PROCEEDINGS OF THE 2005
SOUTHEAST REGIONAL
VEGETABLE CONFERENCE

January 6-9, 2005
Savannah International
Trade & Convention Center
Savannah, Georgia

William Terry Kelley
Editor
Sponsored by Famous Software, LLC
2005 Vegetable Conference Program
Friday - January 7, 2005

8:00-9:30 am

Session #1 - Growing Organically in the Southeast

8:00 Watermelon  
Ms. Rose Koenig - Gainesville, FL  
8:30 Blueberries  
Mr. Dick Byne - Waynesboro, GA  
9:00 Onions  
Mr Shad Dasher - Glenville, GA

10:00-11:00 am Concurrent Sessions

Session #2 - Growing Herbs Organically

10:00-11:00 am Organic Herbs  
Mr. Randy Beavers, Sleepy Hollow Farm - Dalton, GA

Session #3 - Pesticide Update  
Moderator: Ed Harrison  
Mitchell County Extension Agent, Camilla, GA

10:00 New Insecticides and Label Changes for Georgia Vegetables  
Dr. Stormy Sparks, UGA-Tifton, GA  
10:20 New Disease Control Options for Georgia Vegetables  
Dr. David B. Langston, Jr., UGA-Tifton, GA  
10:40 New Herbicide Uses for Vegetables  
Dr. David Monks, N.C. State Univ.- Raleigh, NC

Session #4 - New Products and New Uses  
Moderator: James Jacobs

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Ware County Extension Coordinator, Waycross, GA

10:00  Fertilizer Effects on Vegetables - Slow Release and Chloride Based Materials  
      Dr. William Terry Kelley, UGA-Tifton, GA
10:30  Effectiveness of Admire Insecticide as a Plant Growth Stimulant  
      Mr. Glen H. Beard, Dr. Stormy Sparks and Mr. Keith Rucker,  
      UGA - Moultrie, GA, Tifton, GA

1:30-3:00 pm  Concurrent Sessions

Session #5 - Organic Perspectives

Mr. Kenny Haines, Owner, Looking Back Farms - Tyner, NC  
Research Update: Challenges and Perspectives of Organic Weed Control  
      Dr. Carroll Johnson, USDA-Tifton, GA

Session #6 - Vidalia Onion Production

Moderator: Glen Beard  
Colquitt County Extension Agent, Moultrie, GA

1:30  Control of Storage Rots of Onion with Fungicides  
      Dr. Kenneth W. Seebold, Jr., UGA-Tifton, GA
1:50  Bolting of Sweet Onions is affected by Nitrogen Fertilization and Mulch  
      Dr. Juan Carlos Diaz Perez, UGA-Tifton, GA
2:15  Weed Management in Transplant and Seeded Onions  
      Dr. Stanley Culpepper, UGA-Tifton, GA
2:35  Onion Varieties, Fertility & Future Work  
      Dr. George Boyhan, UGA-Statesboro, GA

Session #7 - Insuring What You Sell is Safe and Secure

Moderator: Frank Lattimore  
Sumter County Extension Coordinator, Americus, GA

1:30  Bioterrorism Law: An Overview on How It Affects Produce Growers and Packers  
      Chris Wilcox, FDA - Savannah, GA
2:00  How to Develop and Maintain a Produce Security Plan for Your Operation  
      Dr. William C. Hurst, UGA-Athens
2:30  Traceability, COOL and ISO 9000  
      Dr. Greg Fonsah, UGA-Tifton, GA

Session #8 - Alternative Crop Options for Georgia Growers

Moderator: Ed Harrison  
Mitchell County Extension Agent, Camilla, GA
1:30  A New Pumpkin Variety for Adverse Conditions  
      Dr. George Boyhan, UGA-Statesboro, GA  
      Gr. Gerard Krewer, UGA-Tifton, GA  
      Dr. Darbie Granberry, UGA-Tifton, GA  
2:00  Producing Broccoli and Cauliflower  
      Dr. William Terry Kelley, UGA-Tifton, GA  
2:30  Getting Started in Greenhouse Tomato Production  
      Dr. Joe Kemble, Auburn Univ-Auburn, AL  

3:30-5:00 pm  Concurrent Sessions  

Session #9 - Organic Certification - Where Are We Now?  

Mr. Marty Mesh, Executive Director, Quality Certifications Services -  
Gainesville, FL  
Mr. Terry Hollifield, GA Dept. Ag.-Athens, GA  
Ms. Rose Koenig, Rosie’s Farm-Gainesville, FL  

Session #10 - Progress in Replacing Methyl Bromide  

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

3:30  Time to Start Incorporating Methyl Bromide Alternatives into  
      Your Plasticulture Programs  
      Dr. Stanley Culpepper, UGA-Tifton, GA  
4:00  Critical Use Exemption - Where's It At, Where's It Going?  
      Dr. William Terry Kelley, UGA-Tifton, GA  
4:30  Application Equipment for Methyl Bromide Replacement  
      Mr. Paul Sumner, UGA-Tifton, GA  

Session #11 - Pest Management  

Moderator: Elvin Andrews  
Lanier County Extension Coordinator, Lakeland, GA  

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3:30  Thrips Vectors of Tomato Spotted Wilt Virus in Weeds
      Dr. David Riley and Mr. Stan Diffie, UGA-Tifton, GA
4:00  Agriphage as a Disease Control Agent
      Dr. Jeff Jones, Univ. FL - Gainesville, FL
4:30  Integrated Pest Management for Leafy Greens
      Dr. J.Powell Smith, Clemson Univ. - Clemson, SC

Session #12 - Regulatory Issues
Moderator: Mitchell May
Decatur County Extension Agent, Bainbridge, GA

3:30  Inspections for Chemical Residues
      Frank J. Schenck, FDA - Atlanta, GA
4:00  Crop Insurance Programs for Vegetables
      Brent Stewart, RMA Representative
4:30  Disaster Relief Programs after the 2004 Season
      FSA Representative

Saturday-January 8, 2005

8:30-11:00 am  General Session

2:00-3:30 pm  Concurrent Sessions

Session #13 - Watermelons
Moderator: Rusty Harris
Worth County Extension Coordinator, Sylvester, GA

2:00  Controlling Gummy Stem Blight with Seed Treatments
      Dr. Kenneth W. Seebold, Jr., Dr. David B. Langston, Jr., UGA-Tifton, GA
2:30  Watermelon Fungicide Programs
      Dr. David B. Langston, Jr., UGA-Tifton, GA
3:00  Watermelon Marketing and Value-Added Research
      Steven R. Fore, National Watermelon Promotion Board

Session #14 - New Technologies on the Farm
Moderator: Jason Brock
Department of Plant Pathology, UGA - Tifton, GA
2:00  Mapping of Yield Variability of Commercially Grown Bell Peppers  
      Mr. Keith Rucker, UGA Coop. Ext. Ser. - Tift County
2:30  Reducing Waste by Composting Vegetables  
      Dr. Gary Hawkins, UGA-Tifton, GA
3:00  Marketing Outside the Box (A Web Based Approach)  
      Betty Hotchkiss, Lane Packing - Byron, GA

Posters
Effectiveness of Gaseous Chlorine Dioxide in Killing Salmonella, Escherichia Coli 0157:H7, Listeria Monocytogenes, and Molds on Fresh and Fresh-Cut Fruits and Vegetables
Kaye V. Sy, UGA - Griffin, GA
Melinda B. Murray, UGA - Griffin, GA
M. David Harrison, UGA - Griffin, GA
Larry R. Beuchat, UGA - Griffin, GA

Survival and Growth of Enterobacter Sakazakii, and Emerging Foodborne Pathogene, on Fresh-Cut Fruits and Vegetables
Hoikyung Kim, UGA - Griffin, GA
Larry Beuchat, UGA - Griffin, GA

The Georgia Automated Environmental Monitoring Network
Gerrit Hoogenboom, UGA - Griffin, GA
Eddie Edenfield, UGA - Griffin, GA
Dee Dee Coker, UGA - Griffin, GA
Chun Fang, UGA - Griffin, GA
Matthew Evans, UGA - Griffin, GA

Temperature Prediction for Frost Forecasting
R. W. McClendon, UGA - Griffin, GA
Gerrit Hoogenboom, UGA - Griffin, GA
Abishek Jain, UGA - Griffin, GA
Ramyaa Ramyaa, UGA - Griffin, GA
Brian Smith, UGA - Griffin, GA

Controlling Fungal and Bacterial Diseases of Peppers with Tanos™
C. Shepherd, DuPont Crop Protection - Newark, DE
M. Martin, DuPont Crop Protection - Newark, DE
R. Williams, DuPont Crop Protection - Newark, DE
S. Rick, DuPont Crop Protection - Newark, DE
D. Ganske, DuPont Crop Protection - Newark, DE
B. McInnes, DuPont Crop Protection - Newark, DE

Controlling Fungal and Bacterial Diseases of Vegetables with a New Fungicide Containing Famoxadone and Cymoxanil
R. Geddens, DuPont Crop Protection - Newark, DE
C. Shepherd, DuPont Crop Protection - Newark, DE
R. Williams, DuPont Crop Protection - Newark, DE
M. Martin, DuPont Crop Protection - Newark, DE
S. Soehner, DuPont Crop Protection - Newark, DE

Impact of Selected Cultural Practices on Yield, Fruit Number and Fruit Size of Watermelon
J. E. Hudgins, CES, Decatur County - Bainbridge, GA
W.T. Kelley, UGA - Tifton, GA
D.B. Langston, UGA - Tifton, GA
R.T. Yager, Stripling Irrigation Park - Camilla, GA
W.E. Harrison, CES, Mitchell County - Camilla, GA
L.M. May, CES, Decatur County - Bainbridge, GA
B.R. Mitchell, CES, Mitchell County - Camilla, GA

Residual Herbicide Carryover Simulation in Transplanted Vidalia Onions
Timothy L. Grey, UGA - Tifton, GA
A. Stanley Culpepper, UGA - Tifton, GA

Predicting Tomato Spotted Wilt Virus Incidence in the Field Using Preseason Thrips and Weed Data from the Surrounding Area
Stan Diffie, UGA - Tifton, GA
Dr. David Riley, UGA - Tifton, GA
NEW INSECTICIDES AND LABEL CHANGES FOR GEORGIA VEGETABLES

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Insecticide registrations on vegetables in 2004 did not include any new active ingredients, but did expand covered crops for some relatively new products and a few older products as well. Products with expanded federal labels included acetamiprid (Assail), buprofezin (Courier), indoxacarb (Avaunt), and lambda-cyhalothrin (Warrior). State registrations in 2004 included a 24C for Asana on turnip greens and Section 18s for Avaunt on collard greens and Knack on beans. The covered crops and uses for these registrations will be discussed. Use of Admire in transplant production was clarified in recent label changes and will also be discussed.

Potential registrations in 2005 do include several new chemistries including novaluron (Crompton/Uniroyal Chemical), spiromesifen (Bayer Corporation), flonicamid (FMC Corp.) and dinotefuran and pyridalyl (Valent). Potential crop registrations and pests controlled by these products will be discussed.
NEW DISEASE CONTROL OPTIONS FOR GEORGIA VEGETABLES

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Switch® is a relatively new product from Syngenta Crop Protection that is a premix of cyprodinil and fludioxonil. It is labeled for brassica crops and carrots and should provide good control of *Alternaria* diseases as well as powdery mildew. Amistar® is now labeled for the heading brassicas and will provide suppression of both *Alternaria* and *Cercospora* diseases. Amistar may also provide some suppression of downy mildew. Curzate® is a DuPont fungicide that is primarily to be used for control of downy mildew and *Phytophthora* diseases. It is newly registered on cucurbits for control of downy mildew and should be tank-mixed with protectant fungicides such as copper, mancozeb or chlorothalonil. Previcur Flex®, from Bayer, is newly labeled on cucurbit crops for suppression of downy mildew. It has excellent activity on downy mildew and should be tank-mixed with protectant chemistries.
NEW HERBICIDE USES FOR VEGETABLES

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Several changes in herbicide registrations exist for vegetable crops in 2005. Aim, Dual Magnum, Envoke, Goal, Roundup, Stinger, and Valor herbicides are new registrations for vegetable crops.

Aim (FMC) – A registration is expected for Aim herbicide for control of emerged weeds in the row middles of many vegetable crops. These vegetables will likely include most beans, broccoli, cabbage, head lettuce, mustard greens, onions, peas, radish, spinach, strawberries, fruiting vegetables (tomato, pepper, eggplant), and cucurbit crops (cantaloupe, cucumber, watermelon). Application of Aim will require using a hooded sprayer. The rate will be up to 1.24 ounces and an adjuvant will need to be used with Aim. A label is expected before 2005. Be on the look out for the label and follow all guidelines on the label.

Dual Magnum (Syngenta) was recently registered for preemergence control of weeds in tomato. For bareground use, Dual may be applied preplant incorporated or preplant to the soil surface before transplanting. Application of Dual may also be made post-directed to transplants after the first settling rain or irrigation. In bedded transplanted tomatoes, Dual Magnum can be applied to the soil surface (not incorporated) at the top of the pressed bed, as the last step, prior to laying plastic. Dual may also be used to treat row middles in bedded tomatoes. Use rate on coarse soils is 1 to 1.33 pints per acre. Dual gives excellent control of many annual grasses, pigweed, nightshade and groundcherry species. See the herbicide label for more information and instructions.

Envoke (Syngenta Crop Protection) was registered recently in Georgia for control of broadleaf sedge and grass weeds in transplanted tomatoes. It can be applied at 0.10 to 0.20 ounces per acre postdirected to tomato grown on plastic for control of many weeds including annual sedges, and purple and yellow nutsedge, Florida beggarweed, common ragweed, sicklepod and certain morningglory species. The application should be made prior to fruit set and at least 45 days prior to harvest. A high quality nonionic surfactant should be used at 1 quart per 100 gallons of spray solution. Allow at least two weeks after transplanting before applying Envoke. Envoke is also registered in Florida and registrations are expected in other states in the near future. Postdirected application is important as Envoke is likely to injure tomatoes when applied over the top of the crop. See the label for more information.

Goal (DowAgroSciences) was registered recently in Florida, Georgia, North Carolina, South Carolina and Virginia for application to fallow-bed prior to transplanting peppers, tomatoes or strawberries in plastic culture. With this application, the field is bedded for plasticulture except laying plastic. Goal is then applied followed by application of the drip and plastic mulch. Application of drip tape and plastic mulch should occur with minimum soil disturbance for best weed control. Application of Goal must occur at least 30 days prior to planting. Use rate of Goal is 1 to 2 pints per acre. Goal controls many broadleaf weeds and certain grass weeds.
including Florida pusley, common purslane, Carolina geranium, cutleaf evening primrose, pigweed, ragweed and nightshade. To learn more about Goal, read the label.

