# GEORGIA VEGETABLE EXTENSION-RESEARCH REPORT 2000

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Gale A Buchanan
Dean and Director

# Table of Contents

## Cultural Practices



## Variety Evaluation



## Transplant Production



## Weed Control

## Disease Control



## Insect Control

# Cultural Practices

## EXCESSIVE SOIL WARMING AFFECTS TOMATO PLANTS GROWN OVER COLORED MULCHES

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### Introduction

In the Southeast USA, the majority of tomatoes and peppers are produced under plastic mulch. The benefits associated to the use of plastic mulches include higher yields, earlier harvests, improved weed control, and increased efficiency in the use of water and fertilizers (Lamont, 1993). Plastic mulches affect the plant microclimate by modifying the soil energy balance and by restricting soil water evaporation (Liakatas et al. 1986). The modification of these microclimate factors influence soil temperature, which in turn affects plant growth and yield. An increased soil temperature is one of the main benefits associated to the use of plastic mulches. However, under certain environmental conditions, mulches may warm the soil to temperatures that are deleterious to plant growth. Based on soil warming considerations, black mulch is utilized during the spring to warm the soil (Taber 1993). In the summer and fall, aluminum or white mulches are used because they heat the soil less than black mulch (Schalk and Robbins 1987). However, research reports indicate that these recommendations vary depending on the year and the region. One reason for these apparent inconsistencies is that we know little about plant responses under field conditions to modification in soil temperature and other environmental factors as a result of the use of plastic mulches. Plastic mulches modify the light environment around the plant. The light reflected from the mulch may affect plant growth and morphogenesis (Decoteau et al. 1988). However, the influence of mulch color on plant responses has been difficult to reconcile. The effect of mulch color on plant growth and yield often varies according to the region and the time of the year (e.g.(Csizinszky et al. 1995)), suggesting that plants grown under colored mulches respond to factors other than light reflected from the mulch. In this study, we evaluated various colored mulches on drip-irrigated tomato grown in the field under high temperature conditions. The objective was to determine the relationship of soil temperature, as affected by the use of various mulches, with plant growth and yield.

### Materials and Methods

This study was conducted at the Horticulture Farm, Coastal Plain Experiment Station, Tifton, Georgia during the summer and fall 1999. The experimental design was a randomized complete block with five treatments (mulch) and ten replications. The mulches used were gray on black (Leco, Montreal, Canada), aluminum on black (Clarke Ag), white on black (Leco, Montreal, Canada), black mulch painted with white latex paint (referred to as '*painted*') and bare soil. The experimental plot consisted of an 8-m long, 0.9-m wide bed formed on 1.8-m centers. Before laying the mulches, the beds were fertilized with (kg $ha^{-1}$) 90N, 90P and 54K. The soil was fumigated with a mix (70:30) of methyl bromide and chloropicrin at 250 kg $ha^{-1}$. Drip irrigation tape (T-Tape; T-Systems Intl., San Diego, CA), with 30.5-cm emitter spacing and a 17-mL $min^{-1}$ emitter flow, was placed manually on the surface of the soil in the center of the bed. Six-week old tomato (cv. 'Sun Chaser', Petoseed) transplants were planted to the field in a single row per bed at 60-cm spacing on August 3. After transplanting, a fertilizer (18-46-00) solution was applied to the transplants.

*Soil temperature and PAR.*- Soil temperature was measured with temperature probes (Mod. 107, Campbell Scientific, Logan, Utah) connected to a data logger (CR10X, Campbell Sci., Logan, Utah). The data logger was programmed to collect readings every 10 min and store hourly averages. Reflected photosynthetically active radiation (PAR) was determined with the quantum sensor of a steady-state porometer (LI-1600, LICOR, Lincoln, Nebraska, USA). Reflected PAR was measured on clear days, once a week during the season at 13:00-14:00 HR until plants developed full canopy. Reflected PAR was measured by placing the quantum sensor in the middle of the bed, between two plants, facing the mulch surface, at 30-cm above the mulch surface.

*Growth analysis.*- During the first four weeks after transplanting, plant height was determined weekly for five weeks in five plants per plot. Leaf area per plant was estimated from measurements of total leaf length per plant (week 2 and 3) or from measurements of plant width (week 4 and 5). Leaf length per plant was measured as the summation of the lengths of all leaves in a plant. Plant width was determined as the average of two measurements of canopy diameter, one measured using the longest leaf as a reference and the second measurement made 180 degrees across the first measurement.

*Harvest.*- At harvest, plants were excised at the soil level and were individually enclosed in plastic bags and kept at 12 $^{o}$C until their shoot and total fruit fresh weight were determined within 24 h.

## Results

*Soil temperature and PAR.*- There was a gradual decline in air and soil temperatures as the growing season advanced. The highest values of morning soil temperature occurred under silver mulch, and the lowest values were observed in bare soil (Fig. 1). The highest midday soil temperature occurred under gray mulch and the lowest midday temperature in bare soil and white mulch (Fig. 1). Midday soil temperature under gray mulch was up to 4 $^{o}$C (7.2 $^{o}$F) higher than in bare soil, or white and silver mulch. Soil under silver mulch showed the smallest fluctuation in diurnal temperature, while bare soil had the largest fluctuation in temperature.

Plastic mulches differed in the amount of light (PAR) they reflected at midday. Among plastic mulches, reflected PAR was highest in silver mulch (1048 $\mu$mol $m^{-2}$ $s^{-1}$) and smallest in gray mulch (532 µmol $m^{-2}$ $s^{-1}$). Reflected PAR of bare soil was 243 µmol $m^{-2}$ $s^{-1}$. Soil temperature was inversely correlated with the percent light reflection by mulches ($r^2$ = 0.677). Percent PAR reflection explained about 68% of the changes in soil temperature among mulches.

*Plant establishment during the first 31 days after transplanting.*- The size of the plants during the establishment period was related to soil temperature under the mulch. There was a linear decline in leaf area ($r^2$ = 0.771) and plant height ($r^2$ = 0.804) with increases in soil temperature among mulches. Shoot weight was highest in plants grown on bare soil (29.4 $^oC$), followed by plants under white (29.8 $^oC$), painted (30.5 $^oC$), silver (30.6 $^oC$), and gray (31.9 $^oC$) mulches, respectively. Shoot weight at 31 DAT was about 18 times higher in plants on bare soil compared to plants growing under gray mulch.

*Mature plant growth and yield.*- The type of plastic mulch used affected growth and fruit yield of mature plants. Plants grown on silver mulch and bare soil were the heaviest, followed by plants on white mulch, black mulch painted white, and gray mulch (Fig. 2). Fruit number and total fruit weight per plant were highest on plants grown on silver mulch and lowest on plants on gray mulch. The soil temperature under the different mulches was inversely related to plant weight, fruit number and fruit weight per plant (Fig. 2).

Plant weight, number of fruit, and total fruit weight per plant were highest under the mulches (silver > bare > white) with the lowest value of midday soil temperature, and lowest under the mulch (gray) with the highest value of midday soil temperature (Fig. 2). The weight of mature plants, the number of fruit and the total fruit weight per plant declined linearly with increases in soil temperature at midday under the various plastic mulches (Fig. 2). The effect of soil temperature on marketable yield was not determined because marketable yield was severely reduced in all treatments due to a high incidence of TYLCV.

## Summary

Warming of the soil is one of the most important effects of plastic mulches. This soil warming, which increases root temperature, has been associated with higher yields and earlier harvests. However, under conditions of high air temperature and high luminosity as occurs during the summer in the Southeast USA, mulches may heat the soils and the roots to levels that may be deleterious to plant growth. In conclusion, under high air temperature conditions, differences in plant growth and yield among colored mulches can be explained, at least partially, by the way mulches warm the soil relative to bare soil.

Literature Cited

Csizinszky, A. A., D. J. Schuster, and J. B. Kring. 1995. Color mulches influence yield and insect pest populations in tomatoes. Journal of the American Society for Horticultural Science 120: 778-784.

Decoteau, D. R., M. J. Kasperbauer, D. D. Daniels, and P. G. Hunt. 1988. Plastic mulch color effects on reflected light and tomato plant growth. Scientia Horticulturae 34: 169-175.

Liakatas, A., J. A. Clark, and J. L. Monteith. 1986. Measurements of the heat balance under plastic mulches. Agricultural and Forest Meteorology 36: 227-239.

Schalk, J. M. and M. L. Robbins. 1987. Reflective mulches influence plant survival, production, and insect control in fall tomatoes. HortScience 22: 30-32.

Taber, H. G. 1993. Early muskmelon production with wavelength-selective and clear plastic mulches. HortTechnology 3: 78-80.

# EVALUATION OF SUMMER SQUASH PERFORMANCE BASED ON VARIETY, MULCH TYPE, AND METHYL BROMIDE FUMIGATION.

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## Introduction

Summer squash is an important crop in south Georgia with over 10,000 acres of combined spring and fall production. Growers typically will plant successive plantings of squash every two weeks through the spring season. This is curtailed as summer approaches because of the increase in aphid transmitted virus infection. Although squash prices are generally higher in the fall, production is not as high as in spring because of the high incidence of virus infection. Viruses are the single most limiting factor to summer squash production.

Several different methods of controlling virus incidence have been tried with varying degrees of success. Controlling the insect vector has not been particularly effective because the viruses are transmitted in a non-persistent manner, which means the insect only has to feed for a few seconds for transmission to occur. Stylet oils delivered in high pressure sprayers have also shown some effect in controlling these diseases. Presumably the insects' stylet is cleaned as it probes the plant tissue. This assumes complete coverage all exposed plant parts, which is difficult to achieve. Highly reflective mulches have been shown to delay the onset of virus symptoms by confusing the insect vectors. One of the most recent methods of control has been the introduction of virus resistant varieties. Three types of resistance are commonly employed. One is the use of the precocious yellow gene. Plants with this gene lack the green color in the peduncle and fruit therefore when infected the fruit fail to develop the green mottling that is common in infected yellow squash. The plants are susceptible to the virus but mask the damage in the fruit. Another type of resistance is from conventional breeding with resistance coming from a closely related species of squash. Finally, resistance has been introduced through genetic engineering with the incorporation of resistance from the virus coat protein gene.

This study was undertaken to assess resistant varieties, reflective mulch, and methyl bromide on squash performance.

## Materials and Methods

Two different experiments were established at the Vidalia Onion and Vegetable Research Center. One experiment was established in a split-block arrangement with a randomized complete block design with four replications. The strip-plot effect was with and without methyl bromide. The main plot effects were yellow squash varieties either ‘Destiny III’ (Asgrow Seed Co.) a virus resistant variety or ‘Dixie’ (Asgrow Seed Co.) a standard virus susceptible type. In addition, the use of a reflective or black plastic mulch were evaluated.

Black plastic was installed and methyl bromide was applied on 4 Aug. 2000. Reflective plastic was applied over the black plastic mulch for those treatments with reflective mulch. Plants were direct seeded on 16 Aug. 2000 with 10 hills per plot into plastic with an in-row spacing of two feet and a between row spacing of six feet. Plants were watered and fertilized through the under plastic drip irrigation system according to University of Georgia soil test recommendations beginning four weeks after seeding. Plants were harvested on 22, 25, 27 Sept. and 2, 6, 12 Oct. 2000. The yield and number of marketable fruit was recorded. The yield results only are presented.

The second experiment was a 2x3 factorial arrangement with a randomized complete block design of four replications. The first factor was black plastic or reflective plastic mulch. The second factor was three varieties of squash including ‘Destiny III’, ‘Dixie’, and ‘HMX 7710’ an experimental zucchini squash from Harris Moran Seed with virus resistance.

Reflective mulch was applied over the black plastic as in experiment 1. Harvest dates were 25, 27 Sept. and 2, 6, 12 Oct. 2000. The yield and number of marketable fruit was recorded. The yield results only are presented.

## Results and Discussion

There were no virus infected plants in the study therefore the results presented here are the direct results of the treatments rather than the affect on virus infection. In the first experiment, methyl bromide reduced the squash yield compared to the untreated plots (Table 1). This may reflect insufficient time between fumigant application and seeding the plots. Current recommendations are for a minimum of three weeks between treatment and planting.

There were no yield differences between ‘Destiny III’ and ‘Dixie’. The reflective mulch resulted in higher yields compared to the black mulch. Overall, throughout the experiment, plants on the reflective mulch appeared larger. This is probably due to the greater amount of light available to these plants as it is reflected back onto the leaf surfaces, which may have contributed to the increased yield.

There was only one interaction effect in the first experiment between methyl bromide and mulch. On the non-fumigated plots the reflective mulch plots yielded higher than in plots with black plastic. This was not the case on fumigated plots where there was no difference between reflective and black mulches.

In the second experiment there was a difference between the varieties Destiny III, Dixie, and HMX 7710 with yields of 5.4, 3.4, and 1.1, respectively (Table 2). In addition, the reflective mulch yielded higher than the black mulch. There were no interaction effects in this experiments.

**Table 1.** Evaluation of methyl bromide, variety, and mulch type on yield of yellow summer squash.

| | Yield (lbs/plot) |
|---|---|
| Methyl Bromide | |
| Yes | 7.3 |
| No | 11.1 |
| Variety | |
| Destiny III | 9.9 |
| Dixie | 8.4 |
| Mulch | |
| Reflective | 11.7 |
| Black | 6.6 |
| Prob.>F | |
| Methyl Bromide | 0.020 |
| Variety | 0.235 |
| Mulch | 0.044 |
| Methyl Bromide x Mulch | 0.017 |

| Yield (lbs/plot)<br>Mulch | Fumigated | Non-fumigated |
|---|---|---|
| Reflective | 8.2 | 15.3 |
| Black | 6.4 | 6.9 |
| Prob.>F | 0.084 | 0.000 |

**Table 2.** Evaluation of variety and mulch on yield of yellow summer squash.

| | Yield (lbs/plot) |
|---|---|
| Variety | |
| Destiny III | 5.4a[z] |
| Dixie | 3.4b |
| HMX 7710 | 1.1c |
| | |
| Mulch | |
| Reflective | 4.6 |
| Black | 2.0 |
| | |
| Prob.>F | |
| Variety | 0.001 |
| Mulch | 0.002 |

[z]Means followed by the same letter within a column are not different by Fisher's Protected LSD ($p \geq 0.05$).

# OPTIMIZING COLLARD SPACING FOR NORTH GEORGIA GROWERS

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## Introduction

Fresh market collard production makes up a sizeable percentage of north Georgia's vegetable industry. Growers have traditionally used wide plant spacings to produce a heavy, large plant. This enables the grower to sell the collards in bunches of whole plants or single plants.

However, overall yields have traditionally been lower than what would be expected for collard production in that area. Intuitively, it would seem that a closer plant spacing would provide a much greater yield. However, the plant must still be large enough to sell as whole plants or bunches of whole plants.

The objective of this study was to evaluate yield potential with several different within-row and between-row plant spacings and to demonstrate the results of these spacings to growers.

## Methods

Plots were established at the Georgia Mountain Branch Experiment Station (elev. 1900 feet) in Blairsville, Georgia. Collard transplants were grown under recommended cultural practices with a local commercial transplant producer. Preplant fertilizer application of 600 pounds/acre of 10-10-10 was broadcast and incorporated. Trifluralin at one pint/acre was also incorporated prior to crop establishment for weed control.

Transplants were set into a Transylvania clay loam soil on August 24, 2000. Six different plant spacing combinations were imposed as treatments. Between-row spacings of 36, 30 and 24 inches were used as well as within-row spacings of nine and twelve inches. Plots were replicated four times each. Resulting plant populations for each spacing combination are shown in Table 1.

Data were collected on the center row of each plot which was bordered by two adjacent rows the designated distance from that row. Otherwise normal cultural and pest control practices were employed. One sidedress application of sodium nitrate for an additional 60 pounds/acre nitrogen was applied. Irrigation was applied as needed.

Due to an impending freeze, the collards were harvested on November 17, 2000, however, they were fully mature. In order to insure the harvest was complete prior to the freeze, a five-foot section of each plot was harvested and data collected from this sample. Data were collected on number of plants, total weight, plant length, plant circumference and length and width of the largest leaf. Data were subjected to analysis of variance using the SAS system and means separated using LSD (0.05).

**Table 1.** Between-row and within-row plant spacing combinations and the resulting theoretical plant populations/acre of collards at the Georgia Mountain Branch Experiment Station at Blairsville, Georgia in 2000.

| Between-row (inches) | Within-row (inches) | Population (plants/acre) |
|---|---|---|
| 36 | 12 | 14,520 |
| 36 | 9 | 19,360 |
| 30 | 12 | 17,424 |
| 30 | 9 | 23,232 |
| 24 | 12 | 21,780 |
| 24 | 9 | 29,040 |

Results

There were no significant differences in plant length (Table 2), although closer spacing tended to produce taller plants. There were, however, significantly smaller plant circumferences produced by closer spacings (Table 2). Leaf length was greater in the twelve-inch spacings than the nine-inch spacings regardless of between-row spacing (Table 3). Only the 30- and 24-inch spacings at nine inches showed significantly shorter leaves. There were no differences among treatments for the width of the largest leaves (Table 3), although the widest spacing produced a particularly longer leaf than other spacings.

