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Cultural Practices

<u>**Variety Evaluation**</u>

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EVALUATION OF WATER MOVEMENT IN RAISED BEDS AS AFFECTED BY IRRIGATION REGIMES AND BED WIDTHS USING DYE INJECTION, UGA-CPES BLACK SHANK FARM, TIFTON GEORGIA - SPRING 2002

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Introduction

Effectiveness of drip-applied chemicals, such as emulsifiable Telone products (eg InLine) and metam sodium, in plasticulture is dependent on adequate distribution of the chemical in the entire bed. Emulsifiable chemicals move mainly with drip irrigation water, and improper wetting of a bed would therefore limit the efficacy of the chemical emulsion. Several methods have been used to determine water movement in soil, but one of the most simple and cheap methods is the use of dye. Previous studies using a blue water-soluble dye have shown that the sandy soils in the southeastern USA are difficult to wet completely. Injection times of up to 8 hours were required to ensure uniform wetting of a 30 in. bed, and even then beds could not be completely wetted up to the shoulder. We wanted to check whether different irrigation regimes, and/or the use of narrower beds could improve the wetting potential of a Tifton sandy loam soil.

The following tests were done to quantify water movement from drip tapes as affected by irrigation frequency, duration and bed width.

Materials and Methods

All tests were done at the Blackshank Farm, CPES, Tifton, GA on a Fuquay loamy sand (88% sand, 9% silt, 3% clay). Each plot was 50 feet long and beds were 32 in. wide for the irrigation regime tests, and either 18, 24, or 30 in. wide for the bed width test.

Raised beds were formed using a commercial tractor-drawn bed-former. Drip tape was installed together with the black polyethylene film mulch. Drip tape was put 2-4 cm below the surface. The drip tape used was Aquatraxx (12-in. spacing between emitters and a flow rate of 0.45 gal/hr at @ 10psi). Distribution of drip irrigation water was evaluated using a blue marking dye (Signal®). The dye was injected into all plots concurrent with the drip irrigation (1 pint of dye/100 gal of water delivered to the plots). The beds were injected with the dye and pushed with water over different time periods and in different size beds (Tables 1 and 2).

Width, depth and area of soil covered by the drip water was evaluated by digging trenches across the beds or by digging out the lateral half of a section of the bed along the drip tubing. After digging rough trenches, the bed face was prepared for measurement by shaving off thin layers of soil until a flat surface was exposed at the desired location in the bed. Measurements were made across the bed at points on the emitters and equidistant between emitters. Maximum width of the blue dye pattern, depth of the pattern from the top of the bed and area covered by the blue dye were recorded for each surface. The width of the dye pattern was measured with a ruler, and the dye-covered area with a 24 in. by 24 in. grid etched in plexiglass by counting all grid squares in which half or more of the square was blue.

Irrigation regime tests were done on February 1 and February 19, 2002, the bed width test was done on March 6, 2002. Data are means of four replications of measurements per bed. Means followed by the same letter are not significantly different (P = 0.05) according to Duncan's multiple range test.

Conclusion

Irrigation regimes had a significant effect on water movement in test 1, but differences were limited in test 2 (Table 1). Having irrigations at consecutive days improved water movement on and between emitters. Dye coverage between emitters was greatest when irrigations were done on 3 consecutive days.

Bed width had no effect on water movement when measured between emitters, and following a 4 hrs push. When measured on emitters and with 8 hrs push dye width and coverage was greater in 18 and 24 in. beds as compared to 30 in. beds.

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Table 1. Width of dye pattern and total dye coverage area of cutaway face of plastic

covered beds, influenced by different irrigation regimes, February 1 (test 1) and 19 (test 2), 2002.

