm and simultaneous application of metam sodium to soil, followed by incorporation of the metam sodium into the upper 10-15 cm of soil. An attached bed shaper formed a 20 cm high by 76 cm wide bed. Drip tape was laid and beds were covered with black polyethylene mulch immediately after treatment. Metam sodium in combination with chloropicrin (applied at 349 l/ha and 84 l/ha, respectively), and methyl bromide (224 kg/ha) were included as comparison treatments along with an untreated control.

Treatment effects on fungal pathogens and yellow nutsedge were evaluated by placing mesh bags measuring 7.5 X 7.5 cm and containing approximately 10 nutlets of *C. esculentus* or 10 oat grains colonized with *Fusarium solani*, *Pythium irregulare*, or *Rhizoctonia solani* AG-4 into plant beds at a depth of 10 cm immediately after treatment. Untreated beds and beds treated with methyl bromide or metam sodium plus chloropicrin received these packets at 4 weeks prior to transplanting. Bags were removed immediately before transplanting of squash. Survival of yellow nutsedge was determined by counting the number of germinated, living nutlets per mesh bag. Survival of fungi was evaluated by plating the contents of mesh bags on selective media and counting the number of colonies recovered. Soil samples were also taken for each treatment and assayed on selective media for total populations of *Fusarium* spp., *Pythium* spp., and *Rhizoctonia* spp.

Results and Discussion

In general, total populations of *Rhizoctonia* spp. and *Pythium* spp. were significantly reduced by applications of 1,3-DC plus metam sodium, metam sodium plus chloropicrin, and methyl bromide when compared to the untreated control. No differences in populations were found between application intervals of 1,3-DC plus metam sodium (Table 1). Total populations of *Fusarium* spp. were reduced by all treatments except 1,3-DC plus metam sodium applied 4 weeks prior to transplanting. Lowest *Fusarium* populations were found in plots treated with 1,3-DC plus metam sodium 4 days before transplanting, or those treated with metam sodium plus chloropicrin or methyl bromide. Populations of *Fusarium* tended to increase as the interval between treatment and sampling lengthened, and could be a result of recolonization by the fungus as levels of residue decreased in soil. *Fusarium* populations in plots treated with metam sodium plus chloropicrin were similar to those in methyl bromide-treated plots; however, the rate of chloropicrin was substantially higher for this treatment than in the 1,3-DC plus metam sodium combinations.

Survival of *F. solani* and *R. solani* in soil treated with 1,3-DC plus metam sodium was greatest when colonized oat grains were exposed to the materials for 2 weeks or less (Table 2). Exposures of 3-4 weeks to 1,3-DC plus metam sodium significantly reduced survival of these pathogens as compared to the untreated checks. Metam sodium plus chloropicrin reduced survival of *F. solani*, *P. irregulare*, *R. solani*, and yellow nutsedge to 18, 0, 0, and 0% respectively. Methyl bromide appeared to have no effect on *F. solani* in this test. A similar pattern was observed for yellow nutsedge, although methyl bromide reduced survival to 2%. *Pythium irregulare* was not recovered for any treatment except the untreated control. Thus, the optimal time of exposure to 1,3-DC plus metam sodium needed to suppress fungal pathogens varies with the species being evaluated; however, longer exposure times tend to be more effective against fungal pathogens and also yellow nutsedge. Both temperature and moisture may also influence the optimum time of exposure and should be studied further.

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Table 1. Population densities of *Phthium* spp., *Rhizoctonia* spp., and *Fusarium* spp., in soil after treatment with alternatives to methyl bromide at various intervals prior to transplanting of squash

	Application		Fungal populations[c]		
Treatment[2]	Rate	Timing[b]	Fusarium	Phythium	Rhizoctonia
1,3-DC plus	93 l/ha	4 weeks	528 ab	4.0 b	0.03 b
Metam sodium 42%	349 l/ha				
1,3-DC plus	93 1/ha	2 weeks	320 bc	0 b	0 b
Metam sodium 42%	349 1/ha				
Metam sodium 42%	349 l/ha	4 weeks	16 d	6.4 b	0.05 b
plus Chloropierin	84 l/ha				
Methyl bromide 98%	224 kg/ha	4 weeks	16 d	0 b	0.08 b
Untreated check	-	-	608 a	140 a	0.5 a

Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test ($P \leq 0.05$).

[a]1,3-DC=1,3-dichloropropene (83%) plus chlorpicrin (17%); methyl bromide 98% contained 2% chloropicrin by weight.

[b]Interval between application and planting.

[c]Total populations of *Fusarium* spp., *Phythium* spp., and *Rhizoctonia* spp. expressed as the number of colony forming units per gram of soil.

Table 2. Survival of *Fusarium solani*, *Pythium irregulare*, *Rhizoctonia solani*, and yellow nutsedge in soil after treatment with alternatives to methyl bromide at various intervals prior to transplanting of squash.

	Application		Pathogen and weed viability[c]			
Treatment[a]	rate	timing[b]	F. solani	P.irregulare	R. solani AG4	Yellow Nutsedge
1,3-DC plus	93 l/ha	4 weeks	48 b	0 b	10 c	0 c
Metam sodium 42%	349 1 ha					
1,3-DC plus	93 1/ha	3 weeks	20 b	0 b	0 c	0 c
Metam sodium 42%	349 1/ha					
1,3-DC plus	93 1/ha	2 weeks	64 ab	0 b	52 ab	10 c
Metam sodium 42%	349 1/ha					
1,3-DC plus	93 1/ha	4 days	64 ab	0 b	86 a	68 b
Metam sodium	349 1/ha					
Metam sodium 42%	349 1/ha	4 weeks	18 b	0 b	0 c	0 c
plus Chloropicrin	84 1/ha					
Methyl bromide 98%	224 kg/ha	4 weeks	100 a	0 b	20 bc	2 c
Untreated check	–	–	100 a	80 a	74 a	88 a

Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test ($P \leq 0.05$).

[a]1,3-DC=1,3 dichloroprene (83%) plus chloropicrin (17%); methyl bromide 98% contained 2% chloropicrin by weight.

[b]Interval between application and planting.

[c]Percentage of pathogen-infested oat grains or yellow nutsedge nutlets that were viable after removal from treated soil prior to transplant of peppers.