Average plant weight was more influenced by within-row spacing than between-row spacing (Table 4). As within-row and between-row spacing decreased, respectively, average plant weight decreased as well. Total yield (Table 4) was more influenced by between-row spacing than within-row spacing. The closer the between-row/within-row spacing combination, the higher the total yield.

**Table 2.** Plant length and circumference of collard plants by in-row/between-row plant spacing combinations at Blairsville, Georgia in 2000.

| Spacing (inches) | Plant Length (inches) | Plant Circumference (inches) |
|---|---|---|
| 36 X 12 | 21.0 a | 33.2 ab |
| 36 X 9 | 21.7 a | 32.9 ab |
| 30 X 12 | 23.0 a | 34.3 a |
| 30 X 9 | 20.8 a | 33.2 ab |
| 24 X 12 | 23.1 a | 30.8 bc |
| 24 X 9 | 22.8 a | 27.6 c |
| LSD (0.05) | 2.6 | 3.5 |

Means followed by the same letter within a column are not significantly different at p=0.05.

**Table 3.** Leaf length and width of collard plants by in-row/between-row plant spacing combinations at Blairsville, Georgia in 2000.

| Spacing (inches) | Leaf Length (inches) | Leaf Width (inches) |
|---|---|---|
| 36 X 12 | 21.4 ab | 15.0 a |
| 36 X 9 | 20.8 ab | 9.6 a |
| 30 X 12 | 21.4 ab | 9.8 a |
| 30 X 9 | 20.2 b | 9.2 a |
| 24 X 12 | 21.6 a | 10.3 a |
| 24 X 9 | 20.3 b | 9.2 a |
| LSD (0.05) | 1.3 | 6.1 |

Means followed by the same letter within a column are not significantly different at p=0.05.

**Table 4.** Average plant weight and yield/acre of collard plants by in-row/between-row plant spacing combinations at Blairsville, Georgia in 2000.

| Spacing (inches) | Average Plant Weight (pounds) | Yield/Acre[1] (50-# boxes) |
|---|---|---|
| 36 X 12 | 2.3 a | 1460 d |
| 36 X 9 | 1.8 bcd | 1535 cd |
| 30 X 12 | 2.1 ab | 1611 bcd |
| 30 X 9 | 1.8 cd | 1806 abc |
| 24 X 12 | 2.0 bc | 1869 ab |
| 24 X 9 | 1.5 d | 1920 a |
| LSD (0.05) | 0.3 | 280 |

Means followed by the same letter within a column are not significantly different at p=0.05. [1]Yield calculated by multiplying average plant weight by the theoretical plant population for that treatment from Table 1.

<u>Summary and Conclusions</u>

Plant circumference and leaf length were both reduced by closer plant spacings. Plant length and leaf width were not affected by varying plant spacings. Average plant weight was more affected by within-row than between-row spacing. Total yield increased with closer plant spacings.

Growers should be able to increase overall yields while still maintaining overall plant quality by reducing their within-row and between-row spacings based on these initial findings. However, more testing is needed to verify these results and to evaluate larger, on-farm plots. Growers currently use at least a 36-inch between row and 14- to 15-inch within-row spacing. Since these collards are usually sold in bunches, growers should still be able to bundle collards and maintain the integrity of their marketing methods while increasing overall yields. Again, these results should be verified and further testing done before definite recommendations are made.

*The authors appreciate the assistance and cooperation of Mr. Joe Garner, superintendent at the Georgia Mountain Branch Experiment Station and his staff in conducting this research.*

# Variety Evaluation

## EVALUATION OF WATERMELON AND CANTALOUPE VARIETIES

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Watermelon and cantaloupe are important crops in Georgia. In 1998 there was 33,430 acres of watermelon accounting for over 20% of the vegetable acreage and 7,840 acres of cantaloupe which was 4.7% of the acreage. Yields for watermelon averaged 420 cwt. in 1998 and 140 cwt. for cantaloupe. Production of watermelon and cantaloupe has primarily been in south central Georgia.

Two watermelon variety trials and one cantaloupe trial were held at the Vidalia Onion and Vegetable Research Center (VOVRC) in Toombs County, Georgia. Thirty-nine different watermelon varieties were trialed in the watermelon trials as well as seven varieties in the cantaloupe trial. In the first watermelon trial the initial number of varieties to be trialed was 33, however, four of the varieties had insufficient germination to be included in the trial. These varieties included 'Revolution (4034)', 'EX 4590339', 'EX 4590249', and 'AU-Sweet Scarlet SS'. Three of the four, 'Revolution (4034)', 'EX 4590339', and 'EX 4590249' were triploid varieties which are known to be difficult to germinate.

Watermelon plants for the first trial and the cantaloupe plants were started in the greenhouse on 4/14/00 in a peatlite mix. All trials were arranged in a randomized complete block design with four replications. Each plot within the trials consisted of ten hills planted five feet apart in the row with six feet between rows. 10-10-10 was applied on 5/15/00 at a rate of 800 pounds per acre. Transplants for the first watermelon trial and the cantaloupe trial were planted on 5/15/00. On 5/26/00 Sonolan herbicide was applied at a rate of 1 quart per acre to the first watermelon and the cantaloupe trials. In addition, Poast was applied on 6/1/00 at a rate of 1 pint per acre, Basagran was applied on 6/9/00 at a rate of 1.5 pints per acre, and Alanap was applied on 6/13/00 at a rate of 5 quarts per acre. Hand weeding was also done as needed. Finally, 400 pounds per acre of 15-0-14 was applied on 6/14/00.

The second watermelon trial was seeded in the greenhouse on 5/3/00 and transplanted to the field on 5/31/00. The second watermelon trial had 800 pounds of 10-10-10 broadcast preplant. In addition 400 pounds of 15-0-14 was sidedressed on the crop one month after transplanting. Weed control consisted of Sonolan herbicide applied as a preemergent herbicide applied at one quart per acre directly after transplanting. In addition, hand weeding was done as necessary. Herbicide selection and application rates and timing for all these trials do not reflect current accepted practices for Georgia.

Three harvests were made on the first watermelon trial and two harvests on the cantaloupe trial. The first harvest was on 7/24/00 and the second on 7/27/00 as the melons ripened. The number of fruit and the total weight was recorded for each plot. In addition, two representative fruit from each plot was cut and measured for length, width, rind thickness, and soluble solids (percent sugar). In addition, melon type and flesh color was noted. Melon types are indicated by representative varieties which help describe the melon types. Jubilee is a relatively large oblong melon with a dark green stripe on a light green background. Crimson Sweet is a round medium sized melon with a stripe pattern similar to Jubilee. Allsweet is a medium sized oblong melon with a light stripe on a dark green background. Sugar Baby are small dark green melons usually less than 10 pounds. Seedless melons are not really seedless, but have a 3n (triploid) number of chromsomes. This prevents the development of hard mature seed, which instead remain soft and edible. The second watermelon trial was harvested on 8/14/00 and the same data as mentioned previously was collected.

Table 1 has the results of the first trial. The varieties are sorted in rank order based on yield per acre. The range of yields was from 48,627 pounds per acre for 'Stars n Stripes' to 12,828 pounds per acre for 'WX 57' with a least significant difference (LSD) of 17,910 pounds per acre. The highest yield for a seedless variety was 39,229 pounds per acre for Asgrow's experimental variety, 'EX 4203337'. Seedless varieties performed much better in these trials compared to previous years. In the 1998 trials, for example, all of the seedless varieties had yields at least 5,000 pounds per acre less than the lowest yielding $F_1$ hybrid. Contrast with this year's trial two of the top five yielding varieties were seedless varieties.

The second watermelon trial consisted primarily of varieties from D. Palmer Seed Company which arrived late for the first trial. Included in this trial was 'Piñata' and 'Stars n Strips' both of which are good yielding $F_1$ hybrid varieties. The range of yields for this trial was from 30,401 pounds per acre to 4,622 pounds per acre with an LSD of 11,126 pounds per acre. The best yielding D. Palmer variety was 'Buttercup' a yellow fleshed small Crimson Sweet type melon. This trial included several Sugar Baby seedless types. These varieties yielded significantly lower than the top performing varieties in this trial. Of the top five yielders in this trial, two were seedless varieties. The trend to seedless watermelons in the Southeast continues with an increase in performance overall for these varieties.

The cantaloupe trial consisted of seven varieties. Four of these varieties were actually seed saved from specific melon types and are indicated as open-pollinated in Table 3. The other three varieties, 'Vienna', 'Athena', and 'SXM 7119' are Eastern types from their respective companies. The range of yields was from 18,263 pounds per acre to 8,770 pounds per acre, however, the LSD was not significant.

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

| Variety | Seed Source | Yield lb/acre | Sugar Content (%) | Fruit Length (in) | Fruit Width (in) | Rind Thickness (in) | Fruit Weight (lbs) | Melon Type | Flesh Color |
|---|---|---|---|---|---|---|---|---|---|
| Stars n Stripes | Asgrow | 48,627 | 9.9 | 17.4 | 8.2 | 1.0 | 15.6 | Jubilee | Red |
| WX22 | Willhite Seed | 47,956 | 10.4 | 14.1 | 9.4 | 0.7 | 17.9 | Blocky Crimson Sweet | Red |
| AU-Jubilant | Hollar Seed Co. | 43,549 | 9.4 | 16.9 | 8.4 | 0.9 | 19.4 | Jubilee | Red |
| EX 4203337 | Asgrow | 39,229 | 9.8 | 10.8 | 8.7 | 0.9 | 11.7 | Crimson Sweet Seedless | Red |
| W 5036 | Sunseeds | 39,160 | 10.1 | 15.5 | 8.2 | 0.9 | 15.6 | Crimson Sweet Seedless | Red |
| EX 4510759 | Asgrow | 38,434 | 10.6 | 11.5 | 8.9 | 0.9 | 13.9 | Crimson Sweet Seedless | Red |
| Dumara | Sunseeds | 38,355 | 10.3 | 14.0 | 9.2 | 0.8 | 16.0 | Allsweet | Red |
| EX 4569319 | Asgrow | 37,981 | 10.0 | 15.3 | 8.5 | 0.9 | 16.9 | Allsweet | Red |
| AU-Golden Producer | Hollar Seed Co. | 37,552 | 10.7 | 11.1 | 9.6 | 0.9 | 15.0 | Crimson Sweet | Yellow |
| WX15 | Willhite Seed | 37,175 | 10.0 | 12.6 | 9.3 | 0.8 | 15.8 | Allsweet | Red |
| AU Producer ZYMV | Auburn Univ. | 37,066 | 9.7 | 11.0 | 9.7 | 0.8 | 14.4 | Crimson Sweet | Red |
| AU Sweet Scarlet | Hollar Seed Co. | 35,465 | 10.3 | 11.3 | 9.8 | 0.6 | 14.6 | Crimson Sweet | Red |
| Legacy | Willhite Seed | 35,044 | 9.7 | 16.2 | 8.6 | 0.8 | 19.3 | Allsweet | Red |
| Athens (5025) | Sunseeds | 34,478 | 10.0 | 14.2 | 8.9 | 0.9 | 15.8 | Allsweet | Red |
| Lady | Sunseeds | 34,129 | 9.6 | 12.3 | 8.9 | 0.9 | 15.4 | Blocky Jubilee | Red |
| Festival | Willhite Seed | 32,975 | 9.6 | 13.8 | 8.2 | 0.8 | 17.1 | Allsweet | Red |
| WX30 | Southwestern | 32,176 | 9.9 | 13.4 | 9.0 | 0.9 | 15.0 | Blocky Jubilee | Red |
| Piñata | Willhite Seed | 31,704 | 9.1 | 15.1 | 9.2 | 0.8 | 16.8 | Allsweet | Red |
| WX8 | Willhite Seed | 31,164 | 10.1 | 14.5 | 8.9 | 0.8 | 15.9 | Allsweet | Red |
| WX55 | Willhite Seed | 30,242 | 10.7 | 10.3 | 9.2 | 0.9 | 12.6 | Jubilee | Red |
| SXW 5023 | Sunseeds | 29,138 | 10.7 | 15.3 | 8.9 | 0.9 | 15.1 | Allsweet | Red |
| Slice N Serve 830 | Southwestern | 27,824 | 10.3 | 10.7 | 8.5 | 0.9 | 11.8 | Crimson Sweet Seedless | Red |
| W 5052 | Sunseeds | 26,169 | 10.4 | 10.7 | 8.5 | 0.8 | 12.6 | Crimson Sweet Seedless | Red |
| Freedom (3022) | Sunseeds | 23,512 | 11.1 | 12.5 | 8.2 | 0.9 | 17.5 | Seedless Jubliee | Red |
| Premiere F1 | Southwestern | 22,800 | 10.6 | 10.9 | 8.5 | 0.7 | 10.8 | Crimson Sweet Seedless | Red |
| XP 452547 | Asgrow | 20,441 | 10.5 | 16.1 | 8.0 | 0.6 | 13.1 | Smokey Jubilee | Red |
| AU-Allsweet BL | Auburn Univ. | 19,947 | 10.6 | 15.1 | 9.7 | 0.8 | 16.2 | Allsweet | Red |
| W 5051 | Sunseeds | 15,863 | 10.3 | 12.5 | 8.2 | 0.9 | 13.2 | Allsweet | Red |
| WX57 | Willhite Seed | 12,828 | 9.9 | 11.6 | 8.7 | 0.9 | 13.1 | Crimson Sweet Seedless | Red |
|  | $R^2$ | 0.429 | 0.371 |  |  |  |  |  |  |
|  | CV | 44% | 8% |  |  |  |  |  |  |
|  | LSD | 17,910 | NS |  |  |  |  |  |  |

**Table 2**. Watermelon variety trial at the VOVRC harvested 8/14/00

| Variety | Seed Sources | Yield lb/acre | Sugar Content (%) | Fruit Length (in) | Fruit Width (in) | Rind Thickness (in) | Fruit Weight (lbs) | Melon Type | Flesh Color |
|---|---|---|---|---|---|---|---|---|---|
| Piñata | Whilhite | 30,401 | 9.2 | 13.7 | 8.2 | 0.7 | 15.0 | Allsweet | Red |
| Buttercup | D. Palmer | 28,085 | 10.4 | 10.7 | 8.5 | 0.5 | 11.5 | Crimson Sweet | Yellow |
| DPS 4571 | D. Palmer | 27,791 | 10.1 | 11.6 | 8.8 | 0.5 | 12.6 | Crimson Sweet Seedless | Red |
| Big Charlie | D. Palmer | 24,216 | 10.5 | 10.8 | 9.3 | 1.0 | 12.1 | Crimson Sweet Seedless | Red |
| Stars n Stripes | Asgrow | 20,797 | 10.4 | 15.5 | 7.4 | 0.4 | 12.6 | Jubilee | Red |
| Sweet Caroline Imp | D. Palmer | 19,410 | 10.9 | 9.4 | 8.7 | 0.5 | 10.3 | Crimson Sweet Seedless | Red |
| Enchantment | D. Palmer | 19,097 | 10.9 | 11.6 | 9.3 | 0.6 | 13.2 | Crimson Sweet Seedless | Red |
| DPS 4586 | D. Palmer | 12,084 | 11.5 | 10.5 | 7.9 | 0.5 | 10.7 | Crimson Sweet Seedless | Red |
| Sweet Amigo | D. Palmer | 11,986 | 9.3 | 16.2 | 8.3 | 0.4 | 16.5 | Allsweet | Red |
| DPSX 4599 | D. Palmer | 7,560 | 10.9 | 7.6 | 7.3 | 0.8 | 6.5 | Sugar Baby Seedless | Red |
| DPSX 4598 | D. Palmer | 5,496 | 11.9 | 8.2 | 7.4 | 0.5 | 7.2 | Sugar Baby Seedless | Red |
| WT-1 | D. Palmer | 4,622 | 10.4 | 7.6 | 6.9 | 0.5 | 6.4 | Sugar Baby Seedless | Red |
| | $R^2$ | 0.667 | 0.672 | | | | | | |
| | CV | 61% | 10% | | | | | | |
| | LSD | 11,126 | 1.0 | | | | | | |

**Table 3.** Cantaloupe variety trial at the VOVRC harvested 7/24/00.

| Variety | Seed Source | Yield lb/acre | Sugar Content (%) | Fruit Length (in) | Fruit Width (in) | Flesh Thickness (in) | Fruit Weight (lbs) | Melon Type | Flesh Color |
|---|---|---|---|---|---|---|---|---|---|
| Vienna | Asgrow | 18,263 | 7.9 | 7.5 | 7.1 | 2.0 | 5.2 | Eastern | Orange |
| Santa Claus | Open-pollinated | 14,353 | 6.2 | 10.3 | 6.3 | 2.1 | 4.9 | Santa Claus | Green |
| Athena | Rogers | 13,914 | 9.3 | 6.9 | 6.4 | 1.9 | 4.1 | Eastern | Orange |
| SXM 7119 | Sunseeds | 13,449 | 7.2 | 7.4 | 6.9 | 1.9 | 4.3 | Eastern | Orange |
| Western Shipping | Open-pollinated | 11,514 | 8.4 | 6.0 | 5.6 | 1.6 | 2.3 | Western | Orange |
| Juan Canary | Open-pollinated | 10,222 | 8.0 | 8.2 | 5.7 | 1.6 | 3.6 | Juan Canary | Green |
| Crenshaw | Open-pollinated | 8,770 | 8.3 | 8.1 | 7.1 | 2.0 | 5.7 | Crenshaw | Salmon |
| | $R^2$ | 0.367 | 0.530 | | | | | | |
| | CV | 40% | 22% | | | | | | |
| | LSD | NS | NS | | | | | | |

**Table 4.** Ratings of 2000 Watermelon & Cantaloupe Variety Trials.

| Location | Bamboo Farm |
|---|---|
| Weather | 5 |
| | 5 |
| | 5 |
| | 5 |
| | 5 |
| Fertility | |
| Irrigation | |
| Pests | |
| Overall | |

*See Introduction for description of rating scales*

# EVALUATION OF TOMATO VARIETY, ADMIRE DRENCH, AND MALATHION/KARATE INSECTICIDES ON TOMATO SPOTTED WILT VIRUS

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## Introduction

Tomato production was once much more prevalent in southeast Georgia in what is now the Vidalia onion production region. This production has waned over the years as onion production has increased. One of the main reasons for this is the increased prevalence of Tomato Spotted Wilt Virus (TSWV). This virus can be devastating on tomato production causing stunting of plants, misshapen and miscolored fruit, and even death of the entire plant. Once a plant is infected there is no cure.