Days receiving irrigation	Irrigation hours per day	Width of dye pattern (inches)				Dye coverage (square inches)			
		On Emitter		Between Emitter		On Emitter		Between Emitter	
		Test 1	Test 2	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
1	6.5 hrs	17 c	22 a	15 de	19	185 c	190 bc	166 de	179 bc
1 and 2	6.5 hrs	26 a	19 b	23 b	17	258 ab	187 bc	197 bc	166 c
1, 2 and 3	6.5 hrs	25 a	19 b	25 a	19	282 a	177 c	261 a	177 bc
1	13 hrs	17 c	19 b	17 d	19	199 c	207 ab	183 cd	181 abc
1	19.5 hrs	22 b	20 ab	19 c	19	237 b	217 a	205 b	204 a
1 and 3	6.5 hrs	16 c	19 b	14 e	18	168 c	205 ab	161 e	194 ab

Data are means of four replications of measurements per bed. Means followed by the same letter are not significantly different ($P = 0.05$) according to Duncan's multiple range test.

Table 2. Width of dye pattern and total dye coverage area of cutaway face of plastic covered beds, influenced by

different bed sizes, March 6, 2002.

Bed width	Irrigation duration	Width of dye pattern (inches)		Dye coverage (square inches)	
		On Emitter	Between Emitter	On Emitter	Between Emitter
30" bed	4 hrs	15 c	15 b	168 c	158 b
24" bed	4 hrs	17 c	15 b	173 c	148 b
18" bed	4 hrs	17 c	12 c	169 c	144 b
30" bed	8 hrs	19 b	19 a	207 b	195 a
24" bed	8 hrs	21 a	19 a	233 a	198 a
18" bed	8 hrs	20 ab	19 a	224 a	197 a

Data are means of four replications of measurements per bed. Means followed by the same letter are not significantly different (P = 0.05) according to Duncan's multiple range test.

EVALUATION OF ARTICHOKE FOR SOUTH GEORGIA PRODUCTION

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Introduction

Artichoke (*Cynara scolymus*), which are native to the Mediterrean, are grown extensively in central California. In fact, Castorville, CA bills itself as the artichoke capital of the world. This region of the U.S. grows a significant amount of artichoke with over 10,000 acres (Sims et al., 1997). Central California is noted for its mild weather particularly during winter months, which is ideal for artichoke production. South Georgia has similar winter weather, but with summers that are considerably hotter. Artichoke are a large plant related to thistle that require a considerable amount of space per plant. The harvested portion of the plant is the immature flower (Figure 1).

Most of the artichoke grown in California are thorned types which are propagated asexually. Each bract of the flower has a small thorn which are characteristic of this type. Many of the varieties grown in California have been selected by the individual grower and are therefore not available commercially.

South Louisiana is believed to have had an artichoke industry in the 19th century that died out with the growth of the California industry. Recently there has been a revival of artichoke production in Louisiana.

D. Palmer Seed Company has available a seed propagated artichoke called Emerald which does not have thorned bracts (Palmer, 2000). According to the seed company this variety has a greater tolerance for high temperatures compared to the California artichokes. This study was undertaken to evaluate this variety under south Georgia production conditions as well as select individual plants with greater adaptability for this region.

Materials and Methods

‘Emerald’ artichoke seed were obtained and planted in Metromix 300 potting mix in the greenhouse at the Bamboo Farm and Coastal Garden in Savannah, GA on 14 Aug. 2000. Plants were transplanted to the field at the Vidalia Onion and Vegetable Research Center (VOVRC), Lyons, GA on 20 Sept. 2000. Plants were set 6 feet apart in the row with 6 foot between-row spacing. Approximately 20-30 plants were set out.

Additional seed were sown as described above on 19 Mar. 2001 and transplanted to the field at the VOVRC on 18 Apr. 2001. Again approximately 20-30 plants were set out. Fertilizer was applied twice a year at 750 pounds per acre of 10-10-10 at planting and again approximately 6 months later. Weed control consisted of mulching with pine bark, hand weeding, and spot spraying with herbicides.

Artichoke counts were taken from each plant on 9 Apr. 2002. Plants were dug, divided, and replanted on 25 Mar. 2003.

Results and Discussion

Yield for one and two year old plants are listed in table 1. These yields appear to be in line with commercial production in California where plant populations from 800-2200 plants are recommended which should yield 400-600 23-lb boxes per acre. Artichoke are marketed and sold based on sizes from 15s-72s which are packs of 15-72 artichokes per box.