Susceptibility of Vegetable Crops to Phytophthora Blight

Gerald J. Holmes [1] and Mark E. Lancaster [2]
[1] Department of Plant Pathology
North Carolina State University
Campus Box 7616; Raleigh, NC 27695
gerald_holmes@ncsu.edu
[2] NC Cooperative Extension Service
740 Glover Street
Hendersonville, NC 28792

Phytophthora blight is one of the most important and devastating diseases of vegetable crops in the southeastern U.S. The pathogen, *Phytophthora capsici*, has a wide host range and is known to cause disease in cucurbits as well as several solanaceous crops (e.g., pepper, tomato and eggplant). Field observations indicate that these crops are not equally susceptible

In 2000 and 2001, we tested the susceptibility of ten crops (summer squash, pumpkin, zucchini, cucumber, muskmelon, watermelon, pepper, eggplant, tomato and cherry tomato) to Phytophthora blight under field conditions on a commercial vegetable farm in Henderson Co. NC. Two additional treatments consisted of pepper and squash inoculated at the germling stage with a non-pathogenic isolate of *Colletotrichum magna* which is known for its ability to protect certain plants from root diseases. While all crops tested were susceptible to *P. capsici*, each differed in the degree of susceptibility, the specific host tissue affected and the symptoms produced. Summer squash, pumpkin and zucchini were the most susceptible crops (100% plant mortality) and were affected similarly by the disease (i.e., crown rot, fruit rot and leaf blight). The other cucurbits tested were susceptible to fruit rot only. We did not detect evidence of disease in other plant tissues (e.g., leaf, stem, crown, root). High plant mortality also occurred in pepper (near 100% mortality), but lagged several weeks behind squash, pumpkin and zucchini. In tomatoes and eggplant, infection was confined to fruit and stems resulting in occasional plant death in eggplant but not in tomato. In 2000, inoculation of squash and pepper with *C. magna* provided significant disease control over the non-inoculated control until frequent rains increased disease pressure. In 2001, *C. magna* had no effect.

These results are of practical importance to growers who are often faced with the difficult decision of choosing rotational crops. All the crops tested were susceptible to the disease and their cultivation should be avoided in fields where Phytophthora blight has been a problem. However, in the event that a susceptible crop is grown where the disease has been a problem, the likelihood of producing a successful crop will vary greatly depending on the particular susceptible crop grown.

Bell Pepper Yield and Incidence of Blossom-End Rot as Affected by Calcium Application and Irrigation Rates

Juan C. Diaz-Perez, Darbie Granberry, David Giddings and Denne Bertrand
Department of Horticulture
Coastal Plain Experiment Station
University of Georgia
P.O. Box 748
Tifton, Georgia 31793-0748
jcdiaz@tifton.cpes.peachnet.edu

Bell pepper is an important vegetable in Southern Georgia, with a farm gate value of $40 million**.** Bell pepper has a high demand for water and nutrients. Under low soil moisture conditions, fruit yield and quality decline and there is an increasing incidence of physiological fruit disorders such as blossom-end rot (BER). BER in peppers and tomatoes is the symptom of a disorder caused by a local calcium deficiency during early stages of fruit development. The incidence of BER has also been associated with high light and temperature conditions. In South Georgia, incidence of BER is particularly high during periods of high-temperature conditions. Under these conditions, during the day plants are exposed to periods of water stress that result in reduced water and calcium uptake from the soil, even under high rates of water application. In this study, we evaluated the effect of irrigation rates, number of drip lines per bed, and pre-plant calcium application on bell pepper yield and incidence of BER.

Materials and Methods

Two adjacent experiments were carried out in Spring 2001 at the Horticulture Farm, Coastal Plain Experiment Station, Tifton, Georgia . Experimental designs were randomized complete blocks with a split-plot arrangement and four replications. Treatments were irrigation rates [0.7, 1.0 or 1.3 Evapotranspiration (ET)], number of drip lines (1 or 2) per bed, and pre-plant calcium application (0 or 180 lb/acre). In

Experiment 1, the main plot was irrigation and the sub-plot was the gypsum rates. In Experiment 2, the main plot was irrigation and the sub-plot was the number of drip lines per bed. Pepper plants were planted in two rows per bed with a 1-ft separation between plants within the row.

The drip tape was buried 2 inch under the soil surface. Plants were irrigated with either one or two drip lines per bed. In order to have a similar quantity of water delivery at each bed, the water flow rate of the drip tape for one-drip line beds was twice as large compared to the drip tape used for two-drip line beds. The drip tapes were placed on the bed in such a way that all plants received about the same amount of water. In beds with one drip line per bed, the drip tape was between the two plant rows. In beds with two drip lines per bed, the drip tape was towards the edge of the bed, 6 inch away from each row. Pre-plant calcium was applied as gypsum (10% calcium). Fertilization was according to the recommendations of the UGA Extension Service.

Results and Discussion

Irrigation rates. Marketable and total fruit yield were lowest at 1.3 ET. Marketable and total fruit yield of plants at 0.7 ET were similar to those of plants at 1.0 ET. Incidence of BER was not significantly affected by irrigation rates. The average BER incidence was 6%

Drip Lines per Bed.. At the same water rate application, marketable and total yield were about 65% higher with two drip lines per bed compared to one drip line per bed. This is probably because two lines per bed resulted in less water infiltration and allowed for better moisture distribution in the bed than one drip line per bed. The average soil moisture content (volume basis) in beds with two drip lines (15.8%) was higher than in beds with one drip line (13.2%). The number of drip lines per bed did not significantly affect the average BER incidence.

Calcium rates. Pre-plant calcium applied as gypsum had no significant effects on yields or BER incidence. However, it is possible that this was because soil calcium levels in the test plots were in the high range.

Conclusions

Bell pepper yields were affected more by water distribution in the bed (i.e., number of drip lines) than by irrigation rates.

Pre-plant calcium applied as gypsum had no effect on yields or incidence of blossom-end rot.

Irrigation rates and number of drip lines per bed had little effect on the incidence of blossom-end rot.

Acknowledgments

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The Effect of Plastic Mulch Color on the Incidence of Tomato Spotted Wilt Virus in Bell Pepper

Glenn Beard
County Extension Agent
Colquitt County
350 Building 1, Room 132
E Bypass NE
Moultrie, Ga. 31768
gbeard@uga.edu

The incidence of Tomato Spotted Wilt Virus (TSWV) in bell pepper costs Colquitt County growers thousands of dollars in lost yield each year. TSWV is a virus which is vectored by small insects called thrips. It has been determined that early intensive insecticide sprays have little effect on the incidence of TSWV. The purpose of this trial was to discover whether the color of the plastic mulch affects the incidence of TSWV on bell pepper. It was hypothesized that the plastic mulch color possibly plays a role in the recognition of the pepper plants by thrips. This trial was initiated utilizing 3 different mulch color schemes while using a TSWV resistant pepper as the check plot. TSWV incidence data was collected weekly until harvest. The results of this trial shows a significant difference in the incidence of TSWV based on plastic mulch color on bell pepper planted in the spring.

The incidence of TSWV is significantly less on the bell pepper grown on the gray mulch color versus the silver shouldered and black mulch color. The incidence of TSWV is significantly less on bell pepper grown on the silver shouldered versus the black plastic.

In conclusion, there is a significant difference in the incidence of TSWV on bell pepper grown on certain colors of plastic mulch when compared to the standard black plastic used in spring production.

Session #9

Marketing

Moderator: Mr. Greg Peacock

Watermelon Production

Moderator: Tom Jennings

Seed Infection by *Acidovorax Avenae* Subsp. *Citrulli,* Causal Agent of Bacterial Fruit Blotch of Watermelon.