This disease is transmitted by thrips in a persistent manner. Persistent transmission requires the insect to feed on the plant for several minutes for the disease to be transmitted. Because of this persistent transmission, effective control of the insect vector should reduce the incidence of the disease.

The Department of Corrections statewide produces about 50% of the food consumed in the prison system. The prison in Tattnall County is one of the largest farms in southeast Georgia. The Department of Corrections has traditionally produced tomatoes for canning. Unlike most field tomato production in the state, which relies on the Florida system (plastic mulch & staking), the Department of Corrections has grown a direct seeded unstaked canning tomato on bareground that relies on inmate labor to harvest the fruit.

The objective of this study was to assess some of the new control measures for TSWV (i.e. resistant varieties, insecticide applications) to see if tomatoes could be produced for the Department of Corrections canning facility.

## Materials & Methods

The experimental design was a 2x2x2 factorial design. Factors included varieties Rutgers and BHN444. With and without soil drench of Admire (imadacloprid) at planting was the second factor. The third factor was treatments with and without applications of malathion and Karate (lambda cyhalothrin) in combination. The experimental arrangement was a randomized complete block design with four replications. Admire was mixed at a rate of 0.64 fluid ounces in 30 gallons of water. Approximately 12 ounces of the Admire mix was applied to each plant in this treatment. Malathion and Karate were used at a rate of three pints per acre and 3.75 ounces per acre, respectively. These were applied to runoff on plants in this treatment immediately after transplanting and every seven days for four weeks.

Fertilizer consisted of 800 pounds of 10-10-10 applied preplant and incorporated. Additional applications of 200 pounds of $CaNO_3$ were applied at four and six weeks after transplanting. Weed control consisted of a preplant incorporated application of trifluralin (Treflan) at a rate of one pint per acre. Each plot consisted of 20 plants planted with an in-row spacing of two feet and a between row spacing of six feet. There was a five-foot in-row alley between each plot. Tomato seed of ‘Rutgers’ and ‘BHN444’ were started in the greenhouse at the Bamboo Farm and Coastal Garden in Savannah, GA on 24 March 2000 and transplanted to the field on 16 May 2000 at the Vidalia Onion and Vegetable Research Center, Lyons, GA.

Leaf tissue was collected on 27 June 2000 from each plant within a plot and two samples were prepared for virus assessment. Plants were evaluated for TSWV by enzyme-linked immunosorbant assay (ELISA) by Agdia Inc., Elkhart, IN. Agdia reported samples with an absorbance value of 0.435 and above as positive for TSWV and the highest negative value of 0.030.

Tomatoes were also assessed visually for overall health and vigor. Plants were rated on a 1-10 scale with 1 indicating healthy vigorous growth while plants rating 10 were stunted, poorly growing, or showed severe TSWV infection.

## Results & Discussion

‘BHN444’ was resistant to TSWV as claimed by the seed company with an ELISA absorbance level of 0.010 (Table 1). By contrast ‘Rutgers’ was highly susceptible. The visual evaluation showed no difference between these varieties with values of 3.6 and 4.2 for ‘BHN444’ and ‘Rutgers’, respectively. This is probably more a function of planting time with the experiment being established in the field on May 16$^{th}$. Although tomatoes are considered a warm season crop they do not perform well during the hottest time of the year. Most tomato production is reserved for early spring and fall to circumvent the high temperatures during summer months.

The Admire drench had an average ELISA absorbance value of 0.363, which was well above the highest single negative value, reported (0.030). There were no differences between plants receiving the Admire drench and those not receiving the drench either for the absorbance value or the visual rating.

Applications of malathion and Karate in combination resulted in a significantly lower average absorbance value compared to plants not treated with these insecticides. The absorbance value of 0.135 however was three times higher than the highest negative reported. There were no differences in the visual evaluation between these treatments.

There were no interaction effects except for a variety x insecticide interaction for ELISA absorbence therefore insecticide absorbence levels are reported separately for the varieties (Table 1). The absorbence levels with the malathion/Karate combination for ‘Rutgers’ was 0.261 compared to 1.617 without the insecticides. This difference was close to but was not significant. There was no difference for the insecticide treatment on ‘BHN444’.

These results clearly show that host plant resistance offers the best method of controlling this devastating disease. Malathion and Karate in combination offered some control, but was not as good as host plant resistance. It should be noted, however, that ‘BHN444’ is not a canning tomato as is ‘Rutgers’. Richard Wojiack with Sunseed, Inc. has indicated that they may have a TSWV resistant canning tomato. In addition, BHN Research may be working on incorporating this resistance into canning type tomatoes. Without a suitable canning tomato with TSWV resistance, insecticide applications are the only alternative.

As mentioned earlier the visual ratings did not differ between the treatments which may have been due to high temperatures with the late planting date. Recently, BHN Research has introduced a heat set variety called BHN555, which may be better suited to high temperature production.

**Table 1.** Effect of variety, Admire drench, and malathion/Karate spray on TSWV in tomato.

| | ELISA Absorbence | Visual Evaluation[z] |
|---|---|---|
| Variety | | |
| BHN444 | 0.010 | 3.6 |
| Rutgers | 0.939 | 4.2 |
| Admire Drench | | |
| Yes | 0.363 | 4.0 |
| No | 0.586 | 3.8 |
| Malathion & Karate | | |
| Yes | 0.135 | 3.8 |
| No | 0.813 | 4.0 |
| Prob.>F | | |
| Variety | 0.009 | 0.087 |
| Admire Drench | 0.501 | 0.542 |
| Malathion & Karate | 0.049 | 0.462 |
| Variety x Insecticides[y] | 0.049 | |

| | ELISA Absorbence | |
|---|---|---|
| Malathion & Karate | Rutgers | BHN444 |
| Yes | 0.261 | 0.010 |
| No | 1.617 | 0.010 |
| Prob.>F | | |
| Insecticides[y] | 0.058 | 0.473 |

[z]Visual Evaluation: 1-10, 1-Healthy, 10-Stunted

[y]Insecticides: Malathion & Karate

# COMMERCIAL SQUASH CULTIVAR EVALUATION

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## Introduction

Summer squash production accounts for over $30 million in farmgate receipts in Georgia. Most of the production occurs in the southern coastal plain. Both yellow (crookneck and straightneck) and zucchini squash are produced. Introduction of virus-resistant squash hybrids in the last few years has drastically changed variety selection in squash. Many of the varieties currently produced have resistance to at least two of the four major squash viruses. Varieties with the precocious yellow gene are also abundant on the market. Continual evaluation of squash varieties is necessary to determine which of these new varieties perform to an acceptable level of production and quality under Georgia conditions.

## Methods

Six zucchini, five yellow crookneck and four yellow straightneck commercially-available squash varieties were compared at the Coastal Plain Experiment Station (elev. 382 feet) in Tifton, Georgia. All varieties were field-seeded on 2 June, 2000 into a Tifton sandy loam soil (fine-loamy siliceous, thermic Plinthic Kandiudults) covered with plastic mulch. Plots consisted of two rows with zucchini spaced 24 inches between plants and yellow spaced 18 inches between plants. Plots were 12 feet in length with two rows planted on each plastic-covered bed. Beds were on six-feet centers with the top of the bed approximately 42 inches across. The planting was arranged in a Randomized Complete Block Design with three replications.

Normal cultural practices were used for squash grown with plastic culture in Georgia. Methyl bromide (300 gallons per acre/65%) was applied at the time plastic mulch was installed. Base fertilizer consisted of 400 pounds/A of 10-10-10 incorporated prior to laying plastic. Additional fertilizer was applied through the drip irrigation system at a rate equal to 1.5 pounds per acre per day of N and K. Fungicide and insecticide applications were made according to current recommendations. Irrigation was applied daily through the drip system.

Squash were harvested on July 10, 12, 14, 17, 20, 24, 26, 28 and 31, 2000. Data were collected on yield by grade, percent virus infection, early yield, marketability, average fruit weight and fruit number. Results are summarized in Tables 1-12.

Results

A higher percentage of squash fell into the medium grade than would be expected under grower conditions since harvests only occurred three times per week. Among zucchinis, Cashflow, Declaration II, Dividend and Tigress produced the highest yields of fancy and medium squash (Table 1). Dividend and Independence II had the highest virus incidence. Tigress, Dividend and Revenue had the highest percentage of marketability while Cashflow and Independence II had the lowest (Table 3).

Among yellow crookneck, Gentry, Sunbrite and Sunglo produced the highest yields of fancy and medium fruit (Table 5). Prelude II had the lowest virus incidence while all the others had over 20% virus each. The same varieties produced the highest early yields (Table 6). All varieties except Dixie produced similar percentages of marketability.

Among yellow straightneck, Fortune, Multipik and Liberator produced the highest yield of fancy and medium squash (Table 9) with similar results for early yield (Table 10). Multipik had the lowest incidence of virus. Fortune and Multipik had the highest level of marketability while Enterprise and Liberator were both barely above 50%.

**Table 1.** Season yield by grade, total yield, total fancy and medium yield and percent fruit infected with mosaic virus of zucchini squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| Variety | Season Yield (21-lb boxes/A) | | | | | Virus Infected (%) |
|---|---|---|---|---|---|---|
| | Fancy | Medium | Jumbo | Total | Total Fan/Med | |
| Cashflow | 76 | 190 | 108 | 374 | 266 | 1.0 |
| Declaration II | 57 | 200 | 205 | 463 | 258 | 7.7 |
| Dividend | 63 | 163 | 51 | 277 | 226 | 13.7 |
| Independence II | 72 | 117 | 199 | 388 | 189 | 20.3 |
| Revenue | 51 | 146 | 163 | 359 | 197 | 2.0 |
| Spineless Beauty | 65 | 129 | 239 | 433 | 194 | 4.7 |
| Tigress | 47 | 177 | 285 | 509 | 224 | 8.7 |
| Mean | 62 | 160 | 179 | 400 | 222 | 8.3 |
| CV (%) | 43.7 | 31.4 | 84.3 | 39.4 | 24.8 | 97.1 |
| L.S.D. (0.05) | 48 | 90 | 268 | 281 | 98 | 14.3 |

Harvests occurred on July 10, 12, 14, 17, 20, 24, 26, 28 and 31, 2000. Planting date: June 2, 2000. Plot size: 12 plants per plot (two rows of six) on 36" X 24" spacing.

**Table 2.** Early* yield by grade, total early yield and total early fancy and medium yield of zucchini squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| | Early Yield (21-lb boxes/A) | | | | |
|---|---|---|---|---|---|
| Variety | Fancy | Medium | Jumbo | Total | Total Fan/Med |
| Cashflow | 61 | 160 | 64 | 285 | 221 |
| Declaration II | 46 | 150 | 143 | 339 | 196 |
| Dividend | 52 | 148 | 25 | 225 | 200 |
| Independence II | 62 | 85 | 132 | 280 | 147 |
| Revenue | 27 | 119 | 64 | 210 | 146 |
| Spineless Beauty | 59 | 115 | 143 | 316 | 174 |
| Tigress | 32 | 130 | 185 | 347 | 162 |
| Mean | 49 | 130 | 108 | 286 | 178 |
| CV (%) | 47.2 | 37.4 | 113.1 | 42.9 | 30.3 |
| L.S.D. (0.05) | 41 | 86 | 217 | 218 | 96 |

*Early harvests occurred on July 10, 12, 14, 17 and 20, 2000. Planting date: June 2, 2000. Plot size: 12 plants per plot (two rows of six) on 36" X 24" spacing.

**Table 3.** Percent marketability by weight of early and season harvests, percent fancy and medium by fruit number of season harvest and average weight of fancy and medium grade zucchini squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| Variety | Percent Marketable Season (%) | Percent Marketable Early (%) | Percent Fancy/Medium Fruit No. (%) | Average Fancy Weight (g) | Average Medium Weight (g) |
|---|---|---|---|---|---|
| Cashflow | 78.7 | 72.3 | 69.0 | 108.6 | 200.3 |
| Declaration II | 80.3 | 83.7 | 59.7 | 160.1 | 221.2 |
| Dividend | 91 | 93.7 | 82.7 | 151.6 | 240.1 |
| Independence II | 67.3 | 74.3 | 46.7 | 92 | 183.8 |
| Revenue | 91 | 90 | 68.0 | 97.3 | 229.8 |
| Spineless Beauty | 89.7 | 92.3 | 60.3 | 119.6 | 206.6 |
| Tigress | 93.7 | 98.7 | 66.3 | 127.1 | 221.1 |
| Mean | 84.4 | 86.4 | 64.7 | 122.3 | 214.8 |
| CV (%) | 10.9 | 11.7 | 15.0 | 13.5 | 18.2 |
| L.S.D. (0.05) | 16.3 | 17.9 | 17.2 | 29.5 | 69.4 |

**Table 4.** Early and season fruit number by grade of zucchini squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| Variety | *Early Harvest Fancy | *Early Harvest Medium | *Early Harvest Jumbo | Season Harvest Fancy | Season Harvest Medium | Season Harvest Jumbo |
|---|---|---|---|---|---|---|
| Cashflow | 5042 | 8067 | 1412 | 6252 | 9478 | 2622 |
| Declaration II | 2022 | 6453 | 3227 | 3428 | 8470 | 4638 |
| Dividend | 3227 | 5848 | 605 | 4033 | 6453 | 1008 |
| Independence II | 6655 | 4437 | 4235 | 7462 | 6050 | 6252 |
| Revenue | 2218 | 5042 | 1412 | 4437 | 6050 | 3630 |
| Spineless Beauty | 4638 | 5647 | 3025 | 5042 | 6252 | 4638 |
| Tigress | 2218 | 5243 | 3428 | 3428 | 7663 | 4840 |
| Mean | 3803 | 5820 | 2478 | 4869 | 7202 | 3947 |
| CV (%) | 48.6 | 42.0 | 99 | 43.1 | 33.5 | 69.2 |
| L.S.D. (0.05) | 3288 | 4350 | 4362 | 3732 | 4289 | 4860 |

Harvests occurred on July 10, 12, 14, 17, 20, 24, 26, 28 and 31, 2000. Planting date: June 2, 2000. Plot size: 12 plants per plot (two rows of six) on 36" X 24" spacing. *Early harvest includes the first five harvests.