**Roundup UltraMax (Monsanto)** – A number of different application types have been recently added to the Roundup UltraMax label. Shielded sprayer application to the middles between rows was added to the label and is now allowed in many vegetable crops. This treatment gives very effective weed control, however, extreme care must be used to prevent contact of the crop and subsequent injury to the crop. See the label for more information.

**Stinger (DowAgroScience)** was recently registered for leafy (cole) crops (broccoli, cabbage, cauliflower, collards, mustard, kale, and certain types of Chinese cabbage, and Chinese mustard), sweet corn, turnip, and strawberry. It is registered to control emerged weeds including many legumes (vetch, clover, etc), cocklebur, galinsoga, prickly lettuce, ragweed, annual sowthistle, and certain other broadleaf weeds. The time between application and harvest varies with crop, therefore, see the label for this information. In addition, Stinger is registered in some states but not other states. This information is also on the label.

**Valor (Valent)** is expected to have label approval for dry bulb onions and sweetpotato in the next few months. The sweetpotato label is expected to allow Valor to be applied preplant within 2 to 5 days of transplanting at up to 2.5 ounces per acre. Extensive testing has occurred with Valor and the Beauregard variety of sweetpotato with no injury being observed with this application. However, Valor will cause injury to sweetpotatoes if applied over the top of the crop. Use of transplants that are high quality is important with Valor and all herbicides. Onions will also be on the Valor label. The application timing of Valor in transplanted onions will be between the 2-leaf and 6-leaf stage and on direct seed onions between the 3-leaf and 6-leaf stage.

Several weeds are increasing in Georgia and the rest of the southeastern U.S. They include nutsedge, purslane (pink and common), pigweed (livid, Palmer), groundcherries, and wild radish. Thus, consider developing scouting programs and management programs that can be utilized to control these weeds.
Due to introduction of new products and lack of availability of traditional ones, fertilizer materials have changed quite a bit in the last couple of years. Liquid slow-release fertilizers are now available on the market that can be injected through drip irrigation systems. Also, many of the traditional analysis injectable fertilizers are now made with chloride-based materials, primarily potassium chloride.

Georgia Pacific has introduced a product that was used for the first time during the 2004 season called Nitamin. This product is a 30% nitrogen liquid material that is designed to be released slowly over time. The advantages to using a product of this nature will vary by crop. However, there are several potential advantages to the use of such a product, provided the cost is not considerably greater than traditional formulations.

Studies have been completed on this product in peppers, onions and cabbage. The results of these studies will be presented. These studies basically have shown that in some crops the slow-release material can be used in a single injection event at planting without supplemental fertilizer without causing a decline in yield below that with a standard fertility program. In cabbage and onions, the use of only 75% of the recommended rate of nitrogen was enough with the slow-release material to produce yields equal or better to using 100% of the recommended rate of nitrogen through standard fertility treatments. The results on pepper were not quite as conclusive, although there was an increase in yield by applying all the slow-release fertilizer at planting versus using season-long applications of standard quick-release materials.

The advantages to using these slow-release materials will depend on the type of crop being produced. In bare ground culture crops that are grown in the winter months, the advantages can be significant. By using a slow-release fertilizer, growers do not have to count on suitable field conditions being prevalent for side dress applications through the wettest months of the season.

In drip irrigated crops, the grower can make fewer applications of fertilizer and be sure that fertilizer is available to the crop without interruption if there is a break down in injection equipment or other delay in fertilizer application. Also, during wetter periods, the irrigation system need not run simply to inject fertilizer. Another advantage is that the materials are not constantly leached out of the root zone by less concentrated more frequent applications.

In regard to chloride-based materials, it has long been a widely held belief that chloride fertilizers damage the quality and shelf life of vegetable crops. Therefore, growers have tended to stay away from the less expensive chloride-based fertilizers. It is common practice on the west coast to use chloride-based materials. While potassium nitrate may have a higher salt index and thus create some potential for salt accumulation in the soil, the chances of a chlorine toxicity or a problem from chloride fertilizers affecting yield and quality are almost nonexistent.

Basically, the only vegetables that run a high risk of decreased quality and shelf life from the use of chloride-based fertilizers are Irish potatoes and some root crops. Excess chlorine can affect the specific gravity of Irish potatoes. However, there is no evidence to support the myth that chlorine will otherwise decrease the quality and shelf life of other vegetables. Therefore, since chlorine-based materials are cheaper and more readily available, there should be nothing
wrong with using these materials as part of a routine vegetable fertility program. As long as the
amount supplied is along the same lines as crop demand, there should be no problems with these
materials.
In the past several years it has been reported that Admire insecticide may indeed provide some type of early season stimulant in plant growth in various types of vegetables including cucurbits, peppers, tomatoes, and crucifers. It is not clearly understood by company officials or researchers as to why this growth stimulation occurs. The objective of this one study was to determine if indeed there was a growth response that resulted in a yield increase in seedless watermelons.

The objective of this trial was to determine if a yield response could be seen with using Admire at the rates of 6 ounces, 16 ounces, and 32 ounces per acre applied as an immediate post transplant drench around the plant. These watermelons were planted into a methyl bromide fumigated bed and covered in plastic mulch approximately 12 inches wide. The treatments were watered immediately after application by overhead irrigation. A second trial was initiated comparing Admire at 16 ounces with Platinum insecticide at 8 ounces per acre as a post transplant drench.

Results from these trials were variable, but observations were made as to possible earliness factors attributed to these insecticides.
YELLOW NUTSEDGE CONTROL WITH METHAM-SODIUM IN TRANSPLANTED CANTALOUPE

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Vegetable growers are losing the broad-spectrum soil fumigant methyl bromide. The regulatory circumstances surrounding the impending cancellation of methyl bromide are well documented. Efforts are on-going to extend the deadline for using methyl bromide until suitable alternatives are developed. Preliminary research showed that perennial nutsedges in these crops could be controlled with metham-sodium fumigation. However, specific questions have not been fully answered regarding rates, application timing, and plastic mulching when using metham-sodium for weed control.

Trials were conducted from 2001 to 2003 at the Coastal Plain Experiment Station Ponder Farm on transplanted cantaloupe to answer the questions regarding metham-sodium fumigation for yellow nutsedge weed control. The trial evaluated all possible combinations of three metham-sodium rates (nontreated, $\frac{1}{2}$x rate, and 1x rate), preplant fumigation intervals (1-wk, 2-wk, or 3-wk before transplanting), and plastic mulching (bare-ground or plastic covered beds). Metham-sodium was applied with a specialized power tiller designed and modified by Mr. Dan Evarts, USDA-ARS. Sites where these trials were conducted had heavy natural infestations of yellow nutsedge (>100 plants/m²).

Over the three year term of this experiment, yellow nutsedge control was not affected by time of metham-sodium application (Table 1). However, metham-sodium rates and plastic mulching significantly affected yellow nutsedge control. Metham-sodium at the $\frac{1}{2}$x rate and 1x rate effectively controlled yellow nutsedge (84 to 85%) when seedbeds were covered with plastic mulch. However, on bare-ground seedbeds, the 1x rate of metham-sodium was more effective (75%) in controlling yellow nutsedge than the $\frac{1}{2}$x rate (59%). Interestingly, the $\frac{1}{2}$x rate of metham-sodium with plastic mulch covered seedbeds controlled yellow nutsedge (84%) better than the 1x rate on bareground (75%). In addition, nontreated plots covered with plastic mulch had yellow nutsedge control (74%) similar to bareground plots treated with the 1x rate of metham-sodium (75%).

Generally, there was very little visual injury from metham-sodium application during this three year study (Table 2). Metham-sodium applications as soon as 1-wk before transplanting caused only 1.1 to 1.8% visual injury. Applications 2-wk prior to transplanting were even less injurious; 0 to 0.4% visual injury. There was an abnormality in data from $\frac{1}{2}$x rate of metham-sodium applied 3-wk before transplanting, with 3.6% visual injury to cantaloupe compared to 0.7% visual injury from the 1x rate.

Total cantaloupe yield, whether expressed as number of fruits or weight of fruits, showed the treatment combinations that provided the best combination of yellow nutsedge control and crop safety margin (Table 2). There was no effect of plastic mulching on cantaloupe yield. This shows that despite the improved yellow nutsedge control when seedbeds were covered with plastic mulch, there was no yield response. This infers that yellow nutsedge is not overly...
competitive with transplanted cantaloupe in this system of vegetable crop production. Of all the treatments evaluated, the greatest cantaloupe yield was in plots treated with 1x rate of metham-sodium at either 1-wk or 2-wk before transplanting. The lowest cantaloupe yield of all treatments evaluated was in the nontreated control.

These data show the value of metham-sodium and plastic mulch for yellow nutsedge control in transplanted cantaloupe. Superior yellow nutsedge control and increased cantaloupe yield is provided by a 1x rate of metham-sodium (with or without plastic mulch). Using these two treatment combinations, applications 1-wk or 2-wk before transplanting were the most effective treatment combinations and were not overly injurious. It should be noted that the metham-sodium registration does not allow for crop seeding/transplanting within three weeks of treatment due to potential for crop injury. However, these data suggest that the registration can be modified with further research, adding flexibility to metham-sodium use in transplanted cantaloupe.

Citations


Webster, T. M. 2005. Mulch type affects growth and tuber production of yellow nutsedge (Cyperus esculentus) and purple nutsedge (Cyperus rotundus). Weed Sci. (in press).
CONTROL OF STORAGE ROTS OF ONION WITH FUNGICIDES

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Introduction

Botrytis neck rot (BNR) causes significant losses in onions that stored in controlled atmosphere or refrigerator rooms. It is believed that infection of the onions takes place in the field prior to harvest and disease develops over the period that the onions are stored, resulting in a decrease in the number of marketable onions taken out of storage. An experiment was conducted to evaluate fungicides applied during the growing season for the control of post-harvest BNR, as well as pink root (PR), caused by the soilborne fungus, Phoma terrestris.

Materials and Methods

A trial was conducted at the Horticulture Research Farm (Hort Hill) in Tifton, GA. Onions (Allium cepa ‘Sweet Vidalia) were transplanted into 4-row beds on November 21, 2003. Beds were spaced on 6 foot centers, and row spacing on individual beds was 12 inches. Plant spacing within rows was 6 inches. Fertility, weed, and insect control was carried out according to guidelines published by the Georgia Cooperative Extension Service. Each plot consisted of a single 20-foot bed with a 5-foot buffer between plots. The experimental design was a randomized complete-block with 5 replications.

Fungicide applications were initiated on January 14, 2004 and continued on a 7-day spray schedule until April 1 for a total of 12 applications. All materials were applied with a CO2-powered backpack sprayer using a 4-nozzle spray boom with 18-inch nozzle spacing. Hollow cone nozzles (TSX-18) were used, and application volume was 40 gallons per acre (GPA). Cuprofix Disperss 20DF was applied bi-weekly at a rate of 3 lb/A to all fungicide treatments to suppress bacterial diseases, and all fungicide treatments were tank-mixed with Bravo WeatherStik 720SC at 1.5 pt/A.

The center two rows of each plot were harvested on May 5, and onions were cured for 72 hours at 98°F before weighing. Due to high levels of sourskin at harvest, onions were not graded. Following the grading process, onions were stored for 5 months at 38°F, and then removed and evaluated for the presence of BNR.

Results and Discussion

Levels of BNR at were high in the field at Hort Hill, which has a history of severe soilborne disease. In general, the fungicide programs employed in this experiment significantly reduced the severity of pink root (PR) on bulbs at the end of the growing season (Table 1). Full season applications of Rovral reduced PR as effectively as the majority of the Pristine programs; however, fewer applications were needed with Pristine to achieve similar levels of disease control. Two applications of Pristine, one at the beginning of the spray program and one at mid-season, were as effective as full-season applications of Pristine for the control of PR. Applications initiated at mid-season were less effective than full season applications of Pristine. No significant difference in yield between any treatment was observed.
Evaluation of onions that had been stored for 5 months for severity of Botrytis neck rot (BNR) showed trends that were similar to those observed for PR. Onions treated full-season with Pristine had a ten-fold reduction in BNR compared to the untreated check or the Rovral spray program (Table 2). Programs with as few as two applications of Pristine, one made at the initiation of the program and one at mid-season, were as effective as full-season applications of Pristine.

Pristine appears to be a potent tool for management of soilborne diseases of onion, and can be effective when applied at strategic points during the onion growing season. Because Pristine is a pre-mix of pyraclostrobin and boscalid, it provides broad-spectrum suppression of important foliar fungal pathogens as well. Further work is needed to identify optimal rates of the material for effective and economical management of PR and BNR.
BOLTING OF SWEET ONIONS IS AFFECTED BY NITROGEN FERTILIZATION AND MULCH

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Seed-stem formation (“bolting”) in onion (*Allium cepa* L.) produces poor quality bulbs with a hard center making them unmarketable (Rabinowitch, 1990). In Georgia, the production of 'Vidalia' type sweet onions may be severely limited by bolting, depending on the cultivar and the environmental conditions during the growing season (R.L. Torrance, personal comm.).

Plant age and several environmental factors influence the flowering process in onion plants (Brewster, 1997; Rabinowitch, 1990; Roberts et al., 1997; Scully et al., 1945). Although temperature and photoperiod both are important environmental factors affecting onion bolting (Brewster, 1997; Roberts et al., 1997), temperature has the greatest influence on inflorescence initiation and development (Rabinowitch, 1990). Flower initiation, however, occurs only after the emergence of a certain number of leaves, depending on the cultivar, followed by exposure of the plant to low, vernalizing temperatures (Brewster, 1985). Other factors affecting bolting include nitrogen and phosphorus fertilization (Brewster, 1983; Paterson et al., 1960; Stuart and Griffin, 1946). Bolting is usually variable from year to year and among cultivars (Rabinowitch, 1990).

Objective

The objective was to determine the relationship of bolting with rates of nitrogen fertilization.

Materials and Methods

The study was conducted at the Horticulture Farm, University of Georgia, Coastal Plain Experiment Station, Tifton, Ga. on a Tifton Sandy Loam soil (a fine loamy, siliceous thermic Plinthic Paledults) with a pH of 6.5-6.8. Rye cover crop was used to minimize fertility differences among the plots prior to onion sowing. Onion was direct-seeded on wide beds formed on 6-ft centers. Plants were spaced 6-inch apart within rows on beds having four rows, with a 9 inch separation between rows, and a final plant density of 58,000 plants/acre. The design was a split plot, with N fertility rate (range = 91 lb/acre to 297 lb/acre) as the main plot and cultivar as the sub-plot. The cultivars used were 'Granex-33', 'Pegasus' and 'Cyclops' (all from Seminis Vegetable Seeds, Staticoy, Calif.). The N rates recommended in the Vidalia onion production area are 138-161 lb/acre (Boyhan et al., 2001; Boyhan and Torrance, 2002).