Ron. R. Walcott
Department of Plant Pathology
University of Georgia
4315 Miller Plant Sciences
Athens GA 30602

Abstract:

Bacterial fruit blotch (BFB) is a devastating disease of watermelon and other cucurbits including melon, pumpkin and cucumber (1,2,3,5,7). Over the past decade, this disease has caused significant problems for the watermelon industry and continues to be a threat. BFB affects watermelon seedlings and mature foliage but the most striking symptoms occur on mature fruit(4). Fruit symptoms appear around harvest maturity as irregularly shaped dark-green, water-soaked spots but rapidly develop into cracks and ultimately result in fruit rot. Losses to commercial growers due to this diseases can be 100%.

BFB is caused by *A. avenae* subsp. *citrulli* (formerly *Pseudomonas pseudoalcaligenes* subsp. *citrulli*), a gram negative, rod-shaped bacterium. *A. avenae* subsp. *citrulli* is a seedborne bacterium and infested seedlots represent the most significant source of primary inoculum(6). With this in mind seed producers have implemented strategies to eliminate *A. avenae* subsp. *citrulli* from watermelon seedlots including seed production in cool, dry environments, seed field inspection , seed treatments and seed testing. Despite this comprehensive approach, there have been significant BFB outbreaks over the past 3 years. In most cases, seeds have been found to be the primary inoculum sources. In 2001, ten states in the US reported BFB outbreaks, including Mississippi, Missouri, Illinois, Georgia, Florida, Texas, North Carolina, South Carolina, Louisiana, and Arkansas. In many of these cases the same watermelon cultivar was used and incidentally, these seeds were subjected to the above-mentioned management strategies. Hence, it is clear that research is needed to better understand the process of seed infection in order to prevent the production of *A. avenae* subsp. *citrulli*-infested seed.

Research was initiated to understand the seed infection process by *A. avenae* subsp. *citrulli* and in particular, the role of blossoms and pollinating insects in seed infection. In 1997, seeds recovered from symptomless fruits in a commercial field with BFB were found to be infested. This suggested that seeds could become infested by a process that did not involve fruit rot. Since there is no evidence for systemic movement of *A. avenae* subsp. *citrulli* in watermelon(6), we hypothesized that *A. avenae* subsp. *citrulli* could penetrate open watermelon blossoms and thereby infest seeds without causing symptoms.

To explore this hypothesis, greenhouse experiments were conducted in which watermelon blossoms were pollinated and inoculated with a green fluorescent protein-mutant of *A. avenae* subsp. *citrulli*, *P. ananatis* or PBS buffer(negative control). Seeds were manually extracted from symptomless mature fruits and assayed for *A. avenae* subsp. *citrulli*. It was found that blossom inoculation with *A. avenae* subsp. *citrulli* led to seed infection and BFB transmission. Blossom inoculation with *P. ananatis*, (causal agent of center rot of onion) also led to seed infection, however, since *P. ananatis* is not a pathogen of watermelon, there was no disease transmission. From these data it was concluded that blossoms could be an infection court for watermelon seed infection. It is also evident that seed infection via this pathway is not unique to *A. avenae* subsp. *citrulli*.

Based on the above-mentioned observations, it was hypothesized that pollinating insects could vector *A. avenae* subsp. *citrulli* to blossoms in to facilitate seed infection. To test this hypothesis honeybees were sampled (n=35) from a research plot with an outbreak of BFB and tested for *A. avenae* subsp. *citrulli*. Forty eight and 14% of the honeybees sampled shortly after bloom and at harvest maturity were found to be contaminated with *A. avenae* subsp. *citrulli*. These data reveal interesting facts about the epidemiology of BFB. We hypothesize that in seed production fields, *A. avenae* subsp. *citrulli* can be vectored by pollinating insects or other means to open female blossoms, where they invade and infest watermelon ovules These seeds can then serve as inoculum sources for BFB outbreaks. More research is needed to determine the significance of the blossom phase of this disease and to develop strategies, based on this information, for preventing seed infection.

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Resistance to Azoxystrobin (Quadris) in the Gummy Stem Blight Pathogen in Georgia

Katherine L. Stevenson
Dept. of Plant Pathology,
University of Georgia
Athens, GA 30602-7274
ks@arches.uga.edu
David B. Langston
Dept. of Plant Pathology
University of Georgia
P O Box 1209
Tifton, GA 31793
dlangsto@arches.uga.edu
Kenneth Seebold
Dept. of Plant Pathology
University of Georgia
Coastal Plain Exp. Station
P O Box 748
Tifton, GA 31793
edukseebold@tifton.cpes.peachnet.edu

Gummy stem blight, caused by the fungus *Didymella bryoniae*, is the most destructive disease of watermelon in Georgia and in many other watermelon-producing areas of the U.S. Azoxystrobin (Quadris) has been used for gummy stem blight control in Georgia since 1998. Compared to previous reports of disease control with azoxystrobin (Langston et al. 2000, Sumner and Hall 1997), unsatisfactory disease control was first observed in Georgia as early as 1999 in watermelon field trials and commercial watermelon fields treated with Quadris. Isolates of the pathogen collected in 2000 from watermelon fields in Delaware, Maryland, South Carolina, and Georgia, where disease control was unsatisfactory, were recently confirmed to be resistant to azoxystrobin (Olaya and Holm 2001). In 2001, an extensive survey was conducted to determine the frequency of azoxystrobin-resistant isolates in commercial watermelon fields in Georgia.

Isolates of the fungus were obtained from samples of infected watermelon from 25 commercial watermelon fields and research sites in Georgia. Sensitivity of each isolate to azoxystrobin was determined using a spore germination assay on water agar (WA) medium amended with azoxystrobin and salicylhydroxamic acid (SHAM) to inhibit an alternative respiratory pathway in the fungus that can interfere with the activity of the fungicide. Conidia of each isolate were transferred to fungicide-amended or unamended agar plates. After 48 h of incubation at 23-25˚C, the percentage of germinated spores was recorded. Fungicide sensitivity was expressed as the ED_{50} value (the fungicide concentration that inhibits spore germination by 50% relative to the control). As reported in the previous study (Olaya and Holm 2001), an isolate was considered resistant to azoxystrobin if the ED_{50} value was >10 $\mu g\ ml^{-1}$. Preliminary results from 8 of the 25 locations provide evidence of widespread resistance in the gummy stem blight pathogen to azoxystrobin in Georgia. Of the 65 isolates tested to date, 54 isolates (83%) were found to be resistant to azoxystrobin based on the spore germination assay. Isolates from the remaining 17 locations are currently being tested.