**Table 5.** Season yield by grade, total yield, total fancy and medium yield and percent fruit infected with mosaic virus of yellow crookneck squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| Variety | Season Yield (30-lb boxes/A) Fancy | Medium | Jumbo | Total | Total Fan/Med | Virus Infected (%) |
|---|---|---|---|---|---|---|
| Dixie | 30 | 19 | 14 | 62 | 48 | 23.7 |
| Gentry | 57 | 79 | 17 | 154 | 136 | 22.3 |
| Prelude II | 32 | 43 | 31 | 106 | 75 | 7.6 |
| Sunbrite | 39 | 72 | 10 | 121 | 111 | 25.3 |
| Sunglo | 41 | 69 | 25 | 135 | 110 | 21.7 |
| Mean | 40 | 56 | 20 | 115 | 96 | 20.1 |
| CV (%) | 49.7 | 30.9 | 52.2 | 33.5 | 31.8 | 51.2 |
| L.S.D. (0.05) | 37 | 33 | 19 | 73 | 58 | 19.4 |

Harvests occurred on July 10, 12, 14, 17, 20, 24, 26, 28 and 31, 2000. Planting date: June 2, 2000. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing.

**Table 6.** Early* yield by grade, total early yield and total early fancy and medium yield of yellow crookneck squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| Variety | Early Yield (21-lb boxes/A) | | | | |
|---|---|---|---|---|---|
| | Fancy | Medium | Jumbo | Total | Total Fan/Med |
| Dixie | 24 | 10 | 10 | 44 | 34 |
| Gentry | 53 | 59 | 7 | 120 | 112 |
| Prelude II | 28 | 27 | 16 | 71 | 55 |
| Sunbrite | 35 | 64 | 10 | 109 | 99 |
| Sunglo | 28 | 56 | 16 | 100 | 84 |
| Mean | 34 | 43 | 12 | 89 | 77 |
| CV (%) | 53.5 | 50.7 | 125 | 47.4 | 37.5 |
| L.S.D. (0.05) | 34 | 41 | 28 | 79 | 54 |

*Early harvests occurred on July 10, 12, 14, 17 and 20, 2000. Planting date: June 2, 2000. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing.

**Table 7.** Percent marketability by weight of early and season harvests, percent fancy and medium by fruit number of season harvest and average weight of fancy and medium grade yellow crookneck squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| Variety | Percent Marketable Season (%) | Percent Marketable Early (%) | Percent Fancy/Medium Fruit No. (%) | Average Fancy Weight (g) | Average Medium Weight (g) |
|---|---|---|---|---|---|
| Dixie | 37 | 38.3 | 36 | 96.8 | 185.5 |
| Gentry | 75.3 | 84.0 | 71.3 | 100.6 | 185.5 |
| Prelude II | 68.3 | 79.3 | 57.3 | 124.5 | 209.5 |
| Sunbrite | 60.3 | 80 | 59 | 95.1 | 191.9 |
| Sunglo | 56.3 | 63.7 | 53.7 | 88.3 | 155.6 |
| Mean | 59.5 | 69.1 | 55.5 | 101.1 | 185.6 |
| CV (%) | 23.8 | 24.9 | 19.9 | 12.2 | 180.2 |
| L.S.D. (0.05) | 26.7 | 32.4 | 20.7 | 23.3 | 63.0 |

**Table 8.** Early and season fruit number by grade of yellow crookneck squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| | *Early Harvest | | | Season Harvest | | |
|---|---|---|---|---|---|---|
| Variety | Fancy | Medium | Jumbo | Fancy | Medium | Jumbo |
| Dixie | 3227 | 807 | 403 | 4033 | 1412 | 605 |
| Gentry | 7260 | 4437 | 403 | 7663 | 5848 | 605 |
| Prelude II | 3025 | 1815 | 605 | 3428 | 2823 | 1210 |
| Sunbrite | 4840 | 4437 | 605 | 5445 | 5042 | 605 |
| Sunglo | 4437 | 4840 | 807 | 6252 | 6050 | 1210 |
| Mean | 4558 | 3267 | 565 | 5364 | 4235 | 847 |
| CV (%) | 49.6 | 56.6 | 136.9 | 45.1 | 29.6 | 69.6 |
| L.S.D. (0.05) | 4254 | 3483 | 1456 | 4559 | 2358 | 1110 |

Harvests occurred on July 10, 12, 14, 17, 20, 24, 26, 28 and 31, 2000. Planting date: June 2, 2000. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing. *Early harvest includes the first five harvests.

**Table 9.** Season yield by grade, total yield, total fancy and medium yield and percent fruit infected with mosaic virus of yellow straight neck squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| | Season Yield (30-lb boxes/A) | | | | | Virus Infected (%) |
|---|---|---|---|---|---|---|
| Variety | Fancy | Medium | Jumbo | Total | Total Fan/Med | |
| Enterprise | 30 | 35 | 18 | 82 | 64 | 30.0 |
| Fortune | 23 | 82 | 22 | 126 | 104 | 23.7 |
| Liberator | 18 | 606 | 7 | 86 | 78 | 37.7 |
| Multipik | 42 | 44 | 33 | 120 | 86 | 13.0 |
| Mean | 28 | 55 | 20 | 103 | 83 | 26.0 |
| CV (%) | 74.7 | 48.2 | 115.2 | 56.1 | 51.3 | 64.7 |
| L.S.D. (0.05) | 42 | 53 | 46 | 116 | 85 | 33.7 |

Harvests occurred on July 10, 12, 14, 17, 20, 24, 26, 28 and 31, 2000. Planting date: June 2, 2000. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing.

**Table 10.** Early* yield by grade, total early yield and total early fancy and medium yield of yellow straightneck squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| Variety | Early Yield (21-lb boxes/A) | | | | |
|---|---|---|---|---|---|
| | Fancy | Medium | Jumbo | Total | Total Fan/Med |
| Enterprise | 28 | 12 | 13 | 53 | 40 |
| Fortune | 20 | 47 | 10 | 76 | 67 |
| Liberator | 16 | 36 | 4 | 56 | 52 |
| Multipik | 35 | 30 | 34 | 99 | 65 |
| Mean | 25 | 31 | 15 | 71 | 56 |
| CV (%) | 60.2 | 58.0 | 128.7 | 56.7 | 43.5 |
| L.S.D. (0.05) | 30 | 36 | 38 | 80 | 49 |

*Early harvests occurred on July 10, 12, 14, 17 and 20, 2000. Planting date: June 2, 2000. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing.

**Table 11.** Percent marketability by weight of early and season harvests, percent fancy and medium by fruit number of season harvest and average weight of fancy and medium grade yellow straightneck squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000.

| Variety | Percent Marketable Season (%) | Percent Marketable Early (%) | Percent Fancy/Medium Fruit No. (%) | Average Fancy Weight (g) | Average Medium Weight (g) |
|---|---|---|---|---|---|
| Enterprise | 51 | 52.3 | 39.3 | 105.3 | 211 |
| Fortune | 71.0 | 88 | 67.7 | 127.9 | 169.1 |
| Liberator | 53.3 | 70.7 | 49.0 | 99.3 | 185.7 |
| Multipik | 69.7 | 72.3 | 59.0 | 95.6 | 165.1 |
| Mean | 61.2 | 70.8 | 53.8 | 107.0 | 182.7 |
| CV (%) | 18.9 | 14.5 | 21.1 | 31.5 | 11.6 |
| L.S.D. (0.05) | 23.2 | 20.5 | 22.7 | 67.3 | 42.3 |

**Table 12.** Early and season fruit number by grade of yellow straightneck squash at the Coastal Plain Experiment Station in Tifton, Georgia in 2000**.**

| | *Early Harvest | | | Season Harvest | | |
|---|---|---|---|---|---|---|
| Variety | Fancy | Medium | Jumbo | Fancy | Medium | Jumbo |
| Enterprise | 3630 | 1008 | 605 | 3832 | 2420 | 807 |
| Fortune | 2218 | 4033 | 202 | 2622 | 6655 | 807 |
| Liberator | 1815 | 2823 | 202 | 2017 | 4638 | 403 |
| Multipik | 4840 | 2622 | 1412 | 5848 | 3630 | 1412 |
| Mean | 3126 | 2622 | 605 | 3580 | 4336 | 857 |
| CV (%) | 44.4 | 60.7 | 138.4 | 61.9 | 49.8 | 115.3 |
| L.S.D. (0.05) | 2770 | 3179 | 1673 | 4427 | 4316 | 1974 |

Harvests occurred on July 10, 12, 14, 17, 20, 24, 26, 28 and 31, 2000. Planting date: June 2, 2000. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing. *Early harvest includes the first five harvests.

# COMMERCIAL PUMPKIN VARIETY TRIALS

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## Introduction

Pumpkin acreage in Georgia continues to expand with most of the growth in the northern tier of the state. Several new varieties have been introduced to the commercial market in the last few years. This project is an annual evaluation to keep growers updated with local information on new pumpkin variety releases.

## Methods

Thirty-two commercially-available pumpkin varieties were compared at the Georgia Mountain Branch Experiment Station (elev. 1900 feet) in Blairsville, Georgia. Pumpkins were field-seeded on May 30, 2000 into a Transylvania clay loam soil. Plots consisted of single rows which contained an appropriate number of hills for each variety's plant habit. Vining types were planted with four hills per plot, semi-bush (or semi-vining) types with six hills and bush types with eight hills. Plots were 16 feet in length with eight feet between rows. The planting was arranged in a Randomized Complete Block Design with three replications.

Normal cultural practices were used for bare ground pumpkin culture in Georgia. Base fertilizer consisted of 300 pounds/A of 10-10-10 incorporated prior to planting followed by two sidedress applications of 10-10-10 (300 pounds/A each). Ethafluralin (0.75 lb a.i./A) was applied pre-emergence for weed control. Fungicide and insecticide applications were made according to current recommendations. Irrigation was applied as needed.

Pumpkins were harvested at maturity on October 3-4, 2000. Data were collected on yield, fruit number and weight, rind color, rind texture and fruit shape. Results are summarized in Table 1.

## Results

Individual pumpkin weights were generally within those expected according to commercial variety descriptions. "First Prize" produced the greatest yield and largest fruit size among all varieties, although not significantly greater than "Magic Lantern". Among miniature varieties "Munchkin", "Little October" and "Lil' Goblin" all produced similar fruit numbers with weights in the 1½ to half-pound range.

Marketability was generally high for all varieties, although "Wee-B-Little", "Ol' Zeb's" and "Casper" were significantly lower than the most marketable varieties. There was some variance among varieties for rind color and rind texture. Rind color ranged from deep orange to light orange. "Lumina" and "Casper" were the only pumpkins in the trial with a white rind. Fruit shape was generally in accordance with the type of pumpkin, with smaller pumpkins having a flatter shape.

Most varieties produced exceptional yields and fruit numbers and many were well within the range for acceptability in north Georgia. Lower performers included "Early Autumn", "Pro Gold #100", "Wee-Be-Little", "Peek-A-Boo", "Ol' Zeb's", "Casper" and "Howdy Doody" which did not produce yields and fruit number per acre that were competitive with other similarly-sized pumpkins.

"Autumn King", "Gold Bullion", "Gold Rush", "Harvest Jack", "HMX 4694", "Jumpin' Jack", "Magic Lantern", "Merlin", and "Pro Gold #500" were all superior performers among the 15-30-pound pumpkins.

*The author wishes to thank Mr. Joe Garner and his staff at the Georgia Mountain Branch Experiment Station for their efforts in support of this work.*

**Table 1.** Yield, number, marketability and horticultural characteristics of 32 varieties of pumpkins grown at Blairsville, GA in 2000.

| Variety | Sponsor | No. Fruit/A | Yield (lb/Acre) | Fruit Wt (lbs.) | Percent Marketable | Rind Color | Fruit Shape | Rind Texture |
|---|---|---|---|---|---|---|---|---|
| Autumn King | Rupp | 4084 | 97337 | 23.90 | 100.0 | 1.67 | 3.00 | 1.33 |
| Casper | Rupp | 3403 | 34251 | 10.24 | 93.1 | 4.67 | 3.00 | 3.00 |
| Early Autumn | Seeds by Design | 4651 | 65167 | 14.19 | 100.0 | 1.67 | 2.67 | 2.00 |
| First Prize | Rupp | 2609 | 139058 | 53.0 | 100.0 | 2.67 | 3.00 | 2.00 |
| Gold Bullion | Rupp | 5785 | 88132 | 15.23 | 100.0 | 2.00 | 2.67 | 2.33 |
| Gold Fever | Rupp | 5672 | 65871 | 11.60 | 100.0 | 2.33 | 2.67 | 2.00 |
| Gold Standard | Rupp | 5105 | 69858 | 13.70 | 98.3 | 1.67 | 2.00 | 2.00 |
| Gold Strike | Rupp | 4084 | 80521 | 19.88 | 100.0 | 1.33 | 3.00 | 1.33 |
| Gold Rush | Rupp | 3063 | 86992 | 28.16 | 100.0 | 1.67 | 3.00 | 1.00 |
| Harvest Jack | Seeds by Design | 3743 | 101636 | 27.42 | 100.0 | 2.00 | 3.33 | 2.00 |
| Howden Biggie | Harris Moran | 3063 | 81258 | 26.05 | 100.0 | 1.67 | 3.83 | 1.33 |
| Howdy Doody | Seeds by Design | 3516 | 57970 | 16.19 | 97.5 | 2.00 | 2.33 | 2.00 |
| HMX 4694 | Harris Moran | 6125 | 87973 | 14.43 | 100.0 | 1.33 | 2.67 | 2.00 |
| Jack-B-Quick | Seeds by Design | 14293 | 38798 | 6.36 | 100.0 | 2.25 | 1.75 | 1.25 |
| Jumpin' Jack | Seeds by Design | 4254 | 102388 | 24.04 | 100.0 | 2.00 | 4.00 | 2.00 |
| Lil' Goblin | Harris Moran | 20418 | 30179 | 1.48 | 100.0 | 2.33 | 2.67 | 2.67 |
| Little October | Willhite | 21099 | 17361 | 0.82 | 100.0 | 2.67 | 2.00 | 3.00 |
| Lumina | Stokes | 3176 | 27661 | 7.02 | 100.0 | 5.00 | 1.33 | 3.00 |
| Magic Lantern | Harris Moran | 6806 | 105504 | 15.52 | 100.0 | 1.33 | 2.67 | 1.67 |
| Merlin | Harris Moran | 5218 | 84043 | 16.24 | 100.0 | 1.67 | 3.00 | 1.67 |
| Munchkin | Harris Moran | 19851 | 10368 | 0.52 | 99.3 | 2.33 | 1.00 | 1.33 |
| Ol' Zeb's | Rupp | 3516 | 70357 | 20.65 | 87.8 | 2.00 | 3.17 | 1.67 |
| Oz | Harris Moran | 10663 | 35885 | 3.37 | 100.0 | 2.67 | 2.33 | 2.67 |
| Peek-A-Boo | Seeds by Design | 6919 | 26135 | 3.80 | 100.0 | 2.33 | 2.33 | 2.33 |
| Pick-a-pie | Rupp | 7373 | 38652 | 5.23 | 100.0 | 1.33 | 2.00 | 2.00 |
| Pro Gold #100 | A&C | 5218 | 10288 | 2.01 | 97.4 | 2.67 | 3.00 | 3.00 |
| Pro Gold #200 | A&C | 4310 | 65338 | 15.87 | 100.0 | 2.00 | 3.17 | 2.00 |
| Pro Gold #300 | A&C | 4084 | 80101 | 19.75 | 100.0 | 2.00 | 2.67 | 2.00 |
| Pro Gold #500 | A&C | 4991 | 94859 | 18.69 | 100.0 | 2.00 | 3.00 | 1.67 |
| Pro Gold #510 | A&C | 4197 | 85551 | 20.39 | 100.0 | 1.67 | 3.00 | 1.33 |
| Touch of | Rupp | 11570 | 30922 | 2.69 | 100.0 | 2.00 | 2.33 | 2.00 |
| Wee-B-Little | Seeds by Design | 2496 | 20452 | 6.12 | 91.3 | 2.00 | 2.33 | 2.67 |
| Mean of Test | | 6834 | 62802 | 14.33 | 98.9 | 2.16 | 2.63 | 2.0 |
| L.S.D. (0.05) | | 4129 | 36379 | 59.1 | 5.1 | 0.87 | 0.97 | 0.63 |
| C.V. (%) | | 36.9 | 35.4 | 25.2 | 3.17 | 24.5 | 22.5 | 19.4 |

Planting Date: May 30, 2000. Harvest Dates: October 3-4, 2000. Randomized Complete Block Design, 3 replications, one-row plot, 16 ft. long x 8 ft. wide. Hills/plot: Vine-4, Semi-bush-6, Bush-8. [2]Marketable Yield. [3]Based on scale: 1=deep orange; 2=medium orange; 3=light orange; 4=yellow; 5=white. [4]Based on scale: 1=flat; 2=round; 3=oval; 4=oblong. [5]Based on scale: 1=coarse; 2=medium; 3=smooth. [6]Based on same scale as rind color.