Plants were harvested when 20% of the necks of each cultivar had collapsed (tops down). Whole plants (bulb + top) and bulbs were weighed immediately after the plants were removed from the soil and submitted to curing. Bulbs were cured for 2 d in a greenhouse and 5 d in a
dryer at 99 °F air temperature (50% to 65% RH) and a linear air velocity of 16 ft min⁻¹ through the stack of onions (Boyhan et al., 2001). After curing, bulbs were graded by size and appearance, counted and weighed. Bulbs were graded into grades as marketable (U.S. No. 1, U.S. No. 2) and culls (USDA, 1995). Bulb decay incidence was determined as the percent bulbs with any visible decay relative to the total number of bulbs. Prior to storage, bulbs and shoots were sampled for tissue N analysis. Tissue N content was determined by the copper catalyst Kjeldahl method (AOAC, 1990).

Results

The results of this report include information of two reports recently published (Díaz-Pérez et al. 2003 and 2004). Shoot and bulb N content increased with increasing N rates, but there were no differences in the respective shoot and bulb N contents among cultivars. Bolting incidence declined steadily with increasing N fertilization rates up to 176 lb/acre N. Bolting incidence was among the highest in the cultivar Pegasus. In an additional study, we found that onion bolting was higher in plants grown on wheat straw, compared to plant on either black plastic mulch or bare soil. The increased bolting of plants on wheat straw was associated to decreased leaf nitrogen content.

The percent of decayed bulbs also increased at a steady rate with the rate of N applied. Total (6.6 ton/acre) and marketable (0.35 t·ha⁻¹) yields at the lowest N rate (91 lb/acre N) were lower ($P < 0.01$) than those at higher N rates. Rates of N higher than 129 lb/acre had no significant effect on either total (mean = 15 ton/acre) or marketable (mean = 9.6 ton/acre) yields. Losses in marketable yield were primarily a combination of bolting and bulb decay and were minimized at 145 lb/acre N. Yield losses at low N rates were mostly due to bolting while yield losses at high N rates were mostly due to decay. Thus, excess applications of N fertilizer should be avoided since they have little effect on yields or bolting but they increase bulb decay.

Conclusions

Data from five growing seasons show that bolting decrease with increasing nitrogen fertilization. These results suggest that management of nitrogen fertilization (preventing exposing plants to nitrogen stress) may be a tool to reduce onion bolting. Excessive applications of nitrogen fertilizer (higher than 176 lb/acre) are not recommended since they may increase bulb decay.
References


During the fall of 2004, Chateau herbicide became registered for use in transplant onion production. Chateau is a new product to many Georgia producers but has the same active ingredient as the herbicide Valor. Valor, as many growers are already familiar with, is an effective herbicide that is currently labeled for use in peanut and cotton. Experiments are currently being conducted to determine transplant onion tolerance and weed control when applying Chateau on Georgia soils. Data is being collected and will be reported at the Georgia Fruit and Vegetable Growers annual meeting addressing the following questions. 1) When is the most effective time to apply Chateau relative to onion transplanting?, 2) What rate of Chateau is needed to provide adequate weed control without causing crop injury?, 3) Do various cultivars respond similarly to Chateau?, and 4) Are other herbicides needed in transplant onion if Chateau is applied timely and activated by rainfall or irrigation.

Weed management is currently a limiting factor in the production of seeded onion. Efforts to develop effective programs are underway and have been effective thus far in the 2004 crop. The most effective systems to date for the control of troublesome weeds such as cutleaf eveningprimrose include the herbicides Dacthal, Prowl, and Goal as well as the fumigant metam (Vapam, K-Pam, other). Data is currently being collected to determine the most effective rates of these pesticides and when they should be applied as to provide economical weed control without crop injury in seeded onion. Results from these trials will be reported at the annual meeting as well.
ONION VARIETIES, FERTILITY & FUTURE WORK

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Statesboro, GA 30460

In 2004 we completed 6 years of onion variety trials at the Vidalia Onion and Vegetable Research Center with 5 years of trials used in consideration of new and existing varieties for the official Georgia Department of Agriculture variety list. The 2004 variety trial had 35 entries evaluated from 10 different seed companies. This year we expect to have 49 entries in the trial. This will be the most we have trialed and probably represents the most we can handle in any one year.

The trial in 2004 had total yields that ranged from 433 50-lb bags per acre to 1,235 50-lb bags per acre for ‘Sweet Vidalia’ and ‘XON-303Y’, respectively (Table 1). The relative range in total yield is in part due to the number of seedstems a specific variety produced.

Jumbo yields ranged from 199 50-lb bags/acre for ‘Sweet Vidalia’ to 1005 50-lb bags/acre for ‘WI-3115’. These yields also appeared to be influenced by seedstem formation. The jumbo size class is the most important for growers because it usually commands the highest prices. Where total yield may be indicative of a varieties yield potential it is jumbo yield that matters most for growers’ bottom line.

This year’s trial was marked by a high number of seedstems, which was the result of cool temperatures in March with plants large enough to respond by going into a reproductive mode. This was exacerbated by earlier then normal transplanting due to early seeding (September 15, 2003) and warm fall weather.

This year was also marked by unacceptable performance of variety WI-609, which is an early Japanese overwintering type. In our trials this variety was not harvested until the third harvest on April 19, 2004. Usually it would be among the first harvested. In addition, the bulbs remained soft and many were misshaped having bulb lengths that exceeded their widths. We also received reports from many growers and buyers of poor performance. Some growers were reporting 40% culls within this variety. In addition, some buyers were requesting that ‘609s’ no longer be sent as part of any shipments. In consideration that as much as 20% of the crop had been planted to ‘WI-609’, it was recommended that this variety and its sister line ‘WI-3115’ be removed from the approved Vidalia onion variety list. In addition, no recommendations were made to add additional varieties in the Japanese overwintering class.

Three years of research into effects of nitrogen, phosphorus, and potassium fertilizer affect on onion yield and leaf tissue concentration are summarized in tables 2, 3, and 4. Nitrogen application up to 168 kg•ha⁻¹ (150 lbs/acre) increased total onion yields, however, neither phosphorus nor potassium affected yield. Phosphorus rates from 0-300 lbs/acre of P₂O₅ (0-131
Phosphorus fertilizer affect on jumbo yield was significant, however, it is difficult to interpret the meaning of these results. Low rates along with rates of 300 lbs/acre P\textsubscript{2}O\textsubscript{5} had the highest yields of jumbo. This effect was more pronounced in 2002 then in 2003 suggesting it is an anomaly of the data. Potassium had no effect on total yield, jumbo yield, or yield of medium onions.

Fertility research in 2004 confirms these findings. These findings will shortly be incorporated into soil test recommendations for dry bulb onions.

Variety trials will still be a primary focus of research in the future. Future work will also continue to evaluate fertility practices particularly as new products are offered to growers. Direct seeding onions has proven to be a cost effective alternative for growers and fertility practices research will continue in this area. Transplanting date research was begun last year and will be expanded to evaluate more varieties and will include plantbed seeding dates as well as transplanting dates. There has been some interest on how different varieties respond to different plantbed seeding dates as well as transplanting dates. In particular, how this affects seedstems and double formation. Transplant size is also of interest and appears to affect seedstem formation in particular. Larger transplants are more prone to seedstem formation, while small transplants have reduced yield and vigor.

I am always interested in hearing from growers and other interested parties for suggestions for future research. Growers in particular are encouraged to bring their problem to the University to see if research efforts may be helpful.
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<th>Entry</th>
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<th>Mediums (50-lb bags/Acre)</th>
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Table 2. Effect of nitrogen fertilizer rates on yield, graded yield, and tissue nutrient levels in short-day onions, 2000-2002.

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<tr>
<th>Fertilizer rates(^z) (kg•ha(^{-1}))</th>
<th>Total yield(^y) (kg•ha(^{-1}))</th>
<th>Jumbos(^x) (≥ 3 in.)</th>
<th>Mediums(^x) (≥ 2 and &lt; 3 in.)</th>
<th>Leaf tissue (mg•g(^{-1}))</th>
<th>N</th>
<th>P</th>
<th>K</th>
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Probabilities

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\(^z\)Multiple by 0.892 to convert to lbs/acre
\(^y\)Multiple by 0.01784 to convert to 50-lb bags/acre.
\(^x\)Jumbos ≥3 in., Mediums ≥2 and <3 in.
Table 3. Effect of phosphorus fertilizer rates on yield, graded yield, and tissue nutrient levels.

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<th>Fertilizer rates (kg•ha⁻¹)</th>
<th>Total yield (kg•ha⁻¹)</th>
<th>Jumbos³</th>
<th>Mediums³</th>
<th>Leaf tissue (mg•g⁻¹)</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
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<td>74</td>
<td>37,381</td>
<td>8,851</td>
<td>1,719</td>
<td></td>
<td>39.1</td>
<td>6.6</td>
<td>38.8</td>
<td>8.6</td>
<td>8.2</td>
</tr>
<tr>
<td>103</td>
<td>38,648</td>
<td>9,807</td>
<td>1,384</td>
<td></td>
<td>38.7</td>
<td>6.6</td>
<td>44.0</td>
<td>9.7</td>
<td>9.2</td>
</tr>
<tr>
<td>131</td>
<td>40,794</td>
<td>13,571</td>
<td>1,180</td>
<td></td>
<td>38.7</td>
<td>6.6</td>
<td>44.0</td>
<td>9.7</td>
<td>9.2</td>
</tr>
</tbody>
</table>

Probabilities

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>0.833</th>
<th>0.016</th>
<th>0.020</th>
<th>0.851</th>
<th>0.060</th>
<th>0.282</th>
<th>0.490</th>
<th>0.309</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year</td>
<td>0.001</td>
<td>0.027</td>
<td>0.426</td>
<td>0.342</td>
<td>0.054</td>
<td>0.121</td>
<td>0.594</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Treatment x Year</td>
<td>0.516</td>
<td>0.961</td>
<td>0.978</td>
<td>0.531</td>
<td>0.110</td>
<td>0.917</td>
<td>0.753</td>
<td>0.071</td>
</tr>
<tr>
<td>Linear</td>
<td></td>
<td>0.438</td>
<td>0.049</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Quadratic</td>
<td></td>
<td>0.231</td>
<td>0.335</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cubic</td>
<td></td>
<td>0.246</td>
<td>0.290</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

²Multiple by 2.29 to convert to lbs/acre P₂O₅

³Multiple by 0.01784 to convert to 50-lb bags/acre.

³Jumbos ≥3 in., Mediums ≥2 and <3 in.
Table 4. Effect of potassium fertilizer rates on yield, graded yield, and tissue nutrient levels of short-day onions, 2000-2003.

<table>
<thead>
<tr>
<th>Fertilizer rates$^z$ (kg•ha$^{-1}$)</th>
<th>Total yield$^y$ (kg•ha$^{-1}$)</th>
<th>Leaf tissue (mg•g$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jumbos$^xx$</td>
<td>Mediums$^xx$</td>
</tr>
<tr>
<td>0</td>
<td>38,183</td>
<td>17,283</td>
</tr>
<tr>
<td>58</td>
<td>39,507</td>
<td>12,476</td>
</tr>
<tr>
<td>83</td>
<td>42,752</td>
<td>16,826</td>
</tr>
<tr>
<td>108</td>
<td>46,542</td>
<td>26,175</td>
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<tr>
<td>133</td>
<td>38,263</td>
<td>15,866</td>
</tr>
<tr>
<td>158</td>
<td>36,711</td>
<td>16,545</td>
</tr>
</tbody>
</table>

Probabilities

<table>
<thead>
<tr>
<th>Probabilities</th>
<th>Treatment</th>
<th>Year</th>
<th>Treatment x Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.637</td>
<td>0.000</td>
<td>0.892</td>
</tr>
<tr>
<td></td>
<td>0.174</td>
<td>0.000</td>
<td>0.797</td>
</tr>
<tr>
<td></td>
<td>0.281</td>
<td>0.001</td>
<td>0.812</td>
</tr>
<tr>
<td></td>
<td>0.683</td>
<td>0.003</td>
<td>0.256</td>
</tr>
<tr>
<td></td>
<td>0.550</td>
<td>0.001</td>
<td>0.462</td>
</tr>
<tr>
<td></td>
<td>0.196</td>
<td>0.000</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>0.397</td>
<td>0.012</td>
<td>0.239</td>
</tr>
<tr>
<td></td>
<td>0.694</td>
<td>0.001</td>
<td>0.362</td>
</tr>
</tbody>
</table>

$^z$Multiple by 1.20 to convert to lbs/acre
$^y$Multiple by 0.01784 to convert to 50-lb bags/acre.
$^x$Jumbos ≥3 in., Mediums ≥2 and <3 in.
The events of September 11, 2001, and subsequent anthrax incidents have given rise to concerns about unconventional terrorist attacks, including the threat of attacks on the U.S. food supply. The Federal government responded with the passage of the Bioterrorism Act of 2002, which requires all packers and shippers of fresh produce to register their facilities with FDA. They are also required to establish and maintain records to identify the immediate previous sources and the immediate subsequent recipients of fresh produce (i.e., where it came from and who received it).

In recent years media attention has heightened consumer awareness of produce biosecurity. Today, third-party auditors require a client to pass not only the GAP (Good Agricultural Practices) portion of their food safety audit, but also the section on produce biosecurity, which has been added in the last few years. Fresh produce is particularly vulnerable to bioterrorism because it is usually eaten raw or in the minimally processed (fresh-cut) stage. It is grown, harvested and packed literally “in the open” and is subject to little inspection. It has no preservation step by which to destroy any intentional contamination by chemical toxins or human microbial pathogens. Therefore, Georgia produce suppliers must be able to document that steps have been taken to prevent intentional contamination of their produce.

The objective of this presentation is to lay out a template or blueprint for ways that a producer might develop and maintain a produce biosecurity plan for his operation using a HACCP-based (food safety) approach.
Introduction

Traceability, Country of Origin and ISO 9000 are all regulatory measures regarded by some countries, especially the Less Developed Countries (LDC) as Technical Barriers to Trade. All these three regulations are covered under the big umbrella of ISO-9000 even though they are treated here as separate entities. The implementation of ISO-9000 is “good business practice” and opens the doors for several marketing opportunities. Country of Origin is the least problematic and easiest to comply with compared to traceability and ISO-9000 that requires well orchestrated record management.

Traceability

Definition of Traceability

There are many definitions for traceability and complete traceability is not possible. According to the ISO 9000 guidelines (Randall, 1995), traceability is “the ability to trace the history, application or location of that which is under consideration. It may refer to the origin of the materials and parts, the processing history and the distribution and location of the product after delivery”. Further and according to Golan et al. (2004) “traceability systems are recordkeeping systems designed to track the flow of product or product attribute through the production process or supply chain” (USDA/ERS, 2004).