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Nutrient and Water Management for Watermelon

Sal J. Locascio
Horticulturist, Horticultural Sciences Department
University of Florida, Gainesville, FL
sjl@mail.ifas.ufl.edu

Watermelon is extensively grown in the Southeastern United States. In 1997, Georgia was third in fruit production (on 34,000 acres) following California (18,200) and Florida (33,000). In some years, Georgia replaces Florida for second place. Texas grows the highest acreage (42,000) but is fourth in watermelon fruit production due to a much lower yields per acre. For early-season production, coarse textured, deep, well drained soils that warm up rapidly are preferred. Plant nutrients and water management are essential to grow the crop profitability. Soil testing is required to manage soil pH and nutrients. Soils with a pH lower than 5.5 should be limed before planting. Lime must be incorporated thoroughly to neutralize the soil acidity in the root zone and may be applied as recent as one day before planting on coarse textured soils. On soils testing low in P and K, 120-120-120 lb/acre $N\text{-}P_2O_5\text{-}K_20$ are generally adequate for maximum production in Georgia. With excessive rains during the first two months of production, an additional 60 lb/acre N and K_20 may be needed. On soils that have a history of micronutrient deficiencies, micronutrients should also be applied before planting.

Fertilizer placement has a drastic effect on fruit yield. With the wide row spacings commonly used (8 to10 ft), application of fertilizer in bands 2 inches to each side of the seed or in a broad band in the center of the bed 2 to 4 inches below the seed often reduces yield due to salt injury. Soluble salt injury is more likely to occur with higher fertilizer rates when irrigation is not used effectively and with wider row spacings. Fertilizer application in a modified broadcast application in the 2 to 3 ft wide bed area with thorough incorporation to a depth of 6 to 8 inches provides less soluble salt injury, reduces nutrient leaching, and results in much higher fruit yields than band application. When soluble N sources are used, all of the P (and micronutrient), and one-half of the N and K_20 should be applied in the bed at planting. The remaining N and K_20 should be applied in12-inch wide bands on the bed shoulders and cultivated into the soil at lay-by. In years when rains cause excessive leaching, additional fertilizer (up to 60-0-60 lb $N\text{-}P_2O_5\text{-}K_20$/acre should be applied as above on the bed shoulders. When black polyethylene mulch (narrow or wide) is used, all the recommended fertilizer should be applied broadcast in the bed area before mulch application. Where drip irrigation is used with the mulch, all the P and 40% of the N and K should be applied broadcast in the bed with the remaining N and K applied in 10 weekly equal application through the irrigation system.

Suitable soluble nutrient sources include NH_4NO_3, NH_4SO_4, urea, KCl, K_2SO_4, KNO_3, ordinary and concentrated superphosphate (30%) of the N should be in the NO_3 form). Much is spoken about KC1 as a K source. Chlorine is highly soluble and moves rapidly with water and does not cause crop injury with the above placement and rates.

Overhead irrigation is the most commonly used method for watermelon. Timing of irrigation is essential to prevent moisture stress. Generally, 1 to 1.5 inches per week is required. Tensiometers placed 6-inches in the bed can be used help schedule irrigation including drip and irrigate to maintain the soil at 10 to 15 centibars. With drip irrigation, water is applied daily or as demanded by tensiometers to provide about 75% of soil water loss by crop use and evaporation.

Ref: http://www.ces.uga.edu/pubcd/B996-w.htm & ttp://edis.ifas.ufl.edu/MENU_HS:COMV.

Controlling Foliar Diseases on Watermelon With Fungicides

Anthony P. Keinath
Dept. of Plant Pathology & Physiology
Clemson University, Coastal Research & Education Center
2865 Savannah Highway
Charleston, SC 29414
tknth@clemson.edu

Depending on the location and weather in a given year, gummy stem blight, anthracnose, and, recently, powdery mildew, are the most common foliar diseases on watermelon across the southeastern United States. All three diseases begin slowly but spread rapidly if weather conditions are favorable. Gummy stem blight and anthracnose are favored by wet or humid weather but powdery mildew by dry or humid weather.

Current recommendations to control both gummy stem blight and powdery mildew are as follows: Apply the first, or cover, spray when the vines begin to run or when first male blooms appear. Use the predictions made by the MELCAST melon disease forecaster (if available in your area) to schedule the rest of the sprays. Alternatively, apply fungicides every 2 weeks until May 15. After May 15, spray fungicide every 7 to 10 days as long as you plan to harvest the field. In the spring, spraying until the last harvest increased overall yields by 13% and income by 18%

If the field has not had cucurbits in the past three seasons, use mancozeb, maneb or chlorothalonil. If your field has had cucurbits in the past three seasons, alternate Quadris with another fungicide. For all fields, spray Quadris about June 1 before the summer rains start. A typical pattern for South Carolina growers is to alternate mancozeb with chlorothalonil until June 1, then alternate mancozeb with Quadris. Low rates of fungicides can be used until May 1, but after May 1, always use the highest labeled rate.

Several cautions about specific fungicides follow. (1) Mancozeb or maneb alone will not control powdery mildew. A systemic fungicide with specific activity against powdery mildew, such as Quadris, Flint, or Nova, should be rotated or tank-mixed with mancozeb. (2) Quadris and Flint must be rotated with another fungicide to prevent resistance to these fungicides in both the gummy stem blight fungus and powdery mildew. (3) Although benomyl has been removed from the market, the related fungicide thiophanate-methyl (Topsin M) is still available. In South Carolina, the gummy stem blight fungus often is resistant to benomyl and thiophanate-methyl, so Topsin M is not recommended in place of benomyl.

Citation

Keinath, A.P. 2001. Controlling foliar diseases on watermelon with fungicides. Clemson Coop. Ext. Serv. IL 77. http://www.clemson.edu/psapublishing/Pages/Plntpath/IL77.pdf

Watermelon Production
(Cont'd)

Moderator: James Jacobs

Watermelon and Cantaloupe Trials

[1]George E. Boyhan, [2]Darbie M. Granberry, [2]W. Terry Kelley, [3]C. Randell Hill
[1]University of Georgia, Department of Horticulture
East Georgia Extension Center, PO Box 8112, GSU, Statesboro, GA 30460
[2]Rural Development Center, P. O. 1209, Tifton, GA 31793
[3]Vidalia Onion and Vegetable Research Center,
8163 Hwy 178, Lyons, GA 30436

Watermelon and cantaloupe variety trials were held at the Vidalia Onion and Vegetable Research Center in Lyons, Georgia. The watermelon trial consisted of 29 varieties and the cantaloupe trial consisted of nine varieties. Seed were started in the greenhouse at the Bamboo Farm and Coastal Garden in Savannah, Georgia in March and April. The watermelon transplants were set on April 19, 2001 and the cantaloupe transplants were set on April 25, 2001. The experiment was arranged in a randomized complete block design with four replications. Each experimental unit consisted of ten hills with an in-row spacing of five feet for the watermelon and an in-row spacing of three feet for the cantaloupe. The between row spacing was six feet for the cantaloupe and 12 feet for the watermelon. Although there was a 12 foot between-row spacing for the watermelon the yield per acre was calculated based on a six-foot between-row spacing.

The fertility program consisted of 750 pounds per acre of 10-10-10 applied preplant and incorporated. This was followed by 750 pounds per acre of 15-0-14 applied on May 11, 2001. This level of fertility is considered a little too high for watermelon and cantaloupe in Georgia and was the result of a miscommunication with the farm superintendent.