# Transplant Production

# INCREASE BELL PEPPER YIELDS WITH COMPOST-AMENDED TRANSPLANT MEDIA

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Amending field soils with stabilized compost can produce many benefits in addition to the inorganic nutrients contained in the compost. Compost, characteristically high in organic matter, can increase the soil's cation exchange capacity, chelating activity and buffering ability and help reduce compaction and improve water infiltration and retention (Hoitink and Keener 1993). In addition, suppression of soilborne plant pathogens and nematodes has also been observed (Granastein 1997, Hoitink and Fahy 1986). In combination, these beneficial effects often result in enhanced growth and productivity of field crops. Also, compost and/or other organic materials such as tree bark, have been shown to be beneficial in potting mixes. There are numerous reports documenting plant disease suppression in compost-amended potting media (Hoitink, Boehm and Hadar 1993).

In the fall of 2000, an experiment was conducted to determine the effects of compost-amended media on bell pepper transplant growth and on subsequent pepper yields after transplanting to the field.

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

Seed of bell pepper cultivar *X3R Wizzard* were planted in styrofoam flats (two-hundred 1.25 inch cells per flat) on June 24, 2000. Seed were germinated and transplants grown in a greenhouse using current commercial transplant recommendations for production of Bell pepper transplants. The two treatments were: (1) commercial transplant growing media routinely used by the cooperating plant grower to produce bell pepper transplants and (2) the same media amended with 20% by volume high quality compost. The media routinely used by the grower consisted of a proprietary mix of peat moss, perlite and vermiculite without added fertilizer. The grower has had excellent success over many years growing bell pepper plants with this mix.

During the first week after germination, the pepper plants received a fertigation of 13-2-13 at a concentration of 100 ppm nitrogen. No additional fertilizer was applied until after transplanting.

### *Plant Height and Canopy Width Fifteen Days after Seeding*

Fifteen days after seeding (DAS) transplant heights and canopy widths were measured. The average plant height of plants grown in media not amended with compost was 1.23 inches whereas transplants grown in compost-amended media averaged 1.81

inches. The average canopy width of plants grown in non-amended media was 1.99 inches whereas transplants grown in compost-amended media averaged 3.08 inches. Differences in both transplant height and canopy width were highly significant (Table 1).

*Plant Height and Plant Stem Diameter Twenty-four Days after Seeding*

Twenty-four DAS transplant heights and transplant stem diameters (taken at the base of the plant, level with top surface of media) were determined. The average plant height of plants grown in non-amended media was 1.87 inches whereas transplants grown in compost amended media averaged 3.05 inches. Stem diameter of plants grown in non-amended media was 0.065 inches whereas transplants grown in compost amended media had an average stem diameter of 0.084 inches. Differences in transplant height and stem diameter were highly significant (Table 1).

*Plant Growth Measurements Fifty-One Days After Seeding*

Fifty-one DAS leaf area, leaf dry weight, stem dry weight, shoot dry weight, root dry weight, and plant height were measured. In all cases, measurements for transplants grown in amended media were significantly higher than for transplants grown in non-amended media (Table 2).

## II. Effects of Compost Amended Transplant Media on Transplant Growth In The Field

On August 10th, approximately seven weeks after seeding, plants were transplanted to the field. The pepper crop was grown using plastic film mulch (1.5 mil, black with aluminum tint) and drip irrigation. Bed width was 32 inches and plants were planted in double rows centered on the bed with 18 inches between rows and 14 inches apart in the row. Prior to plastic installation, sufficient lime was applied to bring the pH to 6.3 and 600 lb/acre of 4-8-12 was applied. Throughout the growing season, fertilizer, pest management control practices, irrigation and fertigation were applied according to University of Georgia Extension Service recommendations.

*Plant Height and Plant Stem Diameter Thirty-Five Days After Transplanting*

Thirty-five days after transplanting (DAT) transplant heights and transplant stem diameters (taken at the base of the plant, level with top surface of the soil) were measured. The average plant height of plants grown in non-amended media was 7.6 inches whereas transplants grown in compost-amended media had an average height of 9.0 inches. The average stem diameter of plants grown in non-amended media was 0.221 inches whereas transplants grown in compost- amended media had an average stem diameter of 0.252 inches. Differences in both plant height and stem diameter were highly significant.

*Plant Height and Plant Stem Diameter Fifty-Six Days After Transplanting*

Fifty-six DAT plant heights and stem diameters were measured again. Although both plant height and stem diameter had increased and were greater for transplants grown in compost amended media, there were no significant differences.

## III. Effects of Transplant Media on Fruit Set, Early and Total Yield

*Fruit Set Fifty-Six Days After Transplanting*

Fifty-six DAT counts were made of the number of fruit on five randomly selected plants in each plot. Plants that had been grown in compost-amended media set more fruit than plants grown in non-amended media.

*Early Fruit Yield Seventy Days After Transplanting*

Seventy DAT plots were harvested and fruit were counted and weighed. Only jumbo and extra large fruit were harvested and there were no defective or cull fruit. Plants grown in non- amended media produced an average of 5.46 fruit per plot whereas plants grown in compost amended media produced an average of 12.8 fruit per plot. Average weights per plot were 2.8 pounds for plants grown in non-compost-amended media and 6.6 pounds for transplants grown in compost-amended media. The average fruit weight for plants grown in non-amended and compost-amended media was 233 grams and 234 grams, respectively. Differences in number of fruit per plot and weight of harvested fruit per plot were highly significant.

*Total Yield*

After the fourth harvest on November15th, a freeze severely damaged the plants and all fruit remaining on the plants. With the four harvests combined, plants grown in compost-amended media out-yielded plants grown in non-amended media by 20%.

## Summary:

Amendment of transplant growing media with 20% high quality compost enhanced transplant growth in the greenhouse and increased dry weight of transplant roots. Thirty-five days after transplanting, transplants grown in compost-amended media were significantly taller and had a significantly larger stem diameter. Fifty-six days after transplanting, more fruit was set on plants that had been grown in compost amended media. Total yield was 20% greater for plants grown in the compost-amended transplant media.

Although the mechanism(s) responsible for enhanced transplant growth and greater yields in the field were not determined, increased leaf area, stem diameter and root mass at transplanting are likely contributors. Additional studies of the effects of compost-amended media on growth and yield of bell pepper and other vegetable transplants are planned.

Acknowledgment

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References

Dick, W. A. and E. L. McCoy. 1993. Enhancing soil fertility by addition of compost. In: Science and Engineering of Composting: Design, Environmental, Microbiological and Utilization Aspects, H. A. Hoitink and H. M. Keener (eds.), Renaissance, Worthington, Ohio, USA. pp:622-644.

Granastein, D. 1997. Suppressing plant disease with compost. In: The Compost Connection Newsletter No. 5. CSANR. pp:1-8.

Hoitink, H. A. and P. C. Fahy. 1986. Basis for the control of soilborne plant pathogens with compost. Ann. Rev. Phytopathology 24:93-114.

Hoitink, H. A., M. J. Boehm and Y. Hadar. 1993. Mechanisms of suppression of soilborne plant pathogens in compost-amended substrates. In: Science and Engineering of Composting: Design, Environmental, Microbiological and Utilization Aspects, H. A. Hoitink and H. M. Keener (eds.), Renaissance, Worthington, Ohio, USA. pp:622-644.

**Table 1.** Effect of compost addition to the potting mixture on the growth of bell pepper (cv. X3R Wizard) transplants. Plants were measured at 15 and 24 days after seeding.

| *Compost* | *Plant height (inch)* | *Canopy width (inch)* | *Stem diameter (inch)* |
|---|---|---|---|
| | | *15 days after seeding* | --- |
| NO | 1.23 | 1.99 | --- |
| YES | 1.81 ** | 3.08 ** | |
| | | *24 days after seeding* | |
| NO | 1.87 | --- | 0.065 |
| YES | 3.05 ** | --- | 0.084 ** |

**, Significant at P > 0.001

**Table 2.** Effect of compost addition to the potting mixture on the growth of bell pepper (cv. X3R Wizard) transplants. Plants were measured 51 days after seeding.

| *Compost* | *Leaf area* | *Leaf dry wt.* | *Stem dry wt.* | *Shoot dry wt.* | *Root dry wt.* | *Plant height* |
|---|---|---|---|---|---|---|
| | *($cm^2$)* | *(g)* | *(g)* | *(g)* | *(g)* | *(inch)* |
| NO | 29.7 | 0.146 | 0.100 | 0.246 | 0.106 | 5.04 |
| YES | 39.2 ** | 0.169 ** | 0.161 ** | 0.330 ** | 0.135 ** | 5.54 ** |

**, Significant at P > 0.001

# Weed Control

# WATERMELON (*Citrullus lanatus*) TOLERANCE AND WEED MANAGEMENT USING HALOSULFURON AT-PLANT AND POSTEMERGENCE

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## Introduction

Only four herbicides are recommended for use in watermelon by the Georgia Cooperative Extension Service; thus, weed control options are very limited. Additionally, of these herbicide options, none have any effect on nutsedge (*Cyperus* sp.) which is the most troublesome weed in watermelon production. Although tillage practices such as cultivation are an effective tool in managing nutsedge, they are only effective between the rows and before the plants begin to vine. Left uncontrolled, nutsedge can drastically reduce watermelon yields and grower profits.

Halosulfuron (Sandea), one of the most effective herbicides for controlling nutsedge, is being tested for potential use in watermelon. However, little to no research is available on watermelon tolerance to halosulfuron applied at planting or postemergence to the crop. Additionally, little to no information is available utilizing halosulfuron in a watermelon weed management program. Therefore, watermelon sensitivity and weed control using halosulfuron were tested at two Georgia locations during the 2000 season.

## Materials and Methods

*Field Preparation.* Field studies were established near Cordele and Vidalia, Georgia. Soil was disked and bedded on six foot centers. Watermelon seed were planted on April 21 in Cordele and May 20 in Vidalia. Every other bed was not planted to allow for watermelon vine growth. Plots were two beds by 25 feet.

*Experimental Design.* Treatments were arranged factorially and the experimental design was a randomized complete block with each block replicated four times. Nine herbicide treatments were evaluated. A non-treated control was included for comparison purposes.

*Treatments.* The first factor of the factorial arrangement was halosulfuron rate (0.5 oz product/A, 0.75 oz product/A, or 1.0 oz product/A ) and the second factor was application method of halosulfuron (at planting, watermelon diameter of 2 inches [early-postemergence], and watermelon diameter of 14 inches [late-postemergence]). Nonionic surfactant at 0.25% V/V was included with all post-emergent applications. Treatments were applied using a spray volume of 14.8 gallons per acre and 21 PSI.

*Data Collection.* Three separate injury parameters (stunting, discoloration, and stand reduction) were visually estimated for watermelon 7 days after each application. Additionally, a late-season rating was taken. Weed control evaluations occurred 2 and 4 week after each herbicide application and again at late-season. Trends in weed control were similar during mid- and late-season; therefore, only late-season weed control will be reported. Yields were measured at Cordele by harvesting the entire plot during three separate harvest dates.

*Statistical Analysis.* Data were subjected to the Analysis of Variance and treatment sums of squares were partitioned appropriately to reflect the two factor factorial. Means were separated using Fisher's Protected LSD at P = 0.05. Interaction of the two factor factorial was significant for each variable and is reported accordingly. Additionally, there was no location interaction and dat is pooled over locations.

Results and Discussion

*Visual Injury.* Halosulfuron did not affect plant stand and chlorosis was minor (less than 5%) regardless of halosulfuron rate or method of application (data not shown). However, watermelon stunting was apparent with several treatments (Table 1). Pooled over both locations, reduction in watermelon growth was greater with halosulfuron applied early-postemergence as compared to an at-plant or late-postemergence application. Halosulfuron at 0.5 or 0.75 oz of product per acre applied at-plant did not affect watermelon growth throughout the season; increasing the halosulfuron rate to 1 oz of product per acre injured watermelon less than 10% throughout the season. Early-postemergence applications of halosulfuron at 0.5, 0.75, and 1 oz of product per acre reduced watermelon growth 38, 51, and 58%, respectively, at 7 days after application. Late-postemergence applications of halosulfuron injured watermelon less than early-postemergence treatments, but injury still ranged from 27 to 30% at 7 days after application. Although growth reduction from postemergence applications was significant during early-season, watermelon recovered very quickly with little visual injury by late-season (data not shown).

*Nutsedge Control.* Yellow nutsedge control by late-season was 30, 66, and 69% with at-plant applications of halosulfuron at 0.5, 0.75, and 1.0 oz of product per acre, respectively (Table 1). Although late-season nutsedge control was poor with at-plant applications, good control was observed for the first 2 to 3 weeks of the growing season. However, continuous nutsedge germination as the crop developed reduced late season weed control. Late-season control with postemergence applications was generally greater (64 to 86%) when compared to at-plant applications. Halosulfuron does have postemergence and residual activity on nutsedge; thus, a post-emergent application should usually be more effective than an at-plant application only.

*Palmer Amaranth Control.* Palmer amaranth (*Amaranthus palmeri*) control with halosulfuron applied at-plant ranged from 95 to 98% by late-season (Table 1). Postemergence applications were less effective on Palmer amaranth with control ranging from 66 to 85% control. Early-postemergence applications tended to be more effective than late-postemergence applications primarily due to weed size at time of application. Palmer amaranth during early-postemergence treatments was less than 3 inches but ranged from 4 to 10 inches at time of late-postemergence applications.

**Table 1**. Watermelon injury and late-season control of yellow nutsedge and Palmer amaranth when applying halosulfuron at-plant and postemergence.[a]

| Halosulfuron Application Timing[b] | Halosulfuron Rate[b] | Visual Injury (percent) | Yellow Nutsedge Control | Palmer Amaranth Control |
|---|---|---|---|---|
| | | 7 days after treatment | late-season | late-season |
| At-plant | 0.5 oz/A | 0 d | 30 e | 95 a |
| At-plant | 0.75 oz/A | 0 d | 66 d | 98 a |
| At-plant | 1.0 oz/A | 0 d | 69 cd | 98 a |
| Early-POST | 0.5 oz/A | 38 c | 64 d | 72 cd |
| Early-POST | 0.75 oz/A | 51 ab | 78 abc | 79 bc |
| Early-POST | 1.0 oz/A | 58 a | 86 a | 85 b |
| Late-POST | 0.5 oz/A | 27 c | 80 abc | 66 d |
| Late-POST | 0.75 oz/A | 30 c | 81 ab | 73 c |
| Late-POST | 1.0 oz/A | 28 c | 79 abc | 79 bc |

[a]Means followed by the same letter within a column are not different based on Fisher's Protected LSD test at $P = 0.05$. Data for visual injury and Palmer amaranth control pooled over two locations. A non-treated control was included for comparative purposes but was not included in the statistical analysis.

[b]At-plant, early-POST, and late-POST applications were applied the day of planting, when watermelon was 2 inches in diameter, and when watermelon was 14 inches in diameter, respectively. Halosulfuron rate is expressed in product per acre.

*Watermelon Yields.* No significant differences were noted among the number of watermelons harvested or the pounds of watermelon harvested among halosulfuron treatments (Table 2). Additionally at harvest, watermelon was separated into three categories including the following: 1) 15 to 20 pounds, 2) 20 to 30 pounds, and 3) greater than 30 pounds (data not shown). Although watermelon was categorized separately by plot, there were no significant differences among treatments. However, there were obvious trends for lowest yields with late-postemergence applications followed by early-postemergence applications and finally a trend for greatest yields with the at-plant applications. These trends were highly correlated with Palmer amaranth control (Table 1).

***Table 2.*** Number and weight of watermelon harvested after applying halosulfuron at-plant and postemergence.[a]

| Halosulfuron Application Timing[b] | Halosulfuron Rate[b] | Harvest Watermelon | |
|---|---|---|---|
| | | number per plot | pounds per plot |
| At-plant | 0.5 oz/A | 11 | 210 |
| At-plant | 0.75 oz/A | 12 | 270 |
| At-plant | 1.0 oz/A | 11 | 225 |
| Early-POST | 0.5 oz/A | 9 | 182 |
| Early-POST | 0.75 oz/A | 10 | 195 |
| Early-POST | 1.0 oz/A | 8 | 143 |
| Late-POST | 0.5 oz/A | 6 | 107 |
| Late-POST | 0.75 oz/A | 3 | 70 |
| Late-POST | 1.0 oz/A | 6 | 100 |

[a]Means within a column are not different based on Fisher's Protected LSD test at P = 0.05. Data for the number of watermelon harvested and yields are from Cordele during the 2000 season. A non-treated control was included for comparative purposes but was not harvested due to severe weed infestations.

[b]At-plant, early-POST, and late-POST applications were applied the day of planting, when watermelon was 2 inches in diameter, and when watermelon was 14 inches in diameter, respectively. Halosulfuron rate is expressed in product per acre.