Talks about mandatory traceability compliance have been a policy issue for a while now. Proposition about enacting a compulsory system that would trace back animal feed to monitor mad cow disease, improve meat safety, monitor food transportation system and to minimize the risk of tempering, has been in the priority agenda issues of policy makers in different parts of the world. All these propositions have one thing in common: provide adequate information to consumers “on a variety of food attributes including country-of-origin, animal welfare and genetic engineering.”
Objectives and Benefits of Traceability

The advantages of adopting traceability are to improve-supply management; make it easy to traceback for food safety and quality, and to detect any quality problem before the product reaches the market. Some of the benefit of adopting traceability includes minimizing the production and marketing of unsafe and inferior quality goods, lower-cost distribution system, minimize the cost of recalls, increasing market niche, reduce potential for bad publicity, reduce liability and increasing overall net revenue of the implementing company (USDA/ERS, 2004).

The concept of traceability is not new. It was introduced in the produce industry as far back as in the early 20th century, e.g. in 1930, Congress passed the Perishable Agricultural Commodities Act (PACA). PACA then became the first recordkeeping requirement in the fresh produce traceability system at the shipper level. Multinational companies supplying fresh fruits and vegetables to Europe have figured out the advantages in adopting these regulatory policies on a timely basis and are usually quick in implementing them. These companies have put in place a system whereby they can monitor the their product from the farm through the packing shed all the way to the final consumer. Effective traceability should cover three main areas: breadth, depth and precision. Breadth refers the amount of information the system has to record. Depth refers to how far back or forward the system should cover. Precision refers to the unit of anaylsis such as container, truck, crate, day of production, shift or any other unit (USDA/ERS, 2004).

Cost of Traceability

Record management is costly and the cost varies with the complexities involved in the data collection and production. The cost further varies from company to company, i.e. from small, medium or large company. Record keeping, labor cost, training and stationeries are all expensive but must be incurred to set up this program. Traceability is a lot easier with horticultural products than other commodities. Table 1 shows some factors affecting benefits and costs of traceability.

<table>
<thead>
<tr>
<th>Factors Affecting Benefits</th>
<th>Factors Affecting Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>The higher the value of coordination along the supply chain, the larger the benefits of traceability for supply-side management.</td>
<td>The wider the breadth of traceability, the more information to record and the higher the costs of traceability</td>
</tr>
<tr>
<td>The larger the market, the larger the benefits of traceability for supply side management, safety and quality control, and credence attribute marketing.</td>
<td>The greater the depth and the number of transactions, the higher the costs of traceability</td>
</tr>
<tr>
<td>The higher the value of the food product, the larger the benefits of traceability for safety and quality control.</td>
<td>The greater the precision, the smaller and more exacting the tracking units, the higher the costs of traceability.</td>
</tr>
<tr>
<td>The higher the likelihood of safety or</td>
<td>The greater the degree of product</td>
</tr>
</tbody>
</table>
quality failure, the larger the benefits of reducing the extent of failure with traceability systems for safety and quality control.  

Table: 

<table>
<thead>
<tr>
<th>Quality or Safety Failure Penalties</th>
<th>Traceability System Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>The higher the penalty for safety or quality failures, where penalties include loss of market, legal expenses, or government mandated fines, the greater the benefits of reducing the extent of safety or quality failures with traceability.</td>
<td>The larger the number of new segregation or identity preservation activities, the higher the costs of traceability.</td>
</tr>
<tr>
<td>The higher the expected premiums, the larger the benefits of traceability for credence attribute marketing.</td>
<td>The larger the number of new accounting systems and procedures, the more expensive the start up costs of traceability.</td>
</tr>
<tr>
<td>The greater the technological difficulties of tracking, the higher the cost of traceability.</td>
<td></td>
</tr>
</tbody>
</table>


**Country of Origin Labeling (COOL)**

The Country of Origin labeling (COOL) for beef, lamb, pork, fish, perishable agricultural commodities and peanuts was initiated on May 13, 2002 when President Bush signed the Farm Security and Rural Investment Act popularly known as 2002 Farm Bill. This was actually a legislative amendment of the Agricultural Marketing Act of 1946, which did not include COOL in Public Law 107-171. In October 2003, the mandatory COOL was proposed to be enacted on or before September 2004. President Bush further signed Public Law 108-199 on January 27, 2004, postponing the mandatory COOL to September 30, 2006. Unfortunately, wild and farm-raised fish and shellfish were excluded in Law 108-199. The USDA’s Agricultural Marketing Service has been sanctioned with the implementation of COOL (Fonsah, 2004; USDA/ERS, 2004).

**Objective of COOL**

The purpose of COOL is simply to provide consumers with more information in respect to the country where the fruits and vegetable in our case originated.

**Exemptions**

Although this labeling law includes beef, pork, lamb, fish, shellfish, fresh fruit, vegetables and peanuts, “it is not required if these foods are ingredients in processed food items or are a combination of substantive food components”. Bacon, orange juice, peanut butter, bagged salad, seafood medley and mixed nuts typify processed products excluded from this law. Further exemptions include food service businesses such as restaurants, food stands, salad bars, grocery
stores with an annual sales less than $230,000 of fruits and vegetables, retail food stores, butcher shops and fish markets that does not stock fruits and vegetables and similar businesses (Fonsah, 2004; USDA/ERS, 2004).

**Record Keeping**

Simplistically, COOL is record keeping. Farmers who already have good records are already covered and can declare and claim country-of-origin compliance so long as their records can be verified and audited to ensure the integrity of the traceability system and claim. If the commodity originated from a foreign country, the traceability system should provide enough information as far as to the port of entry into the United States. Although firms have the flexibility on which information to provide, it is important and required that the record be maintained for a minimum of two hours (Fonsah, 2004; USDA/ERS, 2004).

Table 2 below shows some of the documents required from grower/producers, packer/shipper/processors and wholesaler/distributors for COOL verification purposes. The documents listed below are not conclusive, they might be additional requirements not found in the table.

<table>
<thead>
<tr>
<th><strong>Table 2: Perishable Agricultural Commodity</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grower/Producer</strong></td>
</tr>
<tr>
<td><strong>Responsibility</strong></td>
</tr>
<tr>
<td>Provide enough information for an auditor to identify the county, state, and/or country where the product was grown</td>
</tr>
<tr>
<td><strong>Examples of Records and Activities that may be useful</strong></td>
</tr>
<tr>
<td>Official Inspection Certificates</td>
</tr>
<tr>
<td>Confirmation and Memorandums of Sales</td>
</tr>
<tr>
<td>Harvest Records</td>
</tr>
<tr>
<td>Delivery Tickets</td>
</tr>
<tr>
<td>Pesticide application record</td>
</tr>
<tr>
<td>Copies of statement (bills) of sales to customers</td>
</tr>
<tr>
<td>Purchase Records</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Lost and damage claims documents</td>
</tr>
<tr>
<td>Production and Sales Contracts</td>
</tr>
<tr>
<td>Production Records</td>
</tr>
<tr>
<td>Sales tickets</td>
</tr>
<tr>
<td>Carrier Manifest</td>
</tr>
<tr>
<td>Bill of Lading</td>
</tr>
<tr>
<td>Pick tickets</td>
</tr>
<tr>
<td>Ledger records of sales</td>
</tr>
</tbody>
</table>


The mandatory country of origin (COOL) labeling requirement is a policy that would be beneficial for U.S. produce growers if adopted. COOL was implemented in Europe for almost two decades ago. Although stringent quality requirement are needed, the EU is still an important market in which there is need for us to expand our exports of fresh fruits and vegetables. The reasons are (1) the euro is a hard currency and is now appreciated against the US dollars, thus, an increasing purchasing power parity (2) they have a stable banking and financial institutions and system. (3) the EU member countries, Canada and Japan who are currently the dominant demand-side factors for fruits and vegetables trade, are willing to pay for better quality products all year round (4) the US still remain one of the best producer of quality agricultural food commodity in the world, therefore meeting quality requirement should pose little or no problem to us at all.

Adopting the mandatory COOL and other requirements such as traceability would enable the U.S. to take advantage of these and other markets the world over.

**International Standard Organization (ISO-9000)**

ISO means The International Organization for Standardization. The head quarter is in Geneva. When Europe started thinking of unifying into a single economic marketplace to improve the free movement of goods and services in the European Community (EC), the need to standardized quality requirements for certain product became apparent. That need to create standardized quality assurance in Europe also known as EC-92 was the birth of the International Standard Organization (ISO). ISO 9000 is a guide “geared primarily toward discussing the practical quality concepts and principles necessary to develop and implement the ISO-9000 compliant quality system”.

Benefits Associated With ISO-9000 Compliance

According to Randall (1995) and after analyzing the concepts of corporate strategy, one will realize the following benefits associated with the implementation of ISO-9000:

a) The efficiency of all agricultural or manufacturing operations will be improved.
b) Optimization of company structure and operational integrity
c) Drastically improved the use of company time and materials
d) The model will assist in clearly defining the responsibility of individuals, departments, and systems etc.
e) Communication and quality of information will be improved
f) Good records management can clear the company from litigations.
g) Formulated systems with consistent quality, punctual delivery and a framework for future quality improvement.
h) Documented systems with useful reference and training tools.
i) Minimize rejects, repeated work and warranty costs
j) Reduce, detect and correct errors at an earlier stage, thus, less scrap and losses
k) Maintain and improved good relationships with customers and suppliers.
l) Ability to tender for ISO 9000 contracts at home and abroad.

The ISO 9000 Models

ISO models are guidelines that define specific minimum quality requirement for manufactured or horticultural products or services. Since there is no correct way of compliance, companies have the flexibility to design their quality assurance program based on their company objectives.

The following are examples:


ISO 9003:1994: refers to “Quality Systems–Model for Quality Assurance in Final Inspection and Test”. This model does not include Design/Development, Production and Installation and Servicing. It is concentrated in the Final Inspection and Test only.
ISO Standards Requirements

The ISO Standards require the following documents or record proof of the following: management responsibility, quality system, contract review, design control, document and data control, purchasing, control of customer-supplied product, product identification and traceability, process control, inspection and testing, control of inspection, measuring and test equipment, control of nonconforming product, corrective and preventive action, handling, storage, packaging, preservation and delivery, control of quality records, internal quality audits, training, and etc.

Technically, traceability and country of origin are segments of ISO-9000. A company that is ISO-9000 certified will definitely satisfy both traceability and COOL because these two regulatory measures are well covered in ISO-9000 requirements.

Conclusion

It is imperative that growers start thinking of adopting COOL, especially those who plan to put their fresh produce into the NAFTA markets (Canada, Mexico) and international markets such as the EU and Asia. The early adopters will definitely benefit before intra-competition sets into the equation. Larger companies who are ISO-9000 certified would even benefit more because, both traceability and COOL requirements are already incorporated in ISO-9000 and this would give the early adopters the flexibility to penetrate any markets in the world. In a nutshell, compliance of the ISO-9000 is looked at as “good business practice” and strategy.
Citations


A NEW PUMPKIN VARIETY FOR ADVERSE CONDITIONS

George Boyhan, Gerard Krewer, Darbie Granberry
Department of Horticulture
University of Georgia
East Georgia Extension Center
PO Box 8112, GSU
Statesboro, GA 30460

Pumpkins are an important crop for fall sales during the Halloween season. Retail outlets throughout the U.S. including Georgia will have pumpkins for sale at this time. Unfortunately, due to the high disease pressure in south Georgia, pumpkin production is not possible. Diseases such as downy mildew, powdery mildew, and particularly virus diseases preclude their production.

In 1996 seed of *Cucurbita moschata* (related to pumpkin, *C. pepo*) were collected from Brazil and became the starting material for the development of a disease resistant pumpkin for south Georgia production. Field selection for superior pumpkin quality was carried out from 1997 to 2002. During the winter of 2002-03 superior lines of this material were greenhouse grown for controlled self-pollination. Two more years of field selection in 2003 and 2004 were carried out.

In 1996 seed of *Cucurbita moschata* (related to pumpkin, *C. pepo*) were collected from Brazil and became the starting material for the development of a disease resistant pumpkin for south Georgia production. Field selection for superior pumpkin quality was carried out from 1997 to 2002. During the winter of 2002-03 superior lines of this material were greenhouse grown for controlled self-pollination. Two more years of field selection in 2003 and 2004 were carried out.

In the fall of 2003 and again in the spring and fall of 2004 variety trials were conducted comparing advanced breeding lines with conventional pumpkins for yield and disease resistance. Seed of three commercial pumpkins and four advanced breeding lines were direct-seeded on 21 July 2003 at the Vidalia Onion and Vegetable Research Center, in Lyons, GA. The experiment was arranged in a randomized complete block design (RCBD) with 3 replications. Each plot consisted of 10 plants with a between-row spacing of 6 ft. and an in-row spacing of 6 ft. Fertility and weed control followed University of Georgia Cooperative Extension Service recommendations. No fungicides or insecticides were used in this trial. Pumpkins were harvested on 22 October 2003 and each pumpkin was weighed individually. In addition, each plot was evaluated for virus incidence on 3 September 2003 on 1-5 scale with 1-no symptoms of virus and 5-severe virus symptoms.

In the spring of 2004, 2-week old seedlings of 2 commercial pumpkins and 3 advanced lines were planted on 19 May 2004 with an in-row spacing of 6 ft. and a between-row spacing of 12 ft. The experiment was arranged as RCBD with 3 replications. Weed and fertilizer application followed University of Georgia Cooperative Extension Service recommendations. No fungicides or insecticides were used in this trial.

In the spring of 2004, 2-week old seedlings of 2 commercial pumpkins and 3 advanced lines were planted on 19 May 2004 with an in-row spacing of 6 ft. and a between-row spacing of 12 ft. The experiment was arranged as RCBD with 3 replications. Weed and fertilizer application followed University of Georgia Cooperative Extension Service recommendations. No fungicides or insecticides were used in this trial.

On 6 July 2004, 2-week old seedlings of 2 commercial pumpkin varieties and 4 advanced breeding lines were planted and managed as described for the spring 2004 trial. In addition, this trial was treated twice with Quadris fungicide. Pumpkins were harvested on 13 October 2004 with each pumpkin weighed.

In the fall 2003 trial, experimental varieties #8, #6, and #17 yielded significantly more
pumpkin tonnage compared to ‘Merlin’, ‘Gold Strike’, and ‘Magic Lantern’ (Table 1). In addition, variety #12 had higher yield compared to ‘Gold Strike’ and ‘Merlin’, but did not differ from ‘Magic Lantern’. Finally, all four of the experimental varieties had significantly lower incidence of virus symptoms compared to the commercial varieties.

Results for the spring 2004 trial revealed no difference between the experimental lines and the commercial varieties for yield (Table 2). During spring production disease pressure is much lower particularly to virus diseases. This probably explains the lack of differences among the varieties.