Weed control consisted of two quarts per acre of Cucurbit herbicide applied on April 27, 2001 over the top of the transplants. In addition, Poast Plus was applied at one quart per acre on May 7, 2001 for control of post emergent grasses. Finally, Permit herbicide was spot sprayed on May 7-8,2001 to control nutsedge. Hand weeding was also used as needed. Neither the use of Curbit over the top of transplants or the use of Permit on cucurbits is labeled. We did not apply any fungicides or insecticides to see how the varieties perform under natural disease and insect pressure.

Cantaloupe harvest began on June 29 and continued on July 5, 6, and 9, 2001. The watermelon harvest began on July 2, 2001 and continued on July 5, 6, and 9, 2001.

The Bonferroni adjusted LSD divides the probability (0.05) by 5 before calculating to control the experiment wise error rate. This allows up to five mean comparisons between varieties.

‘Royal Star’ watermelon from Petoseed was the highest yielding variety followed by ‘Big Stripe’, ‘WX8’, and ‘WX22’ from Willhite (Table 1). ‘Montreal’ from Sunseeds rounds out the top five performers. Surprisingly ‘Moon & Stars’ also had good yields. This is an old heirloom variety with an unusual rind pattern (dark green with yellow spots of varying sizes from pencil point to 2-3 inches across). The quality of this old variety was very poor, however, with white streaking in the flesh.

Seedless watermelons continue to be tested and grow in popularity. Nine of the varieties or almost a third were triploid varieties. We are beginning to see triploid varieties outside the Crimson Sweet type. This year ‘WX55’ from Willhite and ‘Revolution’ from Sunseeds were Allsweet types and ‘Freedom’ was a jubilee type from Sunseeds.

We had nine cantaloupe varieties in the trial with ‘Odyssey’ from Sunseeds having the highest yields (Table 2). Both Eastern and Western types were in the trial with the Eastern types yielding higher overall.

Table 1. Watermelon Variety Trial, Vidalia Onion and Vegetable Research Center, Lyons, GA, 2001

Variety	Company	Yield (lbs/acre)	Fruit Weight (lbs)	Length (in.)	Width (in.)	Rind (in.)	Soluble Solids (%)	Flesh Color	Melon Type	Comments
Royal Star	Petoseed	27,240	16.0	12.5	8.9	0.75	10.2	Red	Crimson Sweet	Some blocky & jubilee fruit
Big Stripe	Willhite	25,406	14.9	12.7	8.6	0.83	10.4	Red	Jubilee Blocky	
WX8 (large seed)	Willhite	23,766	12.6	13.6	8.1	0.78	10.8	Red	Allsweet	
WX22 (small seed)	Willhite	21,312	14.0	12.4	8.3	0.66	10.2	Red	Jubilee	
Montreal (5023)	Sunseeds	21,225	13.3	12.7	8.2	0.53	10.0	Red	Allsweet	
Moon & Stars	G. Hunter	20,045	16.7	11.6	9.6	0.78	8.6	Red	Moon & Stars	Old variety, white streaked flesh
WX55 Triploid	Willhite	19,889	12.7	13.7	7.3	0.70	9.0	Red	Allsweet Seedless	
Festival (large seed)	Willhite	19,548	12.0	14.4	7.3	0.63	9.5	Pink/Red	Allsweet	
Revolution (4034) Triploid	Sunseeds	19,471	10.9	12.8	7.9	0.81	11.7	Red	Allsweet Seedless	Variable some jubilee fruit
Piñata (large seed)	Willhite	19,185	13.9	12.4	8.4	0.83	9.4	Red	Allsweet	Some jubilee & blocky types
XP 4525247	Asgrow	18,999	13.1	13.4	8.0	0.58	9.2	Red	Allsweet	
Tribute (PX59696) Triploid	Petoseed	18,999	11.9	10.7	8.7	0.70	11.0	Red	Crimson Sweet Seedless	
Stars n Stripes	Asgrow	18,891	12.7	13.8	7.5	0.72	10.2	Red	Jubilee	
Falcon (PS 56395)	Petoseed	17,874	14.5	14.7	8.0	0.69	11.1	Red	Allsweet	
Sweet Eat'n Triploid	D. Palmer	17,598	10.3	9.6	7.7	0.67	11.4	Red	Crimson Sweet Seedless	Variable Fruit, Some icebox size
Sentinel (PS 36694)	Petoseed	17,544	11.8	12.0	7.9	0.72	11.3	Red	Allsweet	
Sweetheart (large seed)	Willhite	17,105	12.7	11.6	8.8	0.95	10.3	Red	Jubilee	Some variability w/Crimson Sweet type
Legacy (OP)	Willhite	16,212	10.6	12.3	7.6	0.72	8.3	Red	Allsweet Blocky	
Vista F1	Hollar Seed	15,043	14.3	12.0	8.4	0.69	11.6	Red	Jubilee	
AU Golden Producer	Hollar Seed	14,810	13.2	9.9	8.8	0.67	10.0	Yellow	Crimson Sweet	
Freedom (3022) Triploid	Sunseeds	13,957	12.0	12.3	8.2	0.72	11.8	Red	Jubilee Seedless	
AU Producer ZYMV	Auburn U.	13,605	13.4	10.1	9.1	0.72	9.6	Red	Crimson Sweet	
Afternoon Delight Triploid	D. Palmer	13,511	8.9	9.2	8.4	0.77	11.5	Red	Crimson Sweet Seedless	
Stargazer	Asgrow	12,977	11.2	12.7	7.4	0.64	8.5	Red	Allsweet	
WX24 (large seed)	Willhite	12,814	13.1	13.5	7.4	0.81	9.3	Red	Blocky Crimson Sweet	Some jubilee type
Cooperstown	Asgrow	11,576	10.6	9.6	8.2	0.58	10.9	Red	Crimson Sweet Seedless	
Triton	Petoseed	11,558	10.0	8.9	8.4	0.75	11.3	Yellow	Crimson Sweet Seedless	
AU Allsweet	Auburn U.	11,489	13.8	12.0	7.4	0.61	9.1	Red	Allsweet	
Sapphire F1	Hollar Seed	2,222	10.2	8.8	7.5	0.66	10.9	Red	Crimson Sweet Seedless	
	R^2	0.353					0.563			
	CV	50%					14%			

Adjusted LSD (p=0.05)	14,199	1.8

Table 2. Cantaloupe Variety Trial, Vidalia Onion and Vegetable Research Center, Lyons, GA, 2001.