# SUMMER SQUASH (*Cucurbita pepo*) TOLERANCE TO HALOSULFURON APPLIED AT PLANTING AND OVERTOP OF EMERGED SQUASH

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## Introduction

Soil-applied herbicides and cultivation are the primary means of managing weeds in squash. These soil-applied herbicide options are limited to bensulide (Prefar) and ethalfluralin (Curbit) which effectively control many annual grass and several small seeded broadleaf weeds including pigweeds (*Amaranthus* sp.), purslane (*Portulaca* sp.), and common lambsquarters (*Chenopodium album*). However, these herbicides have no effect on the growth of nutsedge species (*Cyperus* sp.). Nutsedge has been prioritized by Georgia County Agents as the most troublesome weed in production of vegetables. Although cultivation is an effective tool in managing nutsedge, it is only effective between the rows. Left uncontrolled, nutsedge can drastically reduce squash yields and grower profits.

Halosulfuron (Sandea), one of the most effective herbicides for controlling nutsedge, is being tested for potential use in squash. However, little to no research is available on squash tolerance to halosulfuron applied at planting or postemergence to the crop. Therefore, an experiment was conducted in a weed free environment to measure squash response to halosulfuron applied at planting and postemergence over-the-top of emerged squash.

## Materials and Methods

*Field Preparation.* A field study was established in 2000 at the RDC Pivot located in Tifton, Georgia. Soil was disked and bedded in an area with low weed pressure. Squash seed were planted 10 to 12 inches apart with two rows per bed on September 22, 2000. Plots were two rows by 20 feet.

*Experimental Design.* The experimental design was a randomized complete block with each block replicated four times. Four herbicide programs were evaluated. A non-treated control was included for comparative purposes.

*Treatments.* Herbicide treatments included halosulfuron applied preemergence (two days after planting) to squash, 10 days after squash emergence, 20 days after squash emergence, and 30 days after squash emergence. Nonionic surfactant at 0.25% V/V was included with all post-emergent applications. Treatments were applied using a spray volume of 14.8 gallons per acre and 21 PSI. Squash sizes at time of application are listed in Table 1.

***Table 1.*** Squash size at application timing of halosulfuron.

| Application Timing | Squash | |
|---|---|---|
| | Leaf Number | Height/Diameter (inches) |
| Preemergence | – | -- |
| 10 days after emergence | 1-2 leaf | 2/3 |
| 20 days after emergence | 4-5 leaf | 3/6 |
| 30 days after emergence | 9 leaf | 4/10 |

*Data Collection.* Three separate injury parameters (stunting, discoloration, and stand reduction) were visually estimated for squash 7 to 10 days after each application. Additionally, a late-season rating was taken. The center 6 foot of each plot was harvested for biomass weight comparisons among treatments**.**

*Statistical Analysis.* Data were subjected to the Analysis of Variance and treatment sums of squares were partitioned to reflect the randomized complete block design. Means were separated using Fisher's Protected LSD at P = 0.05.

## Results and Discussion

*Visual Injury.* Halosulfuron did not affect plant stand or cause chlorosis, regardless of halosulfuron application timing (data not shown). However, at all application dates, halosulfuron did significantly reduce squash size when compared to the non-treated control (Table 2). Greatest variability in visual injury was noted with soil-applied treatments of halosulfuron as injury ranged from 20 to 60% among blocks. Fields were irrigated with set irrigation; however, greater volumes of water (nearly twice) were dispersed in two of the four blocks. Nearly three times the injury was noted with halosulfuron in areas receiving the higher degree of rainfall. Postemergence applications also stunted squash. Averaged over all blocks, injury from halosulfuron applied 10 days after squash emergence was similar to injury from the soil applied application (30 to 40%). Injury tended to decrease as squash size increased at time of the application. Squash was injured less than 15% when halosulfuron was applied at 30 days after emergence and injury was less than that by other halosulfuron treatments.

*Squash Biomass.* Reduction in plant biomass followed similar trends to visual injury (Table 2.) All halosulfuron treatments, regardless of application timing, reduced plant biomass at first bloom when compared to the non-treated control. Greatest biomass reductions were noted with the halosulfuron application applied to squash at 10 days after emergence. Less biomass reduction (42%) was noted with the soil applied treatments as compared to the postemergence application 10 days after emergence primarily due to the variation in plant size among blocks as described previously. Comparing postemergence treatments, the trend was apparent that the larger the squash was at time of halosulfuron application the less reduction in plant biomass was noted at first bloom.

Table 2. Squash injury and fresh weight comparisons among various application timings of halosulfuron.[a]

| Halosulfuron Application Timing | Visual Injury (percent) | | Fresh Weight (grams) |
|---|---|---|---|
| | 10 days after treatment | 1st week of bloom | 1st week of bloom |
| Preemergence | 35 a | 50 a | 135 b |
| 10 days after emergence | 30 ab | 40 ab | 70 c |
| 20 days after emergence | 20 b | 34 b | 125 bc |
| 30 days after emergence | 10 c | 15 c | 160 b |
| Non-treated | 0 d | 0 d | 235 a |

[a]Means followed by the same letter within a column are not different at based on Fisher's Protected LSD test at P = 0.05.

## Conclusions

Squash appear to be less tolerant to halosulfuron than several of the other cucurbits. Halosulfuron applied preemergence or postemergence to squash caused significant visual injury and reduction of biomass at first bloom as compared to the non-treated control. Halosulfuron applied preemergence was the most variable treatment and this variability was most likely a response of an irrigation, weather condition, and halosulfuron interaction. During this fall study, temperatures were rather cool reducing squash vigor and potential tolerance to halosulfuron applied at planting. Postemergence applications of halosulfuron injured cotton less as squash grew; however, even an application 30 days after emergence significantly reduced plant biomass compared to the non-treated control. Additional studies focusing on irrigation, weather conditions, and two extra halosulfuron treatments (halosulfuron applied 10 days before planting; halosulfuron applied 40 days after emergence) are greatly needed before considering a label for using halosulfuron in squash.

# Disease Control

**Methyl Bromide Alternatives in Bell Pepper 2000**

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Introduction

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

Materials and Methods

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

The first of the two experiments was a split-plot design with soil chemical treatments on Camelot Bell pepper sub-plots, replicated four times. Initially, the soil was disc-harrowed, plowed 12 to 15 inches deep with a moldboard plow and shaped into beds 6 feet wide and 3-5 inches high. Five hundred pounds of 4-8-24 fertilizer and 2,000 lbs. per acres of dolomitic limestone were applied broadcast to all plots and incorporated approximately four inches deep with a tractor-powered rototiller. Whole-plots were 24 feet wide and 35 feet long and consisted of four subplots each 6 feet wide and 35 feet long. Soil chemical treatments were applied as follows; March 7 applied Telone C-35 (17.5 gal/A) chisel injected to designated plots, March 13 applied Methyl Bromide (89.5 %, 200 ai/A). Immediately after Methyl Bromide treatments were applied to their designated plots, beds were shaped to 30 inches wide, and 6 to 8 inches high. Irrigation drip tubing was placed in the center of all beds as they were covered with 0.006 mil black polyethylene. Nontreated plots served as controls. Seven days after treatment, March 20, holes (2 inches diam.) were cut 12 inches apart in single row plots to allow aeration. Three days after holes were cut in the plastic, a single greenhouse-grown Camelot Bell pepper plant was planted in each hole on March 23rd. At time of planting, the toxic gas level in Telone and Methyl bromide-treated plots averaged 8 to 10 ppm (safe for planting) according to the Gastec® System. All plots were sprayed with Manex + Zinc (1.8 qts./A) and Kocide LF (0.5 gal./A) on a 7- to 10- day schedule for foliage disease control. Insecticide sprays were applied weekly alternating Ambush 2EC (10 oz./A), and Asana .66EC (6 oz./A), starting May 26th thru July 17th. All plots received 2 to 4 lbs of liquid fertilizer (15-30-15) injected through the irrigation tubing every three days during the growing season.

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

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

## Results and Discussion

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

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

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

**Table 1**. Effects of soil chemical treatments on nematode population densities in Camelot Bell Pepper 2000[a]

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

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

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

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

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

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

[a] Data are means of four replications of plots equaling 42.3 m of row.
[b] Number of nutsedge, a combination of purple nutsedge (cypress rotundus)and yellow nutsedge ( cypress esculuntus), based on plot size = 4 rows 10.7 m in length, bell pepper spaced 30 cm apart.
[c] Means followed by the same letter are not different according to Fisher's Protected LSD at and alpha level of 0.05.
[d] All other weeds include: cutleaf eveningprimrose, crowfootgrass, Bermudagrass, Texas panicum, carpetweed, crabgrass, smallflower morningglory, Florida Pusley, and jimsonweed.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

# EVALUATION OF FUNGICIDES FOR CONTROL OF DOWNY MILDEW OF PUMPKIN

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## Introduction

Downy mildew (caused by the fungus *Pseudoperonspora cubensis*) is the most common and the most consistently destructive disease of pumpkins grown in north Georgia. Preventive fungicide sprays are recommended during periods of cool, wet weather to reduce defoliation caused by downy mildew. Several fungicide options are currently available to growers but their comparative efficacy is not clear. This study was conducted to determine the efficacy of new and currently labeled compounds as well as experimental fungicides for control of downy mildew of pumpkin.

## Materials and Methods

The experiment was conducted at the Mountain Research Station located in Blairsville, GA. Plots were 16 ft long, 12 ft wide and contained six plants ("Wizard") seeded on 15 Jun. The experiment utilized a randomized complete block with four replications. Plots were sprayed with a $CO_2$ pressurized backpack sprayer calibrated to deliver 40 gal/A at 75 psi. Treatments were initiated when the NC Downy Mildew Forecast System indicated a moderate to high risk of infection. Once initiated, sprays were applied every 7 - 14 days depending on weather and disease pressure. Nova 40W was applied at 5.0 oz/A on 30 Aug across all plots to prevent powdery mildew from having an effect on the test. Plots were harvested on 3 Oct.

## Results and Discussion

Weather was conducive to disease development as rainfall during the experiment was 3.9 in. above normal. Disease was first observed on 22 Aug and reached high levels by harvest. All fungicides significantly reduced disease when compared to non-treated plots on 29 Aug with Gavel, Dithane Rainshield, and Fluazinam providing the highest levels of suppression (Table 1). Aliette was the only fungicide that did not significantly suppress downy mildew on the 21 Sep rating date while Tattoo C, Fluazinam and Dithane Rainshield provided the greatest levels of control. No significant differences were detected between treatments for number and total weight of marketable pumpkins. These data indicate that Dithane may be the most cost effective labeled fungicide for downy mildew control in the north Georgia pumpkin growing area.

**Table 1.** Effect of fungicides for control of downy mildew of pumpkin.

| Treatment[1] and rate/A | Downy Mildew Ratings[2] 29 Aug | 21 Sep | No. Fruit[3] | Yield[4] lb./plot |
|---|---|---|---|---|
| Acrobat MZ 69W, 2.25 pt . . . . . . . . . . . . . . . . | 1.9 cd[5] | 6.8 bc | 18.5 a | 172.9 a |
| Ridomil Gold Bravo 76.5W, 2.0 lb . . . . . . . . . . . | 2.6 c | 7.4 b | 20.5 a | 292.3 a |
| Bravo Weather Stik, 2.0 pt . . . . . . . . . . . . . . . . | 2.1 cd | 7.0 b | 19.5 a | 217.5 a |
| Gavel 75DF, 2.25 lb . . . . . . . . . . . . . . . . . . . . . | 1.4 d | 6.1 b-d | 19.0 a | 195.3 a |
| Dithane DF Rainshield, 3.0 lb . . . . . . . . . . . . . . | 1.6 d | 5.5 cd | 16.0 a | 199.0 a |
| Fluazinam 500F, 1.0 pt . . . . . . . . . . . . . . . . . . . | 1.6 d | 4.9 de | 17.0 a | 194.1 a |
| Tattoo C 750SC, 2.75 pt . . . . . . . . . . . . . . . . . . | 2.8 c | 3.9 e | 19.5 a | 232.3 a |
| Aliette WDG, 3.0 lb . . . . . . . . . . . . . . . . . . . . . . | 4.6 b | 9.8 a | 19.0 a | 163.1 a |
| Non-treated . . . . . . . . . . . . . . . . . . . . . . . . . . . | 7.3 a | 9.9 a | 19.5 a | 166.7 a |

[1]Fungicide treatments were applied on the following dates: 3, 10, 17, 31 Aug; 8 and 14 Sep.
[2]Disease rating scale: 1=1-10%; 10=91-100% leaves infected or defoliated by downy mildew.
[3]Total number of marketable pumpkins/plot.
[4]Total marketable yield in lbs/plot.
[5]Means in columns with letter(s) in common are not significantly different according to the Waller-Duncan *k*-ratio t-test at *k=100*

## EVALUATION OF ACTIGARD AND ADMIRE ALONE AND IN COMBINATION FOR SUPPRESSION OF MOSAIC VIRUS INCIDENCE IN SUMMER SQUASH IN GRADY CO. GA

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### Introduction

Mosaic viruses are the most destructive and widespread disease of summer squash in Georgia. These mosaic viruses are generally Potyviruses (ZYMV - zucchini yellow mosaic virus, WMV II - watermelon mosaic virus II, PRSV - papaya ringspot virus) and one Cucumovirus (CMV - cucumber mosaic virus). All of these viruses are aphid transmitted. Transmission is generally low in the spring and increases to extremely high levels in the fall. Current recommendations for reducing losses to these viruses are intensive stylet oil spray programs and use of resistant varieties. However, the stylet oil program requires specialized spray equipment and is very labor intensive and the seed of the transgenic resistant varieties are expensive. Less expensive and intensive options are needed to improve the profitability of fall squash.

### Materials and Methods

Squash (Prelude II) were planted to a commercial bareground field in Grady Co., GA on 16 Aug. Plots were arranged in a randomized complete block design and were replicated four times. Experiment plots were two, 20-ft-long rows spaced 36 in apart. Plants within each row were spaced approximately 18 in apart. Standard insecticide, fungicide and fertility programs were utilized as per University of Georgia Cooperative Extension Service recommendations. Plots were sprayed with a $CO_2$ pressurized backpack sprayer calibrated to deliver 40 GPA at 75 psi. Actigard and Messenger treatments were initiated when 75% or more plants had emerged. Both were applied twice more on a 2 week schedule. Admire was applied 2 in below and 2 in to the side of the seed furrow at planting.

Weather during the experiment was generally hot and dry for the area. There were no significant differences in virus incidence noted among treatments for any of the rating dates (Table 1). There was no indication of phytotoxicity associated with any of the chemical treatments.

**Table 1.** Effect of insecticides and plant defense activators on incidence of summer squash.

| Treatment[1] and rate/A | 20 Sep | Virus Ratings[2] 26 Sep | 10 Oct | AUDPC[3] |
|---|---|---|---|---|
| Admire 2F, 20 fl oz + Actigard 50WG, 0.5 oz . . . . . . . . . . . . . . | 3.0 a[4] | 14.3 a | 15.1 a | 256.8 a |
| Admire 2F, 20 fl oz + Actigard 50WG, 0.25 oz . . . . . . . . . . . . . | 7.3 a | 17.7 a | 15.9 a | 310.0 a |
| Admire 2F, 20 fl oz + Actigard 50WG, 0.125 oz . . . . . . . . . . . . | 9.0 a | 21.0 a | 28.9 a | 440.0 a |
| Admire 2F, 20 fl oz + Messenger 3WG, 30 ppm . . . . . . . . . . . . . | 6.2 a | 23.1 a | 19.2 a | 393.0 a |
| Admire 2F, 20 fl oz . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 5.8 a | 24.2 a | 31.8 a | 483.0 a |

[1]Actigard and Messenger treatments were applied on the following dates: 25 Aug; 9 and 26 Sep.
[2]Number represents the percentage of virus infected plants per plot.
[3]Area under the disease progress curve.
[4]Means in columns with letter(s) in common are not significantly different according to the Waller-Duncan *k*-ratio t-test at *k*=100.

# EVALUATION OF FUNGICIDES AND FOLIAR BIOLOGICAL CONTROL MATERIALS FOR CONTROL OF POWDERY MILDEW IN TRANSGENIC YELLOW CROOKNECK SQUASH

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## Introduction

Powdery mildew (caused by the fungus *Sphaerotheca fuliginea*) affects squash grown in Georgia each year. This fungus thrives during dry, hot, low humidity conditions and generally attacks squash once fruit begin to form. Squash that are under heat and drought stress during the harvest period will not be as productive if powdery mildew goes unchecked. More fungicide options are available to growers for control of powdery mildew than ever before. This study examines many new and potential fungicides for efficacy against powdery mildew of squash.