Finally, in the most recent trial in the fall of 2004, the two commercial varieties produced no pumpkins while the four experimental varieties produced significant numbers of pumpkins (Table 3). Pumpkin production in the fall even among the experimental varieties produced smaller pumpkins compared to spring production. This is probably due to higher disease pressure. Other factors that could help improve fall production would include better weed, insect, and disease control. Although virus diseases are uncontrollable in the fall, other diseases may be controlled with routine applications of fungicides.
Table 1. Pumpkin variety trial, Fall 2003.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Source</th>
<th>Yield (lbs/acre)</th>
<th>Yield (No./acre)</th>
<th>Average Fruit Weight (lbs)</th>
<th>Fruit Size Range (lbs)</th>
<th>Disease Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merlin</td>
<td>Harris Moran</td>
<td>3,081</td>
<td>484</td>
<td>6.4</td>
<td>2.5-10.2</td>
<td>4.3</td>
</tr>
<tr>
<td>Gold Strike</td>
<td>Rupp</td>
<td>1,416</td>
<td>202</td>
<td>7.0</td>
<td>3.6-12.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Magic Lantern</td>
<td>Harris Moran</td>
<td>7,365</td>
<td>1,210</td>
<td>6.1</td>
<td>1.7-12.7</td>
<td>4.0</td>
</tr>
<tr>
<td>#12</td>
<td>Experimental</td>
<td>13,544</td>
<td>1,734</td>
<td>7.8</td>
<td>1.4-15.7</td>
<td>2.2</td>
</tr>
<tr>
<td>#17</td>
<td>Experimental</td>
<td>24,567</td>
<td>3,630</td>
<td>6.8</td>
<td>2.4-13.9</td>
<td>1.0</td>
</tr>
<tr>
<td>#6</td>
<td>Experimental</td>
<td>23,817</td>
<td>4,638</td>
<td>5.1</td>
<td>1.4-16.6</td>
<td>1.6</td>
</tr>
<tr>
<td>#8</td>
<td>Experimental</td>
<td>30,278</td>
<td>3,832</td>
<td>7.9</td>
<td>1.8-18.7</td>
<td>1.0</td>
</tr>
</tbody>
</table>

CV 36%

Fisher's Protected LSD (p ≤ 0.05) 9,423

Virus Disease Rating: 1-5, 1-no visible symptoms, 5-severe symptoms.

Table 2. Pumpkin Variety Trial, Spring 2004.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Source</th>
<th>Yield (lbs/acre)</th>
<th>Yield (No./acre)</th>
<th>Average Fruit Weight (lbs)</th>
<th>Fruit Size Range (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magic Lantern</td>
<td>Harris Moran</td>
<td>11,624</td>
<td>1,008</td>
<td>11.5</td>
<td>3.3 - 17.6</td>
</tr>
<tr>
<td>Gold Strike</td>
<td>Rupp</td>
<td>11,366</td>
<td>857</td>
<td>13.3</td>
<td>3.4 - 25.9</td>
</tr>
<tr>
<td>#6</td>
<td>Experimental</td>
<td>19,368</td>
<td>2,118</td>
<td>9.1</td>
<td>2.6 - 18.8</td>
</tr>
<tr>
<td>#1 &amp; #8</td>
<td>Experimental</td>
<td>20,837</td>
<td>2,118</td>
<td>9.8</td>
<td>3.0 - 16.2</td>
</tr>
<tr>
<td>17A &amp; 17B</td>
<td>Experimental</td>
<td>25,286</td>
<td>2,470</td>
<td>10.2</td>
<td>1.4 - 21.8</td>
</tr>
</tbody>
</table>

CV 51%

Fisher's Protected LSD (p = 0.05) NS
Table 3. Pumpkin Variety Trial, Fall 2004.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Source</th>
<th>Yield (lbs/acre)</th>
<th>Yield (No./acre)</th>
<th>Average Fruit Weight (lbs)</th>
<th>Fruit Size Range (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold Strike</td>
<td>Harris Moran</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Autumn King</td>
<td>Seeds by Design</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td># 6</td>
<td>Experimental</td>
<td>16,121</td>
<td>2,218</td>
<td>7.3</td>
<td>1.4 - 16.2</td>
</tr>
<tr>
<td>Orange T</td>
<td>Experimental</td>
<td>13,345</td>
<td>1,739</td>
<td>7.7</td>
<td>1.5 - 15.5</td>
</tr>
<tr>
<td>14T</td>
<td>Experimental</td>
<td>16,935</td>
<td>2,319</td>
<td>7.3</td>
<td>1.7 - 18.1</td>
</tr>
<tr>
<td>12 &amp; 17A</td>
<td>Experimental</td>
<td>16,930</td>
<td>2,092</td>
<td>8.1</td>
<td>1.4 - 18.0</td>
</tr>
</tbody>
</table>

CV  57%  51%

Fisher's Protected LSD (p=0.05) 11,000  1,293
While production of broccoli (*Brassica oleracea* var. *italica*) and cauliflower (*Brassica oleracea* var. *botrytis*) has always been technically feasible in Georgia, it is only recently that some producers have become interested in its production. The bulk of production in these crops has traditionally been in California. Because of lighter pest pressure and virtually year-round production, the lower cost of production and consistent supply in the West has made it difficult for growers in the Southeast to compete economically. However, both of these crops can be grown during certain production windows in the Southeast. Basically, there is a short production window in early spring and a slightly longer production window in the fall. In most of the Southeast, temperatures are too cold in mid-winter for successful production as the crops can suffer freeze damage and too hot in mid-summer as the heat reduces quality.

For most of the Southeast, broccoli and cauliflower should be planted from early February through early March. This would result in harvests during the mid April through May time period. In the fall (late summer) the crops should be planted from August through mid-September for harvest in October through early December. Plantings can be established throughout the August to February time period, but the chances of freeze damage are quite high in most areas.

There are numerous varieties of both broccoli and cauliflower. Many have been shown to perform well in the Southeast. Many cauliflower varieties are self-blanching and do not have to be banded to produce a white-curled head. However, there are varieties that are more tolerant of extremes in temperature than others. Both crops can be direct-seeded or transplanted, but transplanting would be recommended in the Southeast to gain time in the growing window and also to produce more uniform stands.

Both crops can be grown on a wide array of soil types and both crops require irrigation for optimum production. Planting densities vary between the crops. Whereas broccoli can be planted in double rows that are on 38 to 42-inch centers with plants spaced six inches apart, cauliflower is usually planted in single rows with an in-row spacing of about 12 inches. Fertilization is similar to cabbage production as both broccoli and cauliflower require a fairly heavy rate of nitrogen. Rates of 175 to 200 pounds per acre of N are used with soils testing medium for P and K receiving about 110 pounds of each.

The most tedious part of production is harvest and handling. Both crops are very perishable and must be cooled fairly quickly after harvest. The storage temperature is 32° F and the crops must be brought to this temperature shortly after harvest or quality will begin to deteriorate. Cauliflower is even more tedious in that it must be handled much more cautiously to prevent bruising of the curds. Cauliflower is usually packed in plastic bags and broccoli is usually iced to preserve quality and protect the crop. The shelf-life on both crops is about two to three weeks at optimum storage conditions.

Pest management is important in both crops as both insects and diseases can be of concern during the growing season. A stringent pest management program is required to prevent crop loss. Weed control is also important, but materials are available to provide adequate chemical weed control.
The feasibility of producing the crop economically could still be questionable with the specific harvest and handling requirements as well as the cost of pest control. However, with transportation costs increasing, the possibility of receiving a viable price for these products grown in the Southeast is becoming more likely.
GETTING STARTED IN GREENHOUSE TOMATO PRODUCTION

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The most important question that a prospective greenhouse tomato grower needs to ask is “is the greenhouse tomato business really for me?” Success depends entirely on the management skills of the grower. Daily attention is required to ensure that all of the greenhouse systems (heating, cooling, irrigation, fertigation) are working properly and that no insect or disease problems are developing.

There is a large capital investment in starting a greenhouse tomato operation – land, utilities (propane, oil, electric, water), greenhouse structure, cooler for fruit, packing area, irrigation and fertigation equipment, fertilizers, pesticides, pruning supplies, boxes/packaging, and many others.

The greenhouse vegetable industry is growing in the US. There has been a 40 – 50 % per year increase in the US as compared with Canada and Mexico. At present there are over 850 acres of greenhouse vegetable in production in the US. In Mississippi, there are about 135 greenhouse tomato operations accounting for approximately 18 acres. Mississippi is ranked 11th in the US for greenhouse tomato production. In Alabama, we have about 15 operations accounting for 1½ to 2 acres. These facts points to an increasing demand for greenhouse tomatoes.

There are many reasons to grow in a greenhouse such as –
- High quality product
- Facilitates local marketing
- Can control the growing environment
- Requires little land
- Can compliment other farming operations

But there are also some potential problems –
- High investment & production costs
- Requires intensive management to produce top-quality fruit
- Small margin for error
- Insects and diseases can spread rapidly
- No “cookbook” available
  - Most available information is on tomato production

Some items you need to consider BEFORE you get started. (1) Collect as much information about greenhouse tomato production as you can and study it. Develop a list of questions and comments that you need to discuss with an expert. (2) Consult with experts and
current greenhouse tomato growers. There are many resources available through your state’s Extension Service and land-grant system. There are many great resources (and some not-so-great) available on the web. Never rely on a single source of information. (3) Sell your tomatoes (or other greenhouse vegetable) before you plant your first seed, i.e., develop a marketing plan. (4) Determine a location for your operation. The less traveling you and your tomatoes do the better. (5) Which media am I going to use? In the Southeast, most greenhouse tomato growers use composted pine bark placed into polyethylene bags because pine bark is readily available and relatively inexpensive. (6) Which tomato variety will I use? ‘Trust’ is the dominate greenhouse tomato variety in the US accounting for 80% or the total US acreage. Never use a variety that was developed for field production in a greenhouse. (7) Which planting system will I use – the one-crop system or two-crop system? (8) Greenhouse tomato production is labor intensive – pruning, tying and de-leafing of tomato plants; trimming flower clusters; pollination; insect and disease scouting; pesticide applications; checking the pH and EC of your fertilizer solutions; harvesting. Most of these are daily labor issues. Skipping a few days can lead to serious problems and ultimately loss in production.

There is a great deal of work to be done before you start on your first crop because you potential have a great deal at risk. Start small. The two most common mistakes for first-time greenhouse tomato growers are getting too big too fast and having unrealistic expectations. Don’t expect to produce 25 lb. of tomatoes from each plant.

Selected list of on-line resources for Greenhouse Tomato Production:

Greenhouse Tomato Frequently Asked Questions –
  http://msucares.com/crops/comhort/greenhouse.html

Greenhouse Tomato Production Guide from MS State University –

Budget for Greenhouse Tomato Production from MS State University –

Ohio State University's Hydroponic Tomato Production program –
  http://www.oardc.ohio-state.edu/hydroponics/Home/default.htm

North Carolina State University Greenhouse Food Production –
  http://www.ces.ncsu.edu/depts/hort/greenhouse_veg/
Introduction

Methyl bromide is currently the fumigant of choice for eggplant and pepper production on plastic mulch for control of weeds, nematodes, and soilborne diseases. Methyl bromide has been identified as contributing to the depletion of the atmosphere ozone layer. As a result, the loss of methyl bromide appears certain and growers should start incorporating alternatives into their programs if they have not already done so.

Fumigant combinations of Telone II, Chloropicrin, Telone C35, Methyl Iodide (MIDAS), and K-Pam or Vapam have been touted as replacement alternatives for methyl bromide. Research has shown several of these fumigants are effective in managing nematodes and soilborne diseases but nutsedge control often is extremely variable. Thus, experiments were conducted to compare these potential fumigant combinations with an without an herbicide system under two types of mulch as alternatives for the control of purple nutsedge.

Materials and Methods

The experiment was conducted in the spring and fall of 2004 at the Ponder Farm located near TyTy, Georgia. Treatments included 6 fumigant options, 2 herbicide options, and 2 mulch options as listed below:

Fumigant treatment options and application methods were as follows:
1. Methyl bromide (67:33 at 400 lb/A broadcast) injected 6-8” in the bed with a super-bedder plastic layer.
2. Telone II (12 gal/A broadcast) injected 10-12 inches deep with a Yetter rig followed with Chloropicrin (150 lb/A broadcast) injected 6-8 inches in the bed with a super-bedder plastic layer.
3. Telone C35 (35 gal/A broadcast) injected 10-12 inches deep with a Yetter rig followed with Chloropicrin (150 lb/A broadcast) injected 6-8 inches in the bed with a super-bedder plastic layer.
4. Telone II (12 gal/A broadcast) injected 10-12 inches deep with a Yetter rig followed with K-Pam (60 gal/A broadcast pulled into a 32 inch bed top equaling 135 gal. rate in the bed) incorporated 3-4 inches deep with a tilrovator and followed with a super-bedder plastic layer.
5. MIDAS (98:2 at 200 lb/A broadcast) injected 6-8” in the bed with a super-bedder plastic layer.
6. MIDAS (50:50 with Chloropicrin at 400 lb/A broadcast) injected 6-8” in the bed with super-bedder plastic layer.
7. No fumigant control.

Herbicide treatments (all herbicides applied to pre-formed beds just prior to laying plastic):
1. No herbicide
2. Dual Mag. 1 pt/A broadcast + Devrinol 3 lb/A broadcast + Command 3 ME (pepper only) 1 qt/A broadcast

Mulch options:
1. LDPE (low density polyethylene film)
2. VIF (virtually impermeable film)

Fumigants were applied on February 18 and July 20 for spring and fall crops, respectively. In the spring trial, Santana eggplant were transplanted on March 17 and in the fall, Stiletto pepper were transplanted on August 2 (holes were poked to air fumigant prior to transplant). Eggplant were placed 18 inches apart with one row per 32 inch wide bed top while pepper were placed 12 inches apart with two rows on a 32 inch bed top. Visual estimates of nutsedge control were estimated throughout the season. Nematode samples were taken and
analyzed by the nematode lab in Athens. Insecticides, fungicides, and the fertility programs followed those recommended by the University of Georgia Cooperative Extension Service.

Results and Discussion

_Fumigant effects on nutsedge populations:_

**Spring Trial (Eggplant):** At 37 days after fumigating, nutsedge was controlled at least 90% by all fumigant options when compared to the non-treated control (data not shown). By 62 days after fumigating, purple nutsedge control was greater than 90% except with the following four systems: 1) Telone II followed by Chloropicrin on LDPE film without the herbicide program, 2) Telone C35 followed by Chloropicrin on LDPE film without the herbicide program, 3) MIDAS (98:2) on LDPE film without the herbicide program, and 4) MIDAS (98:2) on VIF film without the herbicide program.