Variety	Source	Yield (lbs/acre)	Fruit Weight (lbs)	Length (in.)	Width (in.)	Flesh Thickness (in.)	Soluble Solids (%)	Flesh Color	Melon Type	Comments
Odyssey (7119)	Sunseeds	16,970	5.6	7.5	6.8	1.9	7.8	Orange	Eastern	
Athena	Syngenta	13,891	4.0	6.9	6.2	1.8	9.8	Orange	Eastern	
Vienna	Asgrow	10,557	5.5	6.8	6.8	2.0	8.1	Orange	Eastern	
Eclipse	Petoseed	10,037	4.9	6.6	6.6	2.0	9.0	Orange	Eastern	
EX 04204099	Asgrow	9,378	4.1	6.8	6.3	2.0	8.2	Orange	Eastern	
AC-75-1A	Auburn University	7,575	2.2	5.0	5.1	1.5	7.1	Orange	Western	Some Eastern type
Super 45	Willhite	6,044	2.9	6.2	5.2	1.5	7.5	Orange	Western	Some Eastern type
AC-89-55MI	Auburn University	6,032	2.6	5.2	5.0	1.4	7.2	Orange	Western	Some Eastern type
AC-82-37RNL	Auburn University	2,311	2.4	5.8	4.9	1.6	4.9	Orange	Western	
	R2	0.574					0.597			
	CV	60%					21%			
	Adjusted LSD (p=0.05)	7,015					2.4			

Control of Powdery Mildew and Anthracnose in Georgia Watermelons

David B. Langston
Dept. of Plant Pathology
University of Georgia
Coastal Plain Exp. Station
Tifton, GA 31793
dlangsto@arches.uga.edu

Ken Lewis
CEC Crisp Co.
UGA Coop. Ext. Service
110 West 13th Ave. Suite C
Cordele, GA 31015
kenlewis@arches.uga.edu

Tom Jennings
CEC Wilcox Co.
UGA Coop. Ext. Service
P.O. Box 218
Rochelle, GA 31079
uge2315@arches.uga.edu

Powdery mildew of watermelon, caused by the fungus *Sphaerotheca fuliginea*, has become more of a problem in Georgia watermelons over the past three years. This disease is favored by dry, low humidity conditions and generally attacks watermelons when they are beginning to reach maturity. This disease is more difficult to diagnose than powdery mildew on other cucurbits because sporulation of the fungus is so sparse. Usually, symptoms first appear as chlorotic foliage near the crown of individual plants. As the disease progresses, foliage near the crown becomes necrotic and the chlorosis may extend down the runners. Infected leaves are often turned upside down which gives the vines the appearance of those that have been blown around by wind. Closer inspection may reveal faint chlorotic spots on the upper surface of leaves with corresponding sparse tufts of fungal mycelium on the undersides of leaves. Tests in Georgia have shown that most fungicides used for control of gummy stem blight will suppress powdery mildew to some degree. In 2000, spray programs containing Quadris, Folicur and Cuprofix MZ Disperss (6.0 lb/acre rate) were the most effective for suppressing powdery mildew in that particular experiment. However, Nova and Flint are very effective on powdery mildew in other cucurbits and should work well in watermelons.

Anthracnose of watermelon, caused by the fungus *Colletotrichum obiculare*, is not as much of a problem in watermelons now as it once was. However, this disease is still causing losses in isolated fields. This disease is identified as small, tan, elliptical lesions on stems and dark, angular lesions on leaves that often have a hole in the center of the lesion. Fruit may also develop lesions that may appear as dry, star-shaped cracks on the rinds of watermelons in the field. Stored fruit may develop circular, sunken lesions with pink sporulation in the center of the lesion. Unlike powdery mildew and gummy stem blight, anthracnose resistant watermelon varieties are available and should be used if anthracnose has been a problem in certain areas. Fungicide evaluations in 2001 showed that most spray programs significantly suppressed foliar anthracnose compared to the non-treated controls if sprayed on a 7-10 day schedule until harvest. Dithane full season, Bravo WeatherStik alternated with Topsin M tank-mixed with Penncozeb, and Bravo Weatherstik full season provided the highest levels of protection of the materials tested.

Posters

Evaluation of Soil Fumigants and Nitrogen Fertilizer Rates on Vidalia Onion Yields

George E. Boyhan[1] and Reid L. Torrance[2]
[1]University of Georgia, Department of Horticulture
East Georgia Extension Center, PO Box 8112, GSU, Statesboro, GA 30460
[2]Tattnall County Extension Service, PO Box 580, Reidsville, GA 30453

Research has shown that soil fumigation can increase onion yield by as much as 100 50-lb bags per acre. Such a significant increase in yield can easily offset the cost of application. There is however some concern that fumigant with high nitrogen fertilization could result in delayed harvest and reduction in yield due to late season bacterial diseases. This study was undertaken to evaluate the effect of Telone C-35, metam-sodium as well as different nitrogen rates on yield of onions.

The experimental design was a split-block design with fertilizer rates superimposed over three soil treatments, metam-sodium, Telone C-35, and the untreated check. Forty-two percent metam-sodium was applied at 60 gallons per acre three weeks prior to transplanting. In addition, Telone C-35 was applied at 15 gallons per acre three weeks before transplanting. Finally there was an untreated section of the field. The four fertilizer rates included 81, 104, 128, and 151 pounds of nitrogen per acre. The base fertilizer rate of 81 pounds per acre nitrogen was applied preplant with 5-10-15. Additional rates were applied as post-plant broadcast applications of $CaNO_3$. Each plot consisted of three beds, 10 feet long.

Tissue samples from all plots were collected on March 26, 2001 and analyzed for nitrogen, phosphorus, potassium, and calcium. Onions were harvested on May 7, 2001 were clipped and weighed in the field. In addition, the onions were hot-air cured and graded into jumbos (>3 in.) and mediums (<3 in. & >2 in.). Data were subject to analysis of variance, which included intereaction effects between the fertilizer rates and fumigants.

Both metam-sodium and Telone C-35 increased yields over the untreated plots (Table 1). Metam-sodium increased field yield over the untreated check by over 14% and Telone C-35 increased it by 17%. The nitrogen rates had no effect on field yields and there was no interaction effect between soil fumigant and nitrogen fertilizer.

There was no difference between cured yields based on applied fumigant although the probability was only 0.052. Also there was no difference based on applied nitrogen fertilizer nor was there any differences in amount of jumbos.

Nitrogen rates did affect foliar nitrogen levels with increasing amounts of nitrogen fertilizer increasing the tissue nitrogen levels. No other foliar tissue nutrient levels were affected.

There was no delay in harvest based on nitrogen or fumigant applications and all the plots were harvested at the same time. Fumigation, as has been found in the past, did increase yields over non-fumigated treatments. The lack of differences between nitrogen rates may have been due to the fact that this particular field was planted late (December) and was subjected to unusually high incidence of freeze injury. In general, we have been reducing our nitrogen rate recommendations and most growers should be able to grow a quality onion with 120-150 pounds of nitrogen per acre.