## Materials and Methods

Squash seed (Destiny III) were planted on 30 May in a bare-ground field every 18 in. in rows spaced 36 in. apart. Standard practices for management of fertility, weeds, nematodes and insects for summer squash grown in Georgia were followed throughout the season. The experiment utilized a randomized complete block design with 4 replications. Fungicide plots were 2, 15-ft long rows that utilized a 3-ft buffer zone between plot ends. Foliar fungicide treatments were initiated just subsequent to anthesis (5 Jul) and were sprayed again on 19 Jul. Fungicides were applied using a $CO_2$ pressurized backpack sprayer calibrated to deliver 40 gal/A at 75 psi through TX-18 hollow cone nozzles.

## Results and Discussions

Weather during the experiment was warm and dry with rainfall accumulations for June and July approximately 0.5 in. below average. Powdery mildew was first observed on 19 Jul and increased to high levels by the 1 Aug rating date. All fungicides significantly reduced powdery mildew severity on both leaf surfaces when compared to non-treated check except Elexa applied alone and Milsana at the 0.5% v/v rate (Table 1). Both Quinoxyfen and Nova consistently provided the most significant suppression of powdery mildew on both leaf surfaces. Of the labeled products, Nova provided the best control of powdery mildew.

**Table 1.** Effect of various fungicides on powdery mildew of squash.

| Treatment[1] and rate/A | Powdery Mildew Ratings[2] (1 Aug) Upper Leaf Surface | Lower Leaf Surface |
|---|---|---|
| Nova, 4.0 oz/A | 4.0 h[3] | 8.0 g |
| Quinoxyfen, 4.1 fl. oz/A | 5.5 gh | 10.0 g |
| Quinoxyfen, 8.1 fl. oz/A | 5.3 gh | 9.9 g |
| Quinoxyfen, 4.1 fl. oz/A + Kinetic 0.5% v/v | 4.0 h | 10.5 g |
| Quinoxyfen, 8.1 fl. oz/A + Kinetic 0.5% v/v | 7.0 gh | 10.3 g |
| Folicur, 6.0 oz/A | 11.8 e-h | 23.5 e |
| Folicur, 4.0 oz/A | 12.5 e-h | 11.3 fg |
| Procure, 4.0 oz/A | 18.8 ef | 27.5 e |
| Procure, 6.0 oz/A | 9.3 f-h | 18.0 e-g |
| Quadris 12.4 oz/A | 10.0 f-h | 22.5 ef |
| Flint 2.0 oz/A | 11.3 e-h | 22.5 ef |
| BAS EXP, 12 oz/A | 20.0 e | 28.3 e |
| BAS EXP, 16 oz/A | 13.8 e-g | 25.0 e |
| Microthiol Special 80DF, 4.0 lb/A | 8.8 gh | 28.8 e |
| Serenade 132, 6.0 lb/A | 30.0 d | 43.8 cd |
| Serenade 132, 8.0 lb/A | 33.8 cd | 45.0 cd |
| Serenade 137, 6.0 lb/A | 35.0 cd | 47.5 b-d |
| Elexa, 1:40 (Elexa:water) | 42.5 a-c | 53.8 a-d |
| Elexa, 1:40 (Elexa:water) + Nutrol (MKP) 1.0 % v/v | 33.3 cd | 43.3 d |
| Milsana, 0.5% v/v | 45.0 ab | 56.7 ab |
| Milsana, 1.0% v/v | 35.0 cd | 51.3 b-d |
| Benlate, 0.5 lb/A | 36.3 cd | 55.0 a-c |
| Non-treated check | 48.8 a | 63.8 a |

[1]Fungicide treatments were applied on the following dates: 5, 19 Jul. . . . . . . . . .
[2]Disease rating scale: 1=1-10%; 10=91-100% leaf area affected (both upper and lower sides).
[3]Means in columns with letter(s) in common are not significantly different according to the Waller-Duncan *k*-ratio t-test at *k*=100.

# EVALUATION OF FUNGICIDE SPRAY PROGRAMS FOR CONTROL OF ALTERNARIA LEAF SPOT OF CANTALOUPE

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## Introduction

Alternaria leaf spot of cantaloupe (caused by the fungus *Alternaria alternata* f.sp. *cucurbitae*) is one of the most common foliar diseases of cantaloupe in Georgia. During wet, overcast conditions lesions can spread rapidly causing extensive defoliation. This study was conducted to determine the most effective fungicides/fungicide programs for control of Alternaria leaf spot of cantaloupe.

## Materials and Methods

Cantaloupe seedlings ("Athena") were transplanted to black plastic covered beds in a commercial field in Mitchell Co., GA on 1 June. The planting pattern consisted of plants being spaced 24 in. apart on plant beds spaced 6-ft from center to center. Standard practices for management of fertility, weeds, nematodes and insects for cantaloupe grown in Georgia were followed throughout the season. The experiment utilized a randomized complete block design with 4 replications. Fungicide plots were 30-ft long and utilized a 3-ft buffer zone between plot ends. Manzate at 2.0 lbs./acre and Bravo Weather Stik were applied to all plots on 13 June and 21 June prior to fungicide treatments. Foliar fungicide treatments were initiated on 28 June and were sprayed approximately every 7 - 10 days until 21 July. Fungicides were applied using a $CO_2$ pressurized backpack sprayer calibrated to deliver 40 gal/A at 75 psi through TX-18 hollow cone nozzles. Mature fruit were harvested from each plot on 18, 19, 20, 21, 24, 25, 27, and 31 July.

Results

Weather during the experiment was normal with rainfall accumulations only .32 in above the fifty year average. Alternaria leaf spot was not detected until 14 July, four days prior to the first harvest. All fungicide treatments significantly reduced Alternaria leaf spot compared to the non-treated check on both the 21 and 31 Jul rating dates (Table 1). Defoliation resulting from disease or phytotoxicity was significantly higher where Actigard was sprayed consecutively at the 1.0 oz rate while defoliation was lowest in plots sprayed with Quadris alternated with Bravo Weather Stik or in plots where Actigard was sprayed at the 0.5 oz./acre rate. There were no significant differences detected in the number of marketable fruit harvested or total weight of marketable fruit.

**Table 1.** Effect of fungicide spray programs for control of Alternaria leaf spot of cantaloupe.

| Treatment, rate/A, and spray timing[1] | Alternaria Leaf Spot[2] 21 Jul | Alternaria Leaf Spot[2] 31 Jul | Def.[3] | No. Fruit[4] | Yield lb/plot[5] |
|---|---|---|---|---|---|
| Flint 50WG, 3.0 oz + Actigard 50WG, 1.0 oz (1, 2, 3, 4) | 2.1 b[6] | 2.5 b | 87.5 a | 32.8 a | 118.0 a |
| Flint 50WG, 3.0 oz + Actigard 50WG, 1.0 oz (1, 3)<br>Bravo Weather Stik, 2.0 pts (2, 4) . . . . . . . . . . . . . . . . . . | 1.6 b | 2.3 b | 45.0 bc | 35.2 a | 139.4 a |
| Flint 50WG, 3.0 oz + Actigard 50WG, 0.5 oz (1, 3)<br>Bravo Weather Stik, 2.0 pts (2, 4) . . . . . . . . . . . . . . . . . . | 1.3 b | 1.8 b | 37.5 c | 35.2 a | 139.4 a |
| Flint 50WG, 3.0 oz + Actigard 50WG, 1.0 oz (1, 2)<br>Bravo Weather Stik, 2.0 pts (3, 4) . . . . . . . . . . . . . . . . . . | 1.0 b | 1.4 b | 53.8 b | 35.2 a | 139.4 a |
| Flint 50WG, 3.0 oz + Actigard 50WG, 1.0 oz (1, 3)<br>Switch 62.5 WG, 11.0 oz (2)<br>Bravo Weather Stik, 2.0 pts (4) . . . . . . . . . . . . . . . . . . . . | 1.4 b | 1.3 b | 57.5 b | 35.2 a | 139.4 a |
| Quadris 2.08F, 12.4 fl. oz (1, 3)<br>Bravo Weather Stik, 2.0 pts (2, 4) . . . . . . . . . . . . . . . . . . | 1.0 b | 1.0 b | 42.5 bc | 35.2 a | 139.4 a |
| Non-treated check . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 76.3 a | 97.5 a | 55.0 b | 33.8 a | 126.2 a |

[1]Fungicide treatments were applied on the following dates: 1=28 Jun, 2=6 Jul, 3=14 Jul, and 4=21 Jul.
[2]Disease rating scale: 1=1-10%; 10=91-100% leaf area with symptoms of Alternaria leaf spot.
[3]Percent defoliation on 31 Jul caused by disease or phytotoxicity.
[4]Total number of marketable fruit/plot.
[5]Total marketable yield in pounds/plot.[6]Means columns with letter(s) in common are not significantly different according to the Waller-Duncan *k*-ratio t-test at *k=100*

# EVALUATION OF ACTIGARD, ADMIRE AND MESSENGER ALONE AND IN COMBINATION FOR SUPPRESSION OF TOMATO SPOTTED WILT VIRUS OF TOMATO

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## Introduction

Tomato spotted wilt virus (TSWV) is the most destructive disease of tomato in Georgia. Losses of up to 100% have been reported in some fields. No suitable remedial control measures have been recommended that provide consistent, effective control of the disease. Intensive insecticide programs and reflective plastic mulches are being tested with some success. Resistant varieties are now available that show good resistance to TSWV but have problems with fruit quality. Studies in tobacco have shown that the use of the plant defense activator Actigard in combination with the insecticide Admire can reduce the incidence of TSWV. This study was conducted to determine if plant defense activators in combination with Admire could suppress TSWV in Tomato.

## Materials and Methods

A commercial tomato field in Grady Co. GA was chosen for this study. Tomato plants (*Lycopersicon esculentum* "Florida 47") were treated in the greenhouse with Actiguard, Admire and Messenger 5 days prior to planting. Plots were sprayed with a $CO_2$ pressurized backpack sprayer calibrated to deliver 40 GPA at 75 psi. Plots were arranged in a randomized complete block design, replicated 4 times, were 50-ft long × 6-ft apart, contained approximately 25 plants/plot. Actiguard treatments were initiated in the greenhouse on 9 Mar. Admire was applied as a greenhouse drench on 9 Mar. Actiguard sprays were applied again at planting and twice more weekly.

## Results

There were no significant differences in TSWV noted between treatments (Table 1). Plots treated with Admire + Actigard, Admire + Messenger, Admire + Actigard +Messenger, Actigard + Messenger, and Actigard alone significantly reduced stem diameter below the industry standard (Table 2). Plots treated with Admire + Actigard, Admire + Actigard +Messenger, Actigard + Messenger, Actigard alone, and Messenger alone significantly reduced plant width. The number of open blooms was significantly reduced by applications of Admire + Actigard, Admire + Actigard +Messenger, Actigard + Messenger, and Actigard alone.

**Table 1.** Effect of Admire, Messenger, and Actigard alone and in combination on the incidence of TSWV.

| Treatment[1] and rate/A | Virus Ratings[2] 21 Apr | 28 Apr | 5 May | 16 May | 23 May | 31 May | AUDPC[3] |
|---|---|---|---|---|---|---|---|
| Admire 2F, 1.0 fl. oz./10,000 plants . . | 1.9 a[4] | 4.8 a | 11.7 a | 22.0 a | 22.5 a | 25.3 a | 558.4 a |
| Admire 2F, 1.0 fl. oz./10,000<br>Actiguard, 0.1 oz./7,000 plants<br>Actiguard, 0.5 oz/acre . . . . . . . . . . . . | 1.0 a | 1.0 a | 2.9 a | 8.9 a | 10.9 a | 12.9 a | 240.0 a |
| Admire 2F, 1.0 fl. oz./10,000<br>Messenger, 30 ppm<br>Messenger, 30 ppm . . . . . . . . . . . . . . | 0.9 a | 3.9 a | 10.9 a | 16.8 a | 20.7 a | 21.6 a | 494.7 a |
| Admire 2F, 1.0 fl. oz./10,000<br>Actiguard, 0.1 oz./7,000 plants<br>Messenger 3WG, 30 ppm<br>Actiguard, 0.5 oz./acre . . . . . . . . . . . | 0.0 a | 1.0 a | 2.9 a | 10.8 a | 15.7 a | 15.7 a | 289.7 a |
| Actiguard, 0.1 oz./7,000 plants<br>Messenger 3WG, 30 ppm<br>Actiguard, 14 g/acre . . . . . . . . . . . . . | 0.0 a | 3.0 a | 8.0 a | 22.0 a | 24.0 a | 26.0 a | 531.5 a |
| Actiguard, 0.1 oz./7,000 plants<br>Actiguard, 0.5 oz./acre . . . . . . . . . . . | 0.0 a | 1.0 a | 6.1 a | 18.1 a | 22.3 a | 23.3 a | 447.5 a |
| Messenger 3WG, 30 ppm . . . . . . . . . | 0.0 a | 2.8 a | 8.5 a | 15.3 a | 20.1 a | 22.9 a | 446.5 a |
| Industry standard[5] . . . . . . . . . . . . . . . | 0.0 a | 3.0 a | 10.9 a | 16.7 a | 18.7 a | 20.7 a | 458.7 a |

[1]Actiguard treatments were applied on the following dates: 15, 22, 29 Mar. Messenger was applied on 22 Mar, 5, 25 Apr, 5, 17 May.

[2]Number represents the percentage of virus infected plants per plot.

[3]Area under the disease progress curve.

[4]Means in columns with letter(s) in common are not significantly different according to the Waller-Duncan *k*-ratio t-test at *k*=100.

[5]Industry standard consists of normal pesticide inputs for control of insects and diseases as recommend by the UGA Cooperative Extension Service.

**Table 2.** Effect of Admire, Messenger, and Actigard alone and in combination on plant growth and development.

| Treatment[1] and rate/A | Plant Measurements[2] | | | |
|---|---|---|---|---|
| | Stem Diameter | Plant Height | Plant Width | Open blooms |
| Admire 2F, 1.0 fl. oz./10,000 plants | 11.4 ab[3] | 289.0 a | 564.5 ab | 0.8 ab |
| Admire 2F, 1.0 fl. oz./10,000<br>Actiguard, 0.1 oz./7,000 plants<br>Actiguard, 0.5 oz/acre | 10.0 cd | 269.0 a | 416.0 c | 0.0 c |
| Admire 2F, 1.0 fl. oz./10,000<br>Messenger, 30 ppm<br>Messenger, 30 ppm | 10.5 b-d | 304.3 a | 549.0 ab | 0.9 a |
| Admire 2F, 1.0 fl. oz./10,000<br>Actiguard, 0.1 oz./7,000 plants<br>Messenger 3WG, 30 ppm<br>Actiguard, 0.5 oz./acre | 9.7 d | 274.0 a | 411.3 c | 0.0 c |
| Actiguard, 0.1 oz./7,000 plants<br>Messenger 3WG, 30 ppm<br>Actiguard, 14 g/acre | 9.8 d | 271.0 a | 415.7 c | 0.0 c |
| Actiguard, 0.1 oz./7,000 plants<br>Actiguard, 0.5 oz./acre | 10.1 cd | 266.0 a | 441.3 c | 0.1 bc |
| Messenger 3WG, 30 ppm | 11.1 a-c | 290.0 a | 535.5 b | 1.4 a |
| Industry standard[4] | 11.8 a | 291.0 a | 586.3 a | 1.1 a |

[1]Actiguard treatments were applied on the following dates: 15, 22, 29 Mar. Messenger was applied on 22 Mar, 5, 25 Apr, 5, 17 May.
[2]Number represents plant measurements and bloom counts recorded from five randomly chosen plants on 12 Apr.
[3]Means in columns with letter(s) in common are not significantly different according to the Waller-Duncan *k*-ratio t-test at *k*=100.
[4]Industry standard consists of normal pesticide inputs for control of insects and diseases as recommend by the UGA Cooperative Extension Service.

# EVALUATION OF ACTIGARD AND ADMIRE ALONE AND IN COMBINATION FOR SUPPRESSION OF MOSAIC VIRUS INCIDENCE IN SUMMER SQUASH IN TIFT CO. GA

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## Introduction

Mosaic viruses are the most destructive and widespread disease of summer squash in Georgia. These mosaic viruses are generally Potyviruses (ZYMV - zucchini yellow mosaic virus, WMV II - watermelon mosaic virus II, PRSV - papaya ringspot virus) and one Cucumovirus (CMV - cucumber mosaic virus). All of these viruses are aphid transmitted. Transmission is generally low in the spring and increases to extremely high levels in the fall. Current recommendations for reducing losses to these viruses are intensive stylet oil spray programs and use of resistant varieties. However, the stylet oil program requires specialized spray equipment and is very labor intensive and the seed of the transgenic resistant varieties are expensive. Less expensive and intensive options are needed to improve the profitability of fall squash.