**Fall Trial (Pepper):** Activity with all fumigants applied in the fall was far less than what was noted in the spring which has been observed consistently for the past three years. At 96 days after the fall fumigation, purple nutsedge control was only 67% with methyl bromide when applied under LDPE film without the herbicide system. Similar or even better control was noted with the following fumigant options (Table 1).

a) Telone C35 followed by Chloropicrin under VIF film with the herbicide program  
b) Telone C35 followed by Chloropicrin under VIF film without the herbicide program  
c) MIDAS (98:2) under VIF film without the herbicide program  
d) MIDAS (98:2) under VIF film with the herbicide program  
e) MIDAS(50:50) under VIF film without the herbicide program  
f) MIDAS (98:2) under LDPE film with the herbicide program  
g) Methyl bromide under LDPE film with the herbicide program  
h) Methyl bromide under LDPE film with the herbicide program  
i) Methyl bromide under VIF film without the herbicide program  
j) Methyl bromide under VIF film with the herbicide program

_Herbicide effects on nutsedge populations:_

Trends for a reduction in nutsedge populations by the herbicide system were noted in each trial when the fumigant alone did not provide excellent control. Dual and Command are only labeled for use in pepper and will cause severe injury to eggplant.
Table 1. Percent nutsedge control with methyl bromide alternatives in the fall pepper trial.\textsuperscript{1}

<table>
<thead>
<tr>
<th>Fumigant Option</th>
<th>Type of Mulch</th>
<th>LDPE</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl Bromide</td>
<td></td>
<td>67 c</td>
<td>86 ab</td>
</tr>
<tr>
<td>Methyl Bromide + Herbicide System</td>
<td></td>
<td>84 b</td>
<td>87 ab</td>
</tr>
<tr>
<td>Telone II + K-Pam</td>
<td></td>
<td>35 gh</td>
<td>45 efg</td>
</tr>
<tr>
<td>Telone II + K-Pam + Herbicide System</td>
<td></td>
<td>35 gh</td>
<td>42 efg</td>
</tr>
<tr>
<td>Telone C35 + Chloropicrin</td>
<td></td>
<td>42 fgh</td>
<td>86 ab</td>
</tr>
<tr>
<td>Telone C35 + Chloropicrin + Herbicide System</td>
<td></td>
<td>47 efg</td>
<td>95 a</td>
</tr>
<tr>
<td>Telone II + Chloropicrin</td>
<td></td>
<td>17 jk</td>
<td>50 def</td>
</tr>
<tr>
<td>Telone II + Chloropicrin + Herbicide System</td>
<td></td>
<td>17 jk</td>
<td>57 d</td>
</tr>
<tr>
<td>MIDAS 98:2</td>
<td></td>
<td>33 gh</td>
<td>74 c</td>
</tr>
<tr>
<td>MIDAS 98:2 + Herbicide System</td>
<td></td>
<td>68 c</td>
<td>89 ab</td>
</tr>
<tr>
<td>MIDAS 50:50</td>
<td></td>
<td>23 ij</td>
<td>54 de</td>
</tr>
<tr>
<td>MIDAS 50:50 + Herbicide System</td>
<td></td>
<td>40 gh</td>
<td>87 ab</td>
</tr>
<tr>
<td>No fumigant</td>
<td></td>
<td>0 l</td>
<td>10 k</td>
</tr>
<tr>
<td>No fumigant + Herbicide System</td>
<td></td>
<td>20 ij</td>
<td>28 hi</td>
</tr>
</tbody>
</table>

\textsuperscript{1}Trial conducted at the Ponder farm. Visual estimates of nutsedge were taken 95 days after fumigating. Nutsedge populations were greater than 50 plants per square yard.

\textsuperscript{2}Control values across rows and columns followed by the same letter are not statistically different at P = 0.05.

Conclusions

Results from these efforts have shown that there are several effective methyl bromide alternatives to control nutsedge. Growers should consider implementing one of these alternatives on at least a small acreage during the 2005 spring season. Nutsedge control in the fall is more difficult than in the spring and poses greater challenges; thus, it is advised to learn application procedures of alternatives in a spring crop. Consistency of nutsedge control, plant back intervals needed between fumigating and planting, and cost of the alternative fumigant systems continue to cause significant challenges for many of these alternatives.

From our 2004 efforts, it is clear that a herbicide system and the eventual adoption of VIF mulch will likely be needed in fields with moderate to severe infestations of nutsedge. Although our work with VIF film is exciting, there are GREAT concerns dealing with the
time interval necessary between applying these fumigants under VIF film and transplanting as the fumigant will likely last much longer than what growers are use to with the commonly used LDPE film. Additionally, our research also suggest that the potential for herbicide injury when applied in conjunction with a fumigant is much greater when applied under VIF film as compared to LDPE film. The plant back interval could be 3 to 4 times longer when using VIF film as compared to methyl bromide under LDPE film.
CRITICAL USE EXEMPTION-WHERE'S IT AT, WHERE'S IT GOING?

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Once again Southeast vegetable growers enter the final year of the methyl bromide (MBr) phase out without knowing what the fumigant's availability for 2005 will be. There will be methyl bromide available, but at this point, the Environmental Protection Agency (EPA) has yet to publish the rules on how the production allowed through critical use exemption (CUE) will be allocated. The Meeting of the Parties to the Montreal Protocol Treaty concluded a week-long session in Prague, Czech Republic on November 26, 2004. The parties amended the approval of quantities of methyl bromide previously awarded to applicants for 2005 and reached a preliminary agreement on quantities to be allowed to applicants for 2006. The nations involved continue to be at odds as to how much MBr can be granted for Critical Use Exemption. The European Union nations continue to argue for lower levels of exemption while the United States, Australia, New Zealand and Canada are pushing for higher amounts. The concern among the latter group is that the Methyl Bromide Technical Options Committee (MBTOC) is trying to make policy decisions rather than conducting technical reviews. In other words, MBTOC is not using science and statistics on which to base decisions.

The U.S. application for critical use in 2005 totaled 42% of the 1991 levels of MBr. The final amount approved for use in 2005 was just over 37% of the 1991 baseline. The actual allowance calls for 30% production and the remaining 7% to be taken from existing stocks. The crops on which CUE were requested in the Southeast include cantaloupe, cucumber, squash, tomato, pepper and eggplant. For 2005, virtually the whole amount requested by EPA was approved. However, that is not the total amount requested by the applicants. The applications came from several states including Georgia, Florida, Michigan, California, North Carolina and South Carolina. Therefore, EPA must still rule on how the amount approved is to be allocated and distributed. The quantities of MBr nominated by EPA covered 100% of the amount requested for melons, squash and cucumbers, but only 30-40% of that requested for eggplant, pepper and tomato.

EPA conducted its final stakeholder meeting on the allocation process on August 15, 2003. They are scheduled to finally post a ruling on allocation in late December, 2004. Until then, growers will not have a clue as to how much methyl bromide they will have access to in 2005. Also, producers and distributors must be geared up to follow those rules. Depending on how complex the process will be, there may be some lag time between when the rules are posted and when companies are prepared to distribute methyl bromide.

Part of the recent meeting in Prague was to discuss the 2006 CUE. For 2006, the EPA had nominated a figure of about 37% of the 1991 baseline. Ultimately, the U.S. conceded to agree on a figure of 27% of the baseline. They will have an opportunity in March to request an additional 8.6% as a supplemental allocation. However, the possibility that the supplemental request will be approved seems remote at this point. Also, the amount approved by MBTOC only included a portion of what EPA nominated for pepper, tomato and eggplant. It did include everything asked for in cantaloupe, cucumber and squash.

There is currently no alternative to MBr that is technically or economically feasible for producers to use. It is estimated that the loss of methyl bromide for use by Georgia vegetable
growers would result in $120 million in lost production. That is roughly 20% of the entire Georgia vegetable industry.
Traditional control of soil insect, weed, nematodes and disease control via methyl bromide is shortly coming to an end in plasticulture. Alternative materials are being tested to control these pests with some success. The materials are a combination of herbicides and fumigants to obtain similar results as methyl bromide. The equipment we have had success to apply these materials are coulter disk injectors, bed shapers, and rototillers.

The equipment used for methyl bromide on vegetables normally consists of a set of injector knives (6-8 inches below surface), bed shaper and plastic layer. This piece of equipment can be modified to apply a fumigant material by lengthening the injector shanks (10-12 inches). To apply herbicide a spray boom must be installed between the bed shaper and the plastic layer.

Coulter disk injectors also can be used to apply fumigant materials (6-8 inches below surface) with little disturbance of the soil. The Yetter® soil fumigant applicator is a 30" disk with an exit point at the bottom of the disk opening can also be used to apply fumigant materials. The fumigant can be placed at 10-12 inches below soil surface with minimal soil disturbance.

Rototillers normally have a spray boom mounted in front of the tines to apply herbicide materials. Injection knives can be added to the rear of the rototiller to apply fumigant materials. A bed press can be attached to seal the bed.

This is a review of the equipment used during the testing of methyl bromide alternatives. Other types of applicators could be used.
THRIPS VECTORS OF TOMATO SPOTTED WILT VIRUS IN WEEDS

by Dr. David G. Riley, UGA Vegetable Entomologist, and Stan Diffie, Research Coordinator TVAC Lab
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Tomato spotted wilt virus (TSWV), which is vectored by several species of thrips including Frankliniella fusca and F. occidentalis, causes severe yearly losses to crops in the Southeast including tomato, pepper, potato, tobacco, peanut, and ornamentals. Similar losses occur in many southeastern states. Management of TSWV has proven difficult because both the virus and its thrips vectors have broad and overlapping host ranges and our knowledge of TSWV epidemiology prior to the growing season is incomplete. Management of TSWV in susceptible vegetable crops requires multiple, expensive tactics, many of which, like metallic silver mulch, have to be selected pre-season. Therefore, what is needed is a way to predict the severity of the disease before the season even begins.

Tobacco thrips, F. fusca, can overwinter in weed hosts, such as wild radish, cudweed, and chickweed, in Georgia. Thus, thrips can be important in maintaining TSWV in weeds over the winter. Infected thrips coming out of weeds in the spring are likely to be important in vectoring the virus early in the growing season. Results of recent weed studies in Georgia indicated that thrips populations on weeds peak in late April (Fig 1) just before thrips peak in tomato blossoms in May. Throughout the year, the majority of thrips detected on weeds were immature stages, suggesting that thrips reproduce year round on these hosts. Winter weeds, such as henbit and chickweed are at full maturity and possibly beginning to dry down (in hot, dry weather) in late February/early March at the same time as tomato transplanting. Movement of thrips out of drying plant hosts is known to occur.

The goal of this project is to develop a system for predicting the timing and relative intensity of TSWV spread from overwintering hosts into susceptible crops in the spring. Such a preventative system would allow growers to adjust their selection of TSWV management tactics to the intensity of the TSWV problem and thereby avoid incurring unnecessary management expenses. The Thrip Vector Lab - Department of Entomology (see Photo) and the Virology Lab - Department of Plant Pathology at the Coastal Plain Experiment Station are conducting extensive surveys of thrips vectors of TSWV and TSWV in weed hosts around commercial field sites in south Georgia with the intent of identifying pre-season risk to the crop. This information is currently being posted monthly at http://www.tomatospottedwiltinfo.org in the form of a pest advisory to commercial growers as the data are gathered.
Bacterial spot of tomato (*Lycopersicon esculentum* Mill.), which is a devastating disease, can cause up to a 50% loss in fruit production and makes fruit unacceptable for fresh market consumption. The causal agent of the disease is the bacterium *Xanthomonas campestris* pv. *vesicatoria* (*Xcv*), which is favored by high temperatures (25-30 °C) and a wet environment. Management of this disease may be achieved by integration of cultural practices and chemical control. However, appearance of copper-resistant bacterial strains in the field hinders the efficacy of chemical control. If weather conditions are favorable for disease development, there are no adequate control measures to manage the disease.

In recent years OmniLytics, Inc. (Salt Lake City, UT) has developed the technology for using bacteriophages to control bacterial diseases. They began this technology with the intent of producing bacteriophages specific to *Xcv* for controlling bacterial spot in commercial tomato transplant and field production. We have compared bacteriophage treatments with the standard copper-mancozeb treatments and found bacteriophages to reduce disease severity and increase yields in comparison with copper-mancozeb.

The efficacy of phage can be affected by application techniques. Phages are adversely affected on plant leaf surfaces as a result of sunlight and to a lesser degree by dry conditions. Therefore timing of application is critical. In our initial experiments we had much better success when phages were applied in the early morning hours prior to sunrise. The rationale for this was based on the concern of the deleterious effects of sunlight. UV is quite lethal to bacteriophages. Later we modified this strategy and applied phages close to dusk. This was sufficient for maintaining high phage populations on the leaf surface throughout the night and significantly improved disease control compared with morning applications.

We also noted that phage survival on leaf surfaces could be improved if the phages were mixed with certain compounds. We tried a number of different compounds but found that mixing the phages with several different compounds including a combination of skim milk and sucrose provided improved survival on leaf surfaces. Once formulations that enhanced bacteriophages for control were identified, field tests were conducted to compare formulated phages applied in the evening with the standard copper-mancozeb treatment. Bacteriophages formulated with skim milk and sucrose were effective against the bacterial spot pathogen in three successive tests and provided better disease control than copper-mancozeb. When results of the disease severity assessments or harvested yield from the bacteriophage treated plots were grouped and compared to the results of the corresponding non-bacteriophage group, the former provided significantly better disease control and yield of total marketable fruits.
Pest management in leafy greens is one of the more important aspects of producing these crops. The tolerance for insect damage is very low. Pesticide residue on food is an important concern for consumers. This fact combined with the low tolerance for insect damage creates a paradox for growers. Consumers don't want insect damage nor do they want pesticide residues. The use of economic thresholds and augmentation of natural enemies of pests are effective means of keeping pests below damaging levels and can help reduce pesticide residues in the harvested crop. Knowledge of what damage is tolerable to buyers/consumers, which pests are present and their contributions to crop damage, and what natural enemies can be found in the crop are necessary to make informed pest management decisions. Typical pests of leafy greens in the southeastern United States, their natural enemies, and regional work on economic thresholds and damage levels are illustrated in this presentation.
CONTROLLING GUMMY STEM BLIGHT WITH SEED TREATMENTS

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Gummy stem blight (GSB), caused by *Didymella bryoniae*, is the most damaging fungal disease of watermelon and cantaloupes in Georgia. Outbreaks of GSB in transplant production houses have become commonplace in recent years. The initial source of inoculum for these outbreaks has not been determined to date. Recommended practices for management of GSB in transplant houses include the use of quality seed and good sanitation practices. Only EBDC fungicides are specifically labeled at this time for use in transplant houses against GSB, although the field performance of these fungicides is marginal at best. Systemic fungicides with known activity against *D. bryoniae* may offer protection against GSB on seedlings when applied as seed dressings.