Table 1. Soil Fumigation & Nitrogen Fertility Effect on Yield and Leaf Tissue Nutrient Status

Treatments	5/7/01				Leaf Tissue Samples Collected 3/26/2001			
Soil Application	Field Weights (1lbs/plot)	Cured Weights (lbs/plot)	Jumbos (lbs/plot)	Mediums (lbs/plot)	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Calcium (%)
Untreated	38.6	37.2	20.5	13.1	3.2	0.45	4.27	0.76
Metam Sodium	44.2	42.7	24.0	16.0	3.2	0.59	4.07	0.54
Telone C-35	45.2	43.4	22.7	17.4	3.2	0.59	4.28	0.58
Nitrogen Application (lbs/acre)								
81	43.0	41.2	21.8	16.2	3.0	0.56	4.12	0.57
104	41.3	39.7	21.4	15.1	3.2	0.54	4.42	0.64
128	42.5	41.3	21.9	16.1	3.2	0.54	4.1	0.63
151	44.0	42.2	24.6	14.7	3.3	0.52	4.18	0.66

Probabilities				
Soil	0.045	0.052	0.278	0.581
Nitrogen	0.493	0.569	0.140	0.000
Soil x Nitrogen	0.721	0.750	0.893	0.103

Grano Onion Trials

George E. Boyhan[1] and Robert T. Boland[2]
[1]University of Georgia, Department of Horticulture
East Georgia Extension Center, PO Box 8112, GSU, Statesboro, GA 30460
[2]Brantley County Extension Service, PO Box 275, Nahunta, GA 31553

Grano onions like the Granex onions grown as Vidalias are short-day onions adapted to overwintering production. Grano onions are particularly well known as Texas sweet onions. These onions are yellow round onions unlike the Granex onions grown as Vidalias which have a slightly flattened shape**.**

Growers outside the Vidalia onion growing region are not allowed to produce onions and use the Vidalia name however production of high quality onions is still possible. There has been some interest in onion production outside the Vidalia growing region. In addition, there is interest in differentiating these onions from Vidalias. Grano onions with their different shape are an ideal candidate for this purpose. The objective of this study was to evaluate Grano onion varieties for south Georgia production.

In the 1999-2000 season two variety trials were established. One trail was established on-farm in Brantley County and another at the Vidalia Onion and Vegetable Research Center (VOVRC). Onion seed were planted at the Brantley County on-farm location on 9/14/99 or 9/24/99. Seed were sown with an Earthway push planter using a 1002-5 Radish medium plate (Bristol, IN). Onions were transplanted from these direct seeded onions to their final spacing on 12/1/99 onto raised plastic beds. Two rows of onions were planted approximately six inches apart in the row with a between row spacing of approximately

14 inches. The onions were planted in a randomized complete block design (RCBD) with three replications. Each plot consisted of 40 bulbs. The fertility program followed Georgia soil test recommendations. Disease, insect, and weed control followed Georgia Cooperative Extension Service recommendations for onions.

At the VOVRC, seed were sown on 9/23/99 in high density plant beds (30-50 seed per linear foot) that had been fumigated with 50 gallons per acre 42% Busan on 8/13/99. The fertility program for the seeded onions started with a preplant application of 800 pounds of 5-10-15 with 9% sulfur. The fertility program for the seeded onions included 180 pounds per acre of diammonium phosphate applied on 9/24/99. In addition,180 pounds of $CaNO_3$ was applied on 10/21/99 as well as 300 pounds of 10-10-10 applied on 10/28/99. Finally, 200 pounds of $CaNO_3$ was applied on 11/8/99.

Transplants were pulled from the plant beds and set at their final spacing on 12/21/99. The fertility program on these plots consisted of 400 pounds per acre of 5-10-15 with 9% sulfur applied preplant. This was followed by 300 pounds of 6-12-18 with 4% sulfur applied on 1/18/00. In addition 150 pounds of diammonium phosphate was applied on 1/25/00 as well as 300 pounds of 6-12-18 with 4% sulfur on 2/10/00. The final fertilizer application was on 3/1/00 with 300 pounds of $CaNO_3$. Harvests were done on 4/6/00, 4/12/00, 4/19/00, 4/26/00, 5/4/00, and 5/11/00 as the onion varieties matured. Weed control consisted of applications of Goal and Prowl herbicides at the rate of 1.5 pints per acre applied on 12/3/99. Disease and insect control followed current Georgia Extension Service recommendations. The experiment was arranged in a RCBD with four replications and each plot was 10 feet long.

Results of the 1999-2000 season trials are summarized in Table 1. At the VOVRC the highest yielding variety was Primavera with 1243 50-lb bags per acre. This was significantly better than ‘Arizona Sunset’, ‘NuMex Dulce’, ‘NuMex BR1’, ‘1025Y’, and ‘Westar’. ‘Arizona Sunset’ had significantly less disease than ‘NuMex Sweetpak’, ‘Asgrow 6846’, or ‘Westar’. It should be noted that the 1999-2000 growing season was very dry and disease pressure was extremely light.

Disease pressure at the Brantley County location was much greater with a significant loss of stand overall. This may have been due to the use of plastic mulch. Other research has shown that plastic mulch increases the incidence of warm season diseases in onions.

The 1999-2000 season was much better for onion production than the 2000-2001 season, which was marred by below freezing temperatures in December that adversely affected the crop. Overall yields were lower this season compared to the previous season. The highest cured yield in the 2000-2001 season was ‘SXO 1503’ with 798 50-lb bags per acre which was better than 75% of the varieties in the trial (Table 2). Overall the early Japanese overwintering onions had reduced yields compared to the Grano types. Although the Grano onions are suppose to be round many exhibited positive length to width ratios (torpedoing). It is unclear if this is a problem in the south Georgia environment or if they perhaps were harvested too early. Generally, Grano onions mature later in south Georgia compared to Texas where the sweet onion market comes in before Vidalia onions.

In conclusion, these onions perform satisfactorily in south Georgia although they are not as well adapted as the Granex types. Plastic mulch is not recommended due to the increased disease problems. More work is needed to identify those Grano varieties that will perform consistently with low disease incidence and occurrence of ‘torpedos’.

Table 1. Sweet Onion Variety Trials - Brantley County & VOVRC, 1999-2000 Season

		Vidalia Onion and Vegetable Research Center					Brantley Co.			
		5/4-5/2000					4/11/00			
Entry	Seed Source	Estimated Maturity Date	Yield 50lb bags/acre	Disease Rating[y]	Sugar %	Pungency (um/gfw)	Stand Count[x]	Disease Rating[y]	Sugars (%)	Pungency (um/gfw)
Sweet Magnolia	D. Palmer Seed						26	2.7	8.0	3.8
DPS 1025	D. Palmer Seed						27	3.0		
DPS 1029	D. Palmer Seed						32	3.0	8.8	3.9
Timon	D. Palmer Seed						30	2.7	9.0	4.4

Arizona Sunset	D. Palmer Seed	4/28-5/11/00	919	1.7	8.1	4.8	34	3.3	10.2	5.3
DPS 1042	D. Palmer Seed						29	2.5	9.8	3.9
Sweet Sun	Sunseed						29	3.3	7.8	3.7
NuMex Sweetpak	NMSU[z]	5/4/00	1181	3.7	6.2	2.3	26	3.0		
NuMex Starlite	NMSU[z]	5/4-11/00	1163	2.0	6.9	4.4	22	3.7	8.2	5.6
NuMex Dulce	NMSU[z]	5/11/00	756	1.0	6.7	3.5	29	4.3	9.2	4.5
NuMex BR1	NMSU[z]	5/4/00	848	4.0	6.2	5.7	31	3.7	7.2	3.9
Pegasus	Asgrow						31	4.0	9.4	5.1
1015Y	Asgrow						29	2.7	10.0	5.8
Granex 33	Asgrow						26	3.0	9.4	4.8
Primavera	Petoseed	4/28/00	1243	3.0	6.5	3.3	37	3.3	8.0	3.4
Terlingua (6786)	Asgrow	5/4-11/00	1156	2.7	6.7	4.7	26	3.3	9.0	3.7
1025y	Asgrow	5/11/00	755	2.3	7.2	5.7	24	3.7	8.6	5.9
Sweet Vidalia	Rio Colorado						33	4.0	7.8	4.5
RCS 1006	Rio Colorado						31	3.3	7.2	3.7
Asgrow 6846	Asgrow	5/4-11/00	1155	4.0	7.0	5.4				
Westar		4/28-5/4/00	980	4.0	7.2	5.2				