## Materials and Methods

Squash (“Enterprise”) was transplanted to beds covered in black plastic in a commercial field in Tift Co., GA on 12 Sept. Plots were arranged in a randomized complete block design, replicated four times, were twin, 20 ft. long rows on 6 ft. centers. Inter-row spacing was 18" and the space between rows on a bed was 18". Plots were sprayed with a $CO_2$ pressurized backpack sprayer calibrated to deliver 40 GPA at 75 psi. Actigard treatments were initiated when 75% or more plants had emerged. Admire was applied as a drench at planting using 6.0 fl. oz. of water per plant. Once initiated, Actigard sprays were applied approximately every 2 weeks. Standard insecticide, fungicide and fertility programs were utilized as per University of Georgia Cooperative Extension Service recommendations.

## Results

There were no significant differences in virus disease noted among treatments. There was no indication of phytotoxicity associated with Actigard treatments.

Table 1. Effect of Actigard and Admire on the incidence of mosaic viruses in squash.

| Treatment[1] and rate/A | Virus Ratings[2] 17 Oct | 14 Nov |
|---|---|---|
| Actigard 50WG, 0.5 oz | 0.0 a[3] | 64.5 a |
| Actigard 50WG, 0.25 oz | 2.8 a | 79.7 a |
| Actigard 50WG, 0.125 oz | 5.7 a | 76.1 a |
| Admire 2F, 24 oz + Actigard 50WG, 0.5 oz | 1.4 a | 80.1 a |
| Admire 2F, 24 oz | 1.4 a | 63.8 a |
| Non-treated check | 1.4 a | 78.2 a |

[1]Actigard treatments were applied on the following dates: 12, 29 Sep; 17 Oct.
[2]Number represents the percentage of virus infected plants per plot.
[3]Means in columns with letter(s) in common are not significantly different according to the Waller-Duncan *k*-ratio t-test at *k*=100.

# 1999-2000 CARROT NEMATICIDE TRIAL

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## Introduction

Root-knot nematodes can severely damage developing carrots. Damage is caused when juvenile nematodes penetrate near the root tip as the tap root is elongating. A damaged tap root can either stop growing or split so that the carrot has two or more tap roots. In either case, the resulting carrot cannot be sold for fresh market use. Minimizing damage caused by root-knot nematodes in carrot production significantly increases profits. Commonly-used nematicides in carrot production include Vydate, Telone II, and metam sodium. Agri-50 is an experimental nematicide which is not yet labeled.

## Methods

A randomized complete block design with seven replications was used to study the effect of seven options for nematode control. Pre-plant treatments were applied on 12 November 1999 to a field in Brantley County, GA. Due to weather and personnel problems, carrots ( Sunseeds variety 'Apache') were planted on 3 December 1999. The soil type is not known, but it was a very sandy soil typical of southeastern Georgia. Carrots were watered with drip irrigation. The field had been planted in okra earlier in 1999, and severe galling was seen on okra roots. Soil samples for nematode assay were collected from each plot prior to treatment application on 12 November and again at harvest on 28 April 2000. Supplemental Vydate applications were made on 11 January and 3 February 2000. Supplemental Agri-50 applications were made on 11 January, 3 February, and 13 March 2000. In each plot, ten-foot sections of the middle two rows were harvested and graded to separate marketable carrots from culls. Foliage was removed from carrots prior to measuring fresh weight. Treatments in this study were applied to 5-foot beds each of which was 23 feet long (0.002640037 acres/plot). There were 12-foot alleys between tiers of plots.

Treatment list

1. Untreated control
2. Vydate 2L broadcast (4 lbs a.i./treated acre - sprayed on surface and rototilled in 4 inches) plus 2 foliar applications of Vydate 2L (2 pints/A) (applied 39 and 62 days after planting)
3. Telone II (12 gal/A)
4. metam sodium (55 gal/A)
5. Telone II (12 gal/A) plus metam sodium (55 gal/A)
6. Telone II (12 gal/A) plus 2 foliar applications of Vydate (2 pints/A) (applied 39 and 62 days after planting)
7. Agri-50 (10 gal/A preplant - sprayed on surface and rototilled in 4 inches), and 1% cover sprays (10 ml Agri-50 plus 990 ml water) (applied 39, 62, and 101 days after planting)

Results and Discussion

Soil temperatures during the test were cool which resulted in slow emergence, slow growth, and relatively low nematode counts. However, some nematode damage was observed on carrots at harvest. A little bit of damage from wireworms was evident, but the damage was relatively slight and did not seem to vary by treatment (no data was collected). Root-knot nematode levels generally were low before treatment application and at harvest, and levels did not vary among treatments. There were no differences among treatments in marketable yield, though the lowest mean yield was 33% less than the highest mean yield. The primary reason for carrots being culled was small size caused primarily by cool weather following late planting. The total yield (fresh weight including culls) differed among treatments, though no treatments differed from the untreated control.

Initial and final root-knot nematode juvenile counts per 100 cm3 soil, and total yield and marketable yield of carrots per 2-row x 10-ft section of plots.

| Treatment # | Root-knot juveniles (12 Nov) | Root-knot juveniles (28 Apr) | Total Yield (kg/20 ft of row) | Marketable Yield (kg/20 ft of row) |
|---|---|---|---|---|
| 1 - Untreated | 32 a | 4 a | 4.64 abc | 2.50 a |
| 2 - Vydate | 59 a | 5 a | 3.92 c | 2.38 a |
| 3 - Telone II | 22 a | 24 a | 4.30 bc | 2.90 a |
| 4 - metam sodium | 10 a | 59 a | 4.98 abc | 3.00 a |
| 5 - Telone II + metam sodium | 2 a | 2 a | 5.60 ab | 3.56 a |
| 6 - Telone II + Vydate | 14 a | 4 a | 5.12 abc | 2.54 a |
| 7 - Agri-50 | 3 a | 14 a | 5.88 a | 2.92 a |

# EVALUATION OF FUNGICIDE SPRAY PROGRAMS FOR CONTROL OF POWDERY MILDEW IN WATERMELON

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## Introduction

Powdery mildew (caused by the fungus *Sphaerotheca fuliginea*)is a relatively new disease problem facing watermelon growers in Georgia. This fungus thrives during dry, hot, low humidity conditions and generally attacks watermelons within two weeks of harvest. In some cases complete defoliation of entire fields can occur within a few days. Information is needed to determine the most effective fungicides and fungicide programs for suppressing losses to powdery mildew on watermelons.

## Materials and Methods

Watermelon seed ("Stars and Stripes") was planted on 21 Apr in a bare-ground field in Crisp Co., GA. Seed were placed every 4 ft in rows spaced 12 ft apart. Standard practices for management of fertility, weeds, nematodes and insects for watermelons grown in Georgia were followed throughout the season. The experiment utilized a randomized complete block design with four replications. Plots were 30-ft long rows that utilized a 10-ft buffer zone between plot ends. Each treatment was bordered on one side by a non-treated border row. Fungicides were applied using a pump-pressurized pull-type sprayer calibrated to deliver 36 gal/A at 80 psi through D4-25 disc core nozzles spaced 18 in apart. Plot were harvested on 12, 15 Jul.

## Results

Weather during the experiment was warm and dry with rainfall accumulations 10.2 in below average from Apr through Jul. Powdery mildew was first observed on 7 Jul and increased to high levels by the 18 Jul rating date. All fungicide treatments significantly reduced powdery mildew severity on 7 and 18 Jul compared to the non-treated check (Table 1). However, spray programs containing Quadris, Folicur and Cuprofix MZ Disperss at the 6.0 lb./acre rate demonstrated the greatest levels of disease suppression. No significant differences between treatments were noted in regard to the total number and marketable weight of melons.

**Table 1.** Effect of fungicides and spray programs on powdery mildew of watermelon.

| Treatment, rate/A (spray timing)[1] | Powdery Mildew Ratings[2] 7 Jul | 18 Jul | No. Melons[3] | Yield[4] lb. plot |
|---|---|---|---|---|
| Bravo WS 6F, 2 pt (1, 3, 5) Quadris 2.08F, 12.4 fl oz (2, 4, 6) | 3.8 b[5] | 42.5 c | 13.0 a | 327 a |
| Bravo WS 6F, 2 pt (1, 3, 5) Benlate 50WP, 0.5 lb + Penncozeb 75DF, 2.0 lb (2, 4, 6). | 4.4 b | 51.7 b | 15.7 a | 381 a |
| Bravo WS 6F, 2 pt (1, 3, 5) Folicur 3.6EC, 7.2 fl oz (2, 4, 6) | 2.4 b | 41.7 c | 11.8 a | 326 a |
| Bravo WS 6F, 2 pt (1, 3, 5) Cuprofix MZ Disperss 30DG, 6.0 lb (2, 4, 6) | 2.9 b | 38.8 c | 15.8 a | 291 a |
| Bravo WS 6F, 2 pt (1, 3, 5) Cuprofix MZ Disperss 30DG, 8.0 lb (2, 4, 6) | 2.9 b | 43.8 bc | 12.8 a | 313 a |
| Non-treated check | 42.5 a | 82.5 a | 10.3 a | 253 a |

[1]Fungicide treatments were applied on the following dates: 1=5 May, 2=1 Jun, 3=19 Jun, 4=27 Jun, 5=4 Jul, 6=13 Jul.
[2]Disease rating scale: 1=1-10%; 10=91-100% leaf area affected (both upper and lower sides).
[3]Total number of melons per plot weighing 15 lbs. or more.
[4]Total weight of melons per plot weighing 15 lbs. or more.
[5]Means in columns with letter(s) in common are not significantly different according to the Waller-Duncan *k*-ratio t-test at *k*=100.

# Insect Control

**AN UPDATE ON THRIPS AND TOMATO SPOTTED WILT MANAGEMENT IN TOMATO**

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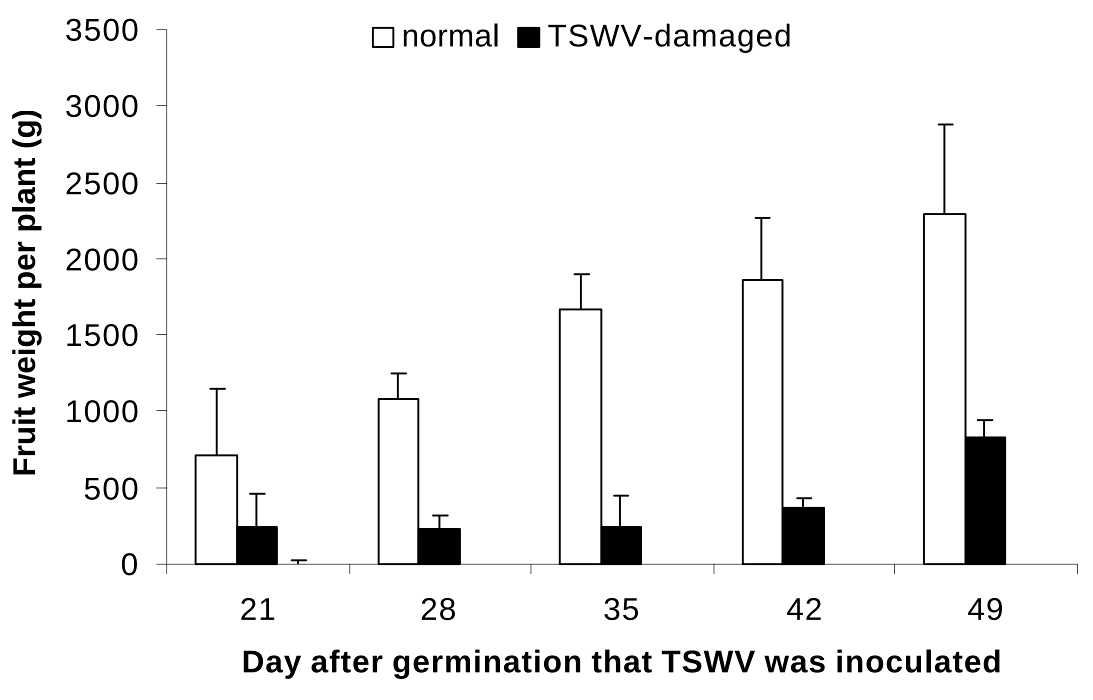
Currently, the greatest insect-disease threat to the tomato industry in Georgia is thrips-vectored *Tomato spotted wilt virus* (TSWV). In tomato, TSWV can often reduce marketable yields by 50% besides greatly increasing the incidence of irregular-ripened tomatoes. The thrips species primarily responsible for transmitting this virus in tomatoes are western flower thrips (*Frankliniella occidentalis*), tobacco thrips (*Frankliniella. fusca*), and others (for example, *Frankliniella bispinosa* and onion thrips, *Thrips tabaci*). Based on recent studies by Drs. David Riley and Hanu Pappu at the University of Georgia - Coastal Plain Experiment Station at Tifton, a thrips-TSWV management program has been developed for tomatoes that offers both short-term and long term benefits to tomato growers in TSWV-affected production areas in Georgia and the southeastern USA. The rationale for this program is based on the discovery that, in the tomato crop, early-season




Greater yield loss in tomato with earlier virus (TSWV) transmission at Tifton, GA in field plots during Spring 2000 (C. Chaisuekul, D. Riley, and H. Pappu).

virus transmission has a much greater impact on yield than if the virus is transmitted to the plant later in the growing season (see Figure). Also, since transmission of the virus occurs through thrips feeding, Dr. Riley's research program has focused on various tactics that prevent thrips feeding, kill thrips before they can feed, and/or reduce the attractiveness of the crop so that less thrips occur on the plant.

The current approach is to manage viruliferous thrips early in the tomato growing season. Virus transmission that occurs later in the season may not be as important in terms of yield, but there is still the problem of irregular ripened fruit that can occur. Irregular ripening caused by TSWV can show up after commercial fruit have been treated with ethylene for ripening and can result in reduced tomato quality. The treatments evaluated in 1998-2000 resulted in less numbers of irregular-ripened fruit in the best treatment, imidacloprid soil drench plus lambda-cyhalothrin plus methamidophos foliar treatments beginning as soon as the tomatoes were transplanted. In addition, host plant resistance in the tomato cultivar BHN444, and silver reflective mulch greatly improved yields (see Table below).

<table>
<tr><td colspan="4" rowspan="2">Results of 1999 tomato test at Tifton, GA in terms of main plot (BHN444 resistance and silver reflective mulch) and subplot (different length periods of insecticide control of thrips) effects on number of thrips, % TSWV, and $ yield per acre, respectively.</td><td>Admire + four weeks of foliar sprays</td><td>53 b</td><td>28% c</td><td>$6,685 a</td></tr>
<tr><td>Admire + two weeks of foliar sprays</td><td>57 b</td><td>56% ab</td><td>$6,102 a</td></tr>
<tr><td>BHN444-silver mulch</td><td>47 b</td><td>28% b</td><td>$7,233 a</td><td>Admire + eight weeks of foliar sprays</td><td>13 c</td><td>44% b</td><td>$5,781 a</td></tr>
<tr><td>Sunny Hyb.-silver mulch</td><td>49 b</td><td>57% a</td><td>$4,721 ab</td><td>Admire + one week of foliar sprays</td><td>70 a</td><td>58% ab</td><td>$3,777 b</td></tr>
<tr><td>Sunny Hyb.-black mulch</td><td>64 a</td><td>67% a</td><td>$3,602 b</td><td>untreated check</td><td>73 a</td><td>67% a</td><td>$3,580 b</td></tr>
</table>

* Means within columns followed by the same letter in above tables are not significantly different, LSD (P<0.05).

The results from several field trials like the 1999 test reported here all indicated that TSWV could be reduced and yields enhanced with the right combination of specific treatments. The role of each treatment is still being quantified. For example, foliar sprays without the imidacloprid treatment in the 1998 test didn't do as well as foliar plus the imidacloprid treatment in terms of improving yields. Further investigation revealed that imidacloprid was needed to reduce thrips feeding which aids in reducing virus transmission when combined with other treatments. The results of these studies demonstrated that thrips and TSWV could be reduced considerably with host plant resistance, reflective mulch, and insecticide treatments. The use of reflective mulch just on the shoulder of the bed aided in early season soil warming in the middle of the bed while still providing a reflective surface to repel thrips.

In summary, management of thrips as vectors of TSWV in tomato should target a reduction in thrips feeding where the transmission of the virus occurs. This includes tactics that will either directly prevent thrips feeding, kill thrips before they feed, and/or reduce the attractiveness of the crop to prevent thrips from occurring on the plant. These tactics should focus on the early season in the tomato growth cycle in order to have the greatest impact on yields. Like the TSWV Risk Index currently in place for peanuts in Georgia, similar programs need to be developed based on sound IPM research in tomatoes and other vegetable crops.

**Author Index** | **Page Number**