Experiments were conducted in transplant production houses at Lewis Taylor Farms in Tifton, GA in 2004. Untreated seed of watermelon cultivars ‘Mardi Gras’ (diploid) and ‘Tri-X 313’ (triploid), along with the cantaloupe cultivar ‘Athena’, were treated with boscalid at a rate of 25 g of active ingredient (a.i.) per 100 kg of seed, or tebuconazole at 2.5 g a.i. per 100 kg of seed. Seed of each treatment (fungicide) were into 200-cell polypropylene plug trays. At the appearance of the first true leaf, plants were inoculated with *D. bryoniae*, and trays were placed on rails in the greenhouse and covered to maintain high (~80%) relative humidity. The severity of GSB was evaluated two weeks later on inoculated and non-inoculated seedlings.

Boscalid significantly reduced the severity of GSB on inoculated ‘Athena’ cantaloupe and ‘Tri-X 313’ watermelon, while the tebuconazole seed treatment did not differ from the untreated control. However, secondary spread (movement from inoculated to non-inoculated seedlings) was reduced ~89% on ‘Athena’, ~75% on ‘Mardi Gras’, and ~55% by boscalid (Fig. 3b). Tebuconazole reduced secondary spread of GSB by ~27% on ‘Athena’ and ~70% on ‘Mardi Gras’ seedlings. Boscalid applied as a seed treatment was more effective in preventing secondary spread of GSB on transplants than initial infections. This was likely affected by the amount of a.i. present in seedlings, and by the high concentration of inoculum used to initiate the epidemic versus the lower amount that contributed to secondary spread. Seed-applied fungicides such as boscalid or tebuconazole have the potential to be used as part of a program to manage GSB in the production of watermelon and cantaloupe transplants. Successful management of GSB on seedlings would reduce significant losses to producers of transplants, and would also reduce a source of initial inoculum that contributes to epidemics of GSB in the field.
Spray trials were conducted at Attapulgus and Crisp Co., and Reidsville, GA to evaluate products for use in rotations with Pristine for control of gummy stem blight and other foliar diseases of watermelon. Tests at both locations used a randomized complete block design with four replications per treatment at Attapulgus and Reidsville while five replications were used at Crisp Co. Data indicate that Topsin tank-mixed with mancozeb is an excellent rotational combination to use with Pristine to manage foliar diseases of watermelons. Folicur is also an excellent material to rotate with Pristine, especially for gummy stem blight suppression. All of these materials are safe alternatives to use late in the season and do not cause phytotoxicity to watermelon rinds. Pristine at the 12.5 oz/acre rate does not seem to be effective against anthracnose and higher rates are warranted as per label instructions.
The objective of the National Watermelon Promotion Board (NWPB) is to promote US exports and increase US consumer demand of watermelon. In light of this, the NWPB has focused on research projects for marketing and industry expansion in the 2004/2005 year. The projects are intended to assist in NWPB retail kit, market expansion, and communications programs, as well as expand industry and professional knowledge of the consumer preferences and demand of watermelon and watermelon products. These are/were a watermelon juice and juice concentrate project, research on Citrulline content in watermelon, and two-watermelon consumer survey’s.

The watermelon juice and juice concentrate project, funded in part by the USDA Rural Development, is intended to develop a shelf stable and palatable watermelon juice by August of 2005. The project is well off to a good start with current research being completed on extraction processes, shelf stability of watermelon juice and juice concentrate, and pasteurization processes. There have been various trials on sensory evaluations that have determined that the best brix level for sugar and acid.

The Citrulline research was intended to determine if there are additional health attributes to watermelon, besides the known vitamins, minerals, and Lycopene. We have conducted a human blood plasma study to determine the bioavailability of Citrulline in watermelon. Our research has shown that consumption of watermelon juice increases Arginine levels in the blood. This is to be expected because Citrulline is converted into Arginine in the human body. Arginine has been prescribed by doctors to cure and prevent angina and cardiovascular problems, and Arginine has also been credited with boosting muscle growth, improving wound healing, combating fatigue, stimulating the immune system, curing impotence, and fighting cancer, which all spells good news for the watermelon industry.

The watermelon consumer survey was intended to determine what consumers prefer when they enter the market place. The survey asked various questions about seasonal consumption, apparent availability during the season, and preferred variety of cuts (whole, sliced, cubed), size, type (seeded, non-seeded), and display. This research is used to help retailers better know the customers, so they can choose the best way to prepare their melons in the store. In addition, to our consumer preference survey, we decided to tackle the issue of consumer demand. This survey was designed to determine what consumers are paying for watermelon, what they prefer to pay, and if the price were increased or lowered what would be the effect on consumer’s watermelon purchasing habits.
MAPPING OF YIELD VARIABILITY OF COMMERCIALLY GROWN BELL PEPPERS

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Abstract
During the past decade, yield mapping has become a valuable tool in crop management. Several electronic yield monitors are commercially available to monitor yield in many mechanically harvested crops. However, little has been done to monitor and map yield variability in hand harvested crops such as commercial vegetables. To overcome this problem, a novel approach to mapping yield in bell peppers was conducted in the spring of 2004. Three persons with backpack GPS systems walked behind manual laborers and logged a point with the GPS for each pepper that was harvested. The geospatial data from all three harvesters was combined using ArcView GIS software. Further analysis was conducted using the ArcView Spatial Analyst extension to create density maps which displayed the yield variability within the test area. Topographical data was also collected using high accuracy (1 cm resolution) RTK GPS and Contour maps using ArcView.

Materials and Methods

Yield Data Collection and Mapping
For each pepper harvest date, yield data collection was achieved by logging a GPS point for each pepper picked in the field. Three data collection workers were equipped with a backpack mounted Trimble 114 GPS system (sub-meter accuracy) and a hand held computer loaded with Farm Site Mate software for data logging. Three farm workers then worked through the test area picking peppers as they normally would. The data collection worker followed close behind and as a pepper was harvested, would log a GPS point, marking the position where the pepper was picked.

Data was processed using the ArcView Spatial Analyst extension. All individual data points (each pepper harvested) were used to create a density map, which uses weighted averages to determine the number of points (peppers) within a grid cell. On our map, we specified each grid cell to represent one square foot. Once a density map was created, the data was converted to boxes per acre by using the ArcView Map Calculator tool to divide the number of peppers per cell by the average number of peppers in a box (60 peppers). The resulting yield map displays pepper yield in boxes per acre.

Topographical Mapping
Data was collected for topographical mapping using a high accuracy (sub cm) RTK Trimble 214 GPS system. The system was mounted to the roof of a high clearance “Spider” tractor and driven across the field at approximately 30 foot intervals. Data was collected using a hand held computer loaded with Farm Site Mate software for data logging. Data was processed using the ArcView Spatial Analyst extension to create a digital elevation model of the field including...
contour lines at 1 foot intervals.

**Results and Discussion**

*Yield Data*

Analysis of the yield data resulted in the series of individual harvest and cumulative yield maps shown above. It is clearly visible from the maps that yield was variable across the 0.5 acre test plot.

Throughout all of the harvest dates, one section of the field was observed to have generally lower yields than the rest of the test plot. Ground truthing in this area indicated that the soil in that portion of the field was very high in clay content. Because the area was also located near a slight ridge in the field, it was hypothesized that the top soil may have been removed from this area while performing land leveling operations in the field, exposing the subsoil to the surface.

Upon the final harvest, the field averaged about 1,000 boxes per acre but variability in the field resulted in areas of the test plot yielding between a low of about 250 boxes per acre to a high of about 1,500 boxes per acre.

*Topographical Mapping*

Topographical Contours show changes in elevation across the entire field. The location of the yield map test plot within the field is outlined in red. Data was processed to show contour lines at one foot intervals. Upon examination of the data, it became obvious that every other pass of data collection showed a difference of a few inches in elevation, resulting in contour lines that were somewhat wavy. This was determined to be due to every other pass through the field being driven down a drive middle while the other passes being driven across bedded land. It was discovered that the bedded portions of the field were a few inches higher in elevation than the drive middles, resulting in a ridge effect on the map. Regardless of the ridge effect, changes in elevation are quite obvious on the resulting map.

**Conclusions**

Similar to most other crops, spatial variability of bell pepper yield can be great across a field. In this test field, soil texture appears to be the greatest contributor to the observed yield variability. The area of the field with a high clay content resulted in plants producing fruit later in the season and lower total yield. Further work needs to be done to determine other factors that may contribute to yield variability in bell peppers.

Further work also needs to be done to find more automated methods of measuring spatial yield variability in a commercial setting. While the yield maps produced in this study were very informative, the amount of labor required to produce them is not practical for large scale data collection in commercial operations. Now that yield variability has been documented in bell pepper production, further study will be done to find methods of measuring yield more efficiently.
REDUCING WASTE BY COMPOSTING VEGETABLES

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Waste can be seen as a problem that causes a drain on financial resources or it can be seen as the input to arrive at a final useful product. If waste vegetables are removed from a field and dumped in a landfill that costs money as well as wasted landfill space. Dumping the vegetable waste in low lying areas around the field, around the processing plant or elsewhere can cause problems of high organic leachate being transported directly to local streams. This leachate can then be the cause of the receiving stream being polluted. However, if we capture the waste vegetables and combine them with other waste products such as peanut hulls, cotton gin trash, grass clippings, wood chips and other organic waste products the final result can be something useful verses a waste. The combination of these various waste streams with the addition of air from fans or turning can produce quality compost that can be used for various purposes. Some of these may be but are not limited to mulches for flower beds, soil amendments for sandy or clayey soils, increases of bacterial activity due to increased organic matter, increased porosity of soils, and increased water holding capacity of the soil.

Data presented is from tests using forced air compost bins measuring 3.6 cubic meters (125 cubic feet) with the main waste streams being peanut hulls and vegetable waste. The hulls and vegetables are layered in the bins and air is forced on a schedule. Within each bin there are 10 temperature measurements, five vertically and five horizontally, to monitor bin temperatures. Proper temperatures are required to biologically reduce and stabilize the waste produces. The stabilized product – compost- when added to the soil can achieve the results listed above. In conclusion, the information presented here will provide the participate with ideas for using the waste product as an input to a process verses treating it as a waste and potentially adversely effecting local streams.
Enterobacter sakazakii is known to cause severe infections in humans, particularly neonates and immunocompromised infants, although elderly immunocompromised individuals also have been diagnosed with infection caused by this bacterium. Its known presence in food processing plants, homes, and the environment raises concern about its ability to survive and grow in a wide range of foods. Recognizing that E. sakazakii belongs to the same family (Enterobacteriaceae) as Salmonella and Escherichia coli O157:H7 and that the latter pathogens have caused outbreaks of infections associated with fresh produce, a study was done to determine its survival and growth characteristics on fresh-cut lettuce, cabbage, carrot, cucumber, tomato, apple, strawberry, watermelon, and cantaloupe.

Inoculated produce was stored at 4, 12, and 25°C and monitored for populations of E. sakazakii over a 6-day period. Populations steadily declined in produce stored at 4°C. E. sakazakii grew on watermelon, cantaloupe, apple, and tomato at 12°C. Growth occurred on all produce except strawberries at 25°C; slowest growth was on lettuce, cabbage, and carrot. Watermelon, cantaloupe, cucumber, apple, and tomato supported population increases of 1 - 3 log CFU/g within 3 days at 12°C and 4 - 6 log CFU/g within 2 days at 25°C. Results show that E. sakazakii can grow on a wide range of temperature-abused fresh-cut produce. Consumption of produce on which the pathogen has grown may increase the risk of E. sakazakii infection, particularly in immunocompromised individuals. To date, however, there are no reports associating infection with fresh or fresh-cut produce.
An increased frequency in the number of outbreaks of illness associated with the consumption of fresh fruits and vegetables in recent years has raised interest in developing effective methods to kill foodborne pathogens. Among the sanitizers of interest in gaseous chlorine dioxide (ClO₂). In a previous study, we observed that treatment of blueberries, strawberries, and raspberries with ClO₂ was effective in killing large numbers of *Salmonella* without compromising shelf life. We expanded these studies to evaluate the efficacy of gaseous ClO₂ in killing *Salmonella*, enterohemorrhagic *Escherichia coli* O157:H7, and *Listeria monocytogenes* inoculated onto the surface of fresh-cut cabbage, carrot, and lettuce as well as fresh whole apples, peaches, Vidalia onions, and tomatoes.

Sachets containing reactant chemicals were formulated to produce gaseous ClO₂ at concentrations of 1.4, 2.7, and 4.1 mg/L of air within 5.4 - 10.5, 10.4 - 20.0, and 20.5 - 30.8 min, respectively, at 23°C. Treatment with 1.4 mg/L ClO₂ significantly (α = 0.05) reduced populations of pathogens on all produce. Significant reductions in yeasts and molds on apples and peaches but not tomatoes and onions were achieved by treatment with ClO₂. Subjective evaluation of produce immediately after treatment revealed discoloration of apples and fresh-cut vegetables.

Studies are underway to objectively evaluate sensory qualities of fresh and fresh-cut produce after treatment with gaseous ClO₂ and storage at temperatures simulating those used in commercial practice. Results of those studies will enable recommendations to be made concerning practical applications of gaseous ClO₂ to produce for the purpose of enhancing safety and retarding decay caused by yeasts and molds.
Weather is one of the most important factors that impacts fruit and vegetable production. Although weather cannot be controlled, accurate weather information provides growers and producers with the option to make appropriate management decisions and to mitigate extreme weather events. The National Weather Service (NWS) is the main federal agency responsible for weather forecasting and reporting local weather conditions. However, most of the observations are based on automated stations located at airports, including Atlanta, Macon and Savannah. In addition, the NWS maintains a Cooperative Observer Network, in which volunteers record the maximum and minimum temperature and rainfall from the previous day at 7.00 or 8.00 a.m. for more than 85 sites across the state of Georgia. Unfortunately the observations at the airport do not represent the main agricultural regions across Georgia, while the observations from the Coop network are not readily available and the variables that are measured are limited.

The College of Agricultural and Environmental Sciences (CAES) of the University of Georgia, therefore, initiated the development of an automated weather station network. The first station was installed in 1991 and currently 60 weather stations are operational across the state of Georgia, including one in Florida and one in South Carolina. Each weather station monitors air temperature, relative humidity and dewpoint, wind speed and direction, solar radiation, precipitation, soil temperature at three different depths, soil moisture and barometric pressure. A data logger scans all sensors at a one-second frequency and every 15 minutes a summary is calculated. At midnight the daily extremes are determined, including the maximum, minimum and average values for temperature and other variables and totals for rainfall and solar radiation. The data are transmitted through dedicated telephone lines to a personal computer located at the UGA-CAES Campus in Griffin.