[z]New Mexico State University	R^2	0.913	0.620	0.724
[y]Rating Scale: 1-Excellent, 5-Poor	CV	19%	46%	30%
[x]Stand Count: Maximum of 40 bults	LSD	122	1.8	1.5

Table 2. Onion Variety Trial with Grano & Japanese Overwintering Types, 2001. Vidalia Onion and Vegetable Research Center, Lyons, GA

Variety	Company	Harvest Date	Field Yield(50lb bags/acre)	Current Yield(50lb bags/acre)	Jumbo(50lb bags/acre)	Medium(50lb bags/acre)	Onion Type
SXO 1503	Sunseed	5/22/01	846	798	582	19	Grano
Cirrus	Asgro	5/22/01	836	791	659	21	Grano
EX 6996	Asgrow	5/22/01	809	763	590	50	Grano
Starlite	NMSU	5/22/01	755	711	571	70	Grano
Sherita	**D. Palmer**	4/19/91	391	703	221	452	Grano
Straws	**Asgrow**	5/22/01	733	690	538	35	Grano
Ringer Grano	**Sunseed**	5/22/01	671	639	483	62	Grano

Encino	**Asgrow**	5/22/01	665	630	457	53	Grano
Texas Early White	**Asgrow**	5/22/01	634	596	449	80	Grano
Nikita	**Sunseed**	5/2/01	597	560	390	138	Grano
Marquesa	**Asgrow**	5/22/01	593	556	433	78	Grano
Don Victor	**Sunseed**	5/22/01	573	541	388	43	Grano
SXO 1046	**Sunsweet**	5/2/01	559	532	429	83	Grano
Sweet Magnolia	**D. Palmer**	5/2/01	486	452	309	111	Grano
T.G. 428	**Asgrow**	5/22/01	474	439	328	48	Grano
Timon	**D. Palmer**	5/2/01	451	424	264	117	Grano
King Midas	**Sunseed**	4/27/01	441	417	237	171	Grano
Big Pete	**D. Palmer**	4/27/01	433	399	169	210	Grano
T.G. 1015	**Asgrow**	5/22/01	423	394	301	37	Grano
Sweetpak	**NMSU**	5/2/01	409	385	224	146	Grano
Texas Legend	**Asgrow**	5/2/01	411	383	213	136	Grano
SSC 6436 F1	**Shamrock**	4/19/01	473	369	190	158	Japanese
SSC 6372 F1	**Shamrock**	4/27/01	389	361	187	147	Japanese
Sweet Sun	**Sunseed**	4/27/01	382	351	140	170	Grano
SSC 6371 F1	**Shamrock**	4/19/01	371	343	128	196	Japanese
DPS 1029	**D. Palmer**	4/27/01	368	338	159	152	Grano
Georgia Pride	**Shamrock**	4/19/01	305	286	147	128	Japanese
T.G. 1025Y	**Asgrow**	5/2/01	250	226	46	137	Grano

R2 0.785 0.801 CV 35% 36% Adjusted LSD (p<0.05) 178 167

On-Farm Evaluation of Plantbed Fertility

George E. Boyhan[1] and Greg Hardison[2]
[1]University of Georgia, Department of Horticulture
East Georgia Extension Center, PO Box 8112, GSU, Statesboro, GA 30460
[2]Montgomery County Extension Service, PO Box 276, Mount Vernon, GA 30445

Previous work has indicated that supplemental high phosphorus fertilizers are not required for onion plantbed production. Growers will begin their fertility program with 800-1000 pounds per acre of 5-10-15 applied preplant incorporated. They will then plant their seed and come back with 150 pounds per acre of 18-46-0 (diammonium phosphate, DAP). This is followed up with 200 pounds per acre of 15.5-0-0 (calcium nitrate, $CaNO_3$) at four and six weeks after planting. Onion transplants are ready for transplanting to their final spacing eight to 10 weeks after seeding. Additions of DAP directly after seeding have been shown to be unnecessary in September when onions are usually seeded. The warm weather coupled with generally high residual phosphorus precludes the need for the additional DAP application. The objective of this study was to validate these findings under on-farm conditions.

A cooperating grower in Montgomery County preplant incorporated 800 pounds per acre of 5-10-15. Seed were sown at 50-70 seed per linear foot with five rows per bed, which were spaced six feet on center. Treatments were applied 9/12/01, which was the day after seed were sown. Our treatments consisted of additional 5-10-15 at rates of 200, 400, and 600 pounds per acre as well as 150 pounds per acre of DAP. Additionally 200 pounds per acre of $CaNO_3$ was applied at four and six weeks after seeding to all plots and evaluations were conducted at eight weeks. Each plot consisted of 50 feet of bed and the experiment was arranged in a randomized complete block design.

Data collected consisted of plant height of 20 plants chosen at random from each plot. In addition, 10 randomly chosen plants had their diameter measured at the widest point of the bulb (approximately 0.25 inches above the basel plate. Finally 100 randomly chosen plants from each plot were weighed.

The results of this study are summarized in table 1. Differences were detected for all three parameters measured. There was a significant linear increase in plant height from 800-1400 pounds per acre application of 5-10-15. There were also significant differences in plant diameter but without any linear or quadratic effects with 5-10-15 applications. Finally, plant weight significantly differed with treatment application. In addition, there was a significant linear increase in plant weight with increasing applications of 5-10-15.

The results of this study support previous work that indicated there was no need for a second trip across the field to apply DAP. These results also suggested that higher rates of 5-10-15 should be applied, perhaps as high as 1200 pounds per acre.

Table 1. Effect of fertilizer treatments on plant height, plant diameter, and plant weight.

Treatment	Plant Height (in.)	Plant Diameter (in.)	Plant Weight (Gms/100 plants)
800 lbs/acre 5-10-15	14.0	0.29	353
1000 lbs/acre 5-10-15	15.2	0.29	467
1200 lbs/acre 5-10-15	15.8	0.24	488
1400 lbs/acre 5-10-15	15.8	0.28	481
800 lbs/acre 5-10-15 & 150 DAP	15.4	0.29	485
P>F			
Treatments	0.022	0.050	0.013
5-10-15 Linear	0.010	-	0.010
5-10-15 Quadratic	0.167	-	0.058

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