After the weather data have been received, they are processed and prepared for dissemination via the internet and world wide web. Users can access current weather conditions for all 60 sites at www.Georgiaweather.net. The data are updated at least every hour and more frequently for some of the locations. Yesterday’s weather conditions can be retrieved after midnight. Simple tools have been implemented for determining degree-days, chilling hours, a water balance, an irrigation scheduler for peaches, and other information pertinent to fruit and vegetable production. Additional tools will be added in the near future, depending on user needs.
Late frosts during the end of Winter and early Spring can have a detrimental impact on fruits and vegetables. Flowers on blueberry bushes and peach trees can be permanently damaged and young vegetable plants can be frozen during these late frosts, causing, in some cases, a permanent loss in production. Growers and producers have several options for freeze protection, including irrigation and wind machines. However, critical for implementing frost and freeze protection is accurate and timely weather forecasts. Recent changes in the federal law prohibit the National Weather Service from providing agricultural-specific weather forecasts. The University of Georgia, therefore, has explored the use of artificial intelligence techniques to predict temperature based on local temperature, relative humidity and other weather information.

The College of Agricultural and Environmental Sciences of the University of Georgia currently operates a network of automated weather stations that are located across the state of Georgia. These weather stations have been sited in regions where agriculture is the dominant economic sector. Each automated station monitors local weather conditions, including air temperature, relative humidity, dewpoint, wind speed and direction, solar radiation, precipitation, and other variables. The weather data are transmitted to a computer in Griffin and then disseminated via the world wide web at www.Georgiaweather.net. Current weather conditions are updated at least hourly.

Based on the historical weather data that have been collected for each site, neural network models have been developed that can predict temperature for up to 12 hours. An artificial neural network is a complex computer model that emulates the operation of neurons in the human brain. An ANN can determine relationships between complex data structures and based on past experience, can predict what will happen in the future. In this implementation the ANN model is provided with the current weather conditions, as well as with the conditions during the previous eight hours to predict the temperature for up to 12 hours. The average prediction error was 1°F for the one-hour model and 4.5 °F for the 12-hour model. A graphical user interface has been developed to display both the current weather conditions as well as the predicted temperatures for each site where an automated weather station is operational. Further research is being conducted to refine the use of neural network and other artificial intelligence techniques for temperature prediction.
IMPACT OF SELECTED CULTURAL PRACTICES ON YIELD, FRUIT NUMBER AND FRUIT SIZE OF WATERMELON

The University of Georgia, College of Agricultural and Environmental Sciences
1Cooperative Extension Service, Decatur County, Bainbridge, GA
2Tifton Campus, Tifton, GA
3Stripling Irrigation Park, Camilla, GA
4Cooperative Extension Service, Mitchell, County, Camilla, GA

Growing watermelons on fumigated plastic-mulched beds with drip irrigation is not a traditional practice in Georgia. The use of a standard six-foot center to center bed spacing would require more fumigant, more plastic and more drip tape than if nine-foot centers were used. To evaluate the feasibility of the different row pattern and to determine more appropriate nitrogen and irrigation rates, a test was conducted in the Spring of 2004 to evaluate the impact of row spacing, nitrogen fertility, and irrigation rate on yield, fruit number and fruit size of seedless watermelon (Citrullus lanatus). Plastic mulch was installed over beds simultaneously fumigated with methyl bromide (~400 lbs a.i./broadcast acre) two weeks prior to planting at the Stripling Irrigation Park near Camilla, GA. Commercially produced seedlings of "Tri-X Carousel" were transplanted into plastic-mulched beds with drip irrigation on April 12, 2004. Beds were spaced six and nine feet apart from center to center with transplants spaced to provide approximately 24 square feet per plant or 1812 plants/acre. Nitrogen rates were varied only in the nine-foot beds and were 130, 160, and 190 lbs/acre. Watermark sensors were used to schedule irrigation. The low irrigation rate was applied to maintain 10 centibars of pressure or less. The high irrigation rate was 20% greater than the low rate. Treatments were arranged in a Randomized Complete Block Design with four replications. Otherwise normal cultural and pest management practices were used. Melons were harvested on June24, July 1 and 13, 2004 and data collected on yield, fruit number and fruit size. Data were then subjected to Analysis of Variance and means separated by LSD. There was no significant differences in yield, fruit number or fruit weight for the parameters measured, however, yield was numerically higher at the nine-foot bed spacing, 190 lb nitrogen rate, and low irrigation rate. The results indicate that it is feasible to produce drip irrigated watermelons on nine-foot bed spacing and further emphasize the need for higher nitrogen rates for watermelon production on sandy soils.
Georgia onion growers often produce multiple crops on their farms including cotton, peanut, or soybean. Although rotation of various crop species is usually beneficial, the potential for herbicides applied in cotton, peanut, or soybean to carryover to onion is of greatest concern to Vidalia onion producers. In cotton, growers often rely on herbicides such as Direx, Staple or Envoke for control of weed species while in peanut most Georgia fields are treated with Cadre or Strongarm. Although Roundup is usually the only herbicide used in soybean, some fields are treated with Roundup plus Firstrate for improved morningglory control. All of these residual herbicides can be very beneficial in controlling weeds in their respective agronomic crops but they also all pose serious threat to a following onion crop due to rotational label restrictions.

A field experiment was conducted at the Vidalia Onion and Vegetable Research Center near Lyons, Ga. in 2003 and 2004. The area was conventionally tilled by moldboard plowing then smoothed with a rotary tiller to form six foot wide beds. This area had not been previously exposed to any of the herbicides evaluated for this experiment. On October 13, 2003, residual herbicides were applied. Treatments included Cadre at 0.77 and 0.385 oz product/acre, Strongarm at 0.225 and 0.113 oz product/acre, Staple at 0.90 and 0.45 oz product/acre, Envoke at 0.25 and 0.125 oz product/acre, Direx at 12.8 and 6.4 oz product/acre, and Firstrate at 0.38 oz product/acre. A nontreated control treatment was also included. The intent was to simulate herbicide carryover by using approximately one-half and one-fourth of the labeled rate of each herbicide to their respective crop. The experimental design was a randomized complete block with four replications (blocks). Plots consisted of four transplanted onion rows per bed which was 25 feet long. Onion bulbs were hand transplanted approximately 1 inch deep on November 6, 2003. The entire test was maintained weed-free throughout the growing season by a blanket treatment of Prowl plus Goal.

Onion injury ratings for stunting and bleaching were visually estimated using a scale of 0% (no injury) to 100% (death) during the course of the study and prior to harvest. Yield was determined by hand harvesting all onion from 10 feet of the center two rows of each plot, and recording their number and weight. Cumulative number and yield per acre are reported. Weight per fruit was determined by dividing the total fruit yield by total fruit count. These results are intended for research purposes only. Follow all label directions and restrictions. Onion injury, fresh weight, bulbs per acre, and average bulb weights were herbicide dependent.

Cadre injury was 1 and 6% for 0.77 and 0.385 oz/acre, respectively. These data would indicate that transplanted onion has good tolerance to the peanut herbicide Cadre. In contrast, transplanted onion was extremely sensitive to Strongarm at either rate with injury of 56% or greater at 149 days after application. The number of onion bulbs/acre was not significantly affected by either of these herbicides. However, there was a significant reduction in average bulb weight for Strongarm. This would indicate that Strongarm did not kill the transplanted onion but did cause injury that reduced growth for the entire season. Staple caused severe onion injury with 56 and 86% at 0.45 and 0.90 oz product/acre, respectively. Staple also caused significant reductions in average bulb weight. Envoke
injury was variable, but there was significant reduction in the average bulb weight as compared to the nontreated control. In contrast to Staple and Envoke, Direx did not adversely affect onion for any variable. Firstrate was the most injurious and detrimental herbicide evaluated. Compared to the non-treated control, onion was visually injured 86%, onion fresh weight was reduced 76%, and average bulb weight was reduced 69%.

This research indicates that there needs to be further evaluation of some of the herbicides used in cotton, peanut, and soybean cotton and peanut with respect to plant back restrictions for transplanted onion. It appears that Cadre and Direx restrictions could possibly be reduced with further evaluation. In contrast, the onion plant back (rotational) restrictions for Strongarm, Staple, Envoke, and Firstrate must be followed. Not following these guidelines could result in potential crop failure.
Several species of thrips vector Tomato Spotted Wilt Virus (TSWV) and are responsible for millions of dollars in losses annually in Georgia. These losses occur in several crops including tomato and pepper. TSWV has been hard to manage due to the wide plant host ranges of the virus and the complexity of the thrips vectors. Monitoring thrips build-up and movement from roadsides and adjacent fields into production fields will assist growers in pre-season planning for thrips management and TSWV suppression.

Two sampling methods are employed monthly to determine the presence of thrips populations surrounding and within two fields in four south Georgia counties. Brooks, Colquitt, Decatur, and Tift Counties were preselected based on their tomato and pepper production. Sampling consists of harvesting host weeds in six plots adjacent to each production field. Based on prior research, six host weeds were selected for summer/fall collections and six were chosen for winter/spring collections. The weeds are returned to the laboratory where thrips are extracted using Berlese funnels. Also, six sticky traps are placed along a transect outside the field and six parallel traps are run within the field. Each of the sticky traps consists of one yellow card and one blue card stapled to opposite sides of a 12” garden stake. The traps are left in the field for one week before returning them to the lab for thrips counting.

Additional weed samples are collected and labeled at the six plots adjacent to the fields and sent to the Virology Lab for analysis. Depending on the number of weeds present, up to three samples of each weed species are collected at each plot. ELISA is performed on the samples to determine the level of TSWV infection.

Crop leaf samples are taken during the growing season to estimate the percentage of TSWV in the field. One leaf sample is selected from the top 1/3 of ninety randomly chosen plants in the field. These samples are sent to the Virology Lab for analysis using ELISA.

Data collected from the Berlese funnels and sticky traps are compiled and posted monthly for county extension personnel. Also included in the report is an analysis of TSWV infection found in the collected weeds.

This project is on-going and should provide relevant information to extension personnel and growers concerning the movement of thrips vectors from infected host plants into the production fields.
Table 1. Severity of pink root and yield (No. 40# box/A) of sweet onions treated with Pristine at the Hort Hill (Tifton), 2004.

<table>
<thead>
<tr>
<th>Material</th>
<th>rate/A</th>
<th>Application timing</th>
<th>PR&lt;sup&gt;b&lt;/sup&gt; (0-10)</th>
<th>Yield&lt;sup&gt;c&lt;/sup&gt; No. 40# box/A</th>
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<td>--</td>
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<td>146.9 a</td>
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<td>EGIK</td>
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<tr>
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<td>3 lb</td>
<td>BDFHJL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pristine 38WG</td>
<td>14.5 oz/A</td>
<td>ACE</td>
<td>0.6 cde</td>
<td>84.7 a</td>
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<tr>
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<tr>
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<td>GIK</td>
<td>1.0 bc</td>
<td>65.4 a</td>
</tr>
<tr>
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<td>A-L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cuprofix Disperss 20DF</td>
<td>3 lb</td>
<td>BDFHJL</td>
<td></td>
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</table>

<sup>a</sup>Applications made on a 7 day schedule, where A=application 1 and L=application 12.
<sup>b</sup>Severity of pink root (PR) rated on a 0-10 scale where 0=no disease and 10=completely decomposed root system.
<sup>c</sup>Yield determined as the number of 40# boxes harvested per acre (across all grades).
<sup>d</sup>Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test (P value listed for each variable).
<table>
<thead>
<tr>
<th>Material</th>
<th>rate/A</th>
<th>timing&lt;sup&gt;a&lt;/sup&gt;</th>
<th>% BNR&lt;sup&gt;b&lt;/sup&gt;</th>
<th>% Healthy&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Check</td>
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<td>--</td>
<td>43.9</td>
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<td>52.4 c</td>
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<td>Rovral 480SC</td>
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<td>EGIK</td>
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<td>86.2 a</td>
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<td>ADGJ</td>
<td>11.2 bc</td>
<td>79.8 a</td>
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<td>BDFHJL</td>
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<tr>
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<td>14.5 oz/A</td>
<td>AEI</td>
<td>10.1 bc</td>
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<td>A</td>
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</tr>
</tbody>
</table>

<sup>a</sup>Applications made on a 7 day schedule, where A=application 1 and L=application 12.

<sup>b</sup>Percentage of onions with symptoms of Botrytis neck rot (BNR) after 5 months in storage at 38°F.

<sup>c</sup>Percentage of healthy onions after 5 months in storage at 38°F.

<sup>d</sup>Means followed by the same letter do not differ significantly as determined by Fisher’s protected least significant difference test ($P$ value listed for each variable).
Table 1. Effect of metham-sodium and plastic mulching on yellow nutsedge control in transplanted cantaloupe; Tifton, GA, 2001-2003.¹

<table>
<thead>
<tr>
<th>Mulching</th>
<th>Metham rate²</th>
<th>Yellow nutsedge control (%)</th>
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</thead>
<tbody>
<tr>
<td>Plastic covered seedbeds</td>
<td></td>
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<tr>
<td>nontreated</td>
<td>74</td>
<td></td>
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<tr>
<td>metham-sodium (½x)</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>metham-sodium (1x)</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Non-covered seedbeds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nontreated</td>
<td>8</td>
<td></td>
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<tr>
<td>metham-sodium (½x)</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>metham-sodium (1x)</td>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

LSD (0.05) 11

¹All data are averaged across times of metham-sodium fumigation.

²Metham-sodium applied with a modified power-tiller and sprayer. Rates: ½x: 40 gal./A, 1x rate: 80 gal./A. Registered use rate for metham-sodium is 75 gal./A. Sprayer calibration was achieved by altering ground speed. This resulted in slightly different rates from those registered.
Table 2. Effect of metham rate and time of fumigation on cantaloupe injury and total yield; Tifton, GA, 2001-2003.\(^1\)

<table>
<thead>
<tr>
<th>Time of fumigation</th>
<th>Metham rate(^2)</th>
<th>Visual injury</th>
<th>Total yield</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>(%)</td>
<td>(no./ha)</td>
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<tr>
<td>3-wk pre-transplant</td>
<td>nontreated</td>
<td>0</td>
<td>9,860</td>
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<td></td>
<td>metham-sodium (½x)</td>
<td>3.6</td>
<td>12,380</td>
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<td>metham-sodium (1x)</td>
<td>0.7</td>
<td>11,770</td>
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<td>2-wk pre-transplant</td>
<td>nontreated</td>
<td>0</td>
<td>11,100</td>
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<td></td>
<td>metham-sodium (1x)</td>
<td>0.4</td>
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<td>1-wk pre-transplant</td>
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<td>0</td>
<td>12,050</td>
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<td></td>
<td>metham-sodium (x)</td>
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<td>11,380</td>
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<td></td>
<td>metham-sodium (1x)</td>
<td>1.8</td>
<td>16,310</td>
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<tr>
<td>LSD (0.05)</td>
<td>1.4</td>
<td>1,950</td>
<td>14,700</td>
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</tbody>
</table>

\(^1\) All data are averaged across times of metham-sodium fumigation.

\(^2\) Metham-sodium applied with a modified power-tiller and sprayer. Rates: ½x: 40 gal./A, 1x rate: 80 gal./A. Registered use rate for metham-sodium is 75 gal./A. Sprayer calibration was achieved by altering ground speed. This resulted in slightly different rates from those registered.