Artichokes are apparently heavy feeders requiring from 250-300 units of nitrogen per year for production. Our fertilizer application was probably inadequate to maximize the potential of the crop. In discussions with a D. Palmer Seed Company representative who visited the site it was indicated that our plants should have grown much larger suggesting that we were not applying adequate fertilizer. Because of this, yields may potentially have been greater.

During seedling production we noticed a number of the seedlings died in the peat based media. We also noticed that several plants died in the field where they had been mulched with pine bark. This practice was stopped when we realized that organic matter had such a detrimental effect on the artichokes. In subsequent discussions with the D. Palmer Seed Co. representative, he indicated they had a lot of trouble trying to grow artichokes on the muck soils in Florida. Apparently artichokes do not do well in soils with high organic matter.

Plants set out in 2000 were exposed to below freezing weather that first winter which killed the plants back to the ground. Many of these plants recovered and produced artichokes the following spring. Transplants set out in the spring of 2001 fared better with no plants dying back to the ground during subsequent freezing winter weather. This suggests that for south Georgia it may be better to set transplants in the spring to insure plants can survive the following winter.

Plants were exposed to below freezing temperatures during each winter and to very high temperatures during the summers. Only seven plants survived to the spring of 2003. These plants were lifted, divided, and replanted to a more convenient location for perennial production. It is hoped they plants will be the nucleolus of asexually propagated artichoke plants adapted to south Georgia.

Whether asexually propagated or from seed, south Georgia has the potential to produce artichokes. There are still many issues that have to be resolved concerning fertilization, environmental stress, weed control, etc. before a viable industry could develop. We would, however, encourage growers to try artichoke on a limited scale.

Literature Cited

Palmer, D. 2000. DPS variety description, artichoke. D. Palmer Seed Co. Yuma AZ.

Sims, W.L., V.E. Rubatzky, R.H. Sciaroni, and W.H. Lange. 1997. Growing globe artichokes in California. Univ. of Calif. Leaflet 2675.

Table 1. Artichoke yield for one and two year old plants.

	No./plant
1-year old plants	5.3
2-year old plants	10.3

Figure 1. Artichoke plant and closeup of immature flower.

EVALUATION OF SHORT-VINE POLLINIZER AND DISTANCE FROM POLLEN SOURCE IN TRIPLOID (SEEDLESS) WATERMELON PRODUCTION

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Introduction

Watermelons are an important crop in Georgia with almost 34,000 acres, which represents over 17% of the vegetable acres in production. More vegetable acres are used for watermelon than any other vegetable in the state and the value of the crop is estimated at over $80 million (Doherty et al., 2002).

An increasing percentage of this acreage is used for triploid (seedless) watermelon production. Seedless watermelons are produced by manipulating the chromosome number so there is an odd number of chromosomes (3n), which results in the plant's inability to produce viable seed. Seed in such fruit are present but remain small, soft, and edible.

Although these plants don't produce viable seed, they do require pollinization in order to produce fruit. This means that normal pollen producing plants must be present in the field for successful triploid watermelon production. Production practices have generally recommended that 1 in 3 rows be of normal plants in order for there to be sufficient pollen present to produce a successful crop. Recent work has suggested that as little as one pollinizer row in five may be adequate for successful pollination of triploids (NeSmith & Duval, 2001).

A couple of seed companies have been experimenting with novel approaches to pollination by eliminating the space needed for pollinizers. Seminis Seed Co. has introduced a short-vine pollinizer called 'Companion', which never growers larger than 3-4 feet across, so they do not compete with other plants in the field. They recommend that a field should be planted 100% to triploids and that this pollinizer be planted every second plant in the row. Syngenta Seed Co. is working on a similar production practice that uses a variety selected for high pollen production, but does not compete with the triploids. Their variety produces a normal vine, but with an inedible small fruit.

Materials and Methods

In the first experiment short-vine pollinizers were evaluated at different planting densities. Seed for these experiments were planted in the greenhouse at the Bamboo Farm and Coastal Garden in Savannah, GA. Seventy-two cell trays were filled with Metromix 300 peat based media. Seed were sown on 20 Mar. 2002. Care was taken so that the triploid watermelon seed were not overwatered to insure a high germination rate. All transplants received one application of Peters 20-20-20 at 200 ppm after emergence.

Land at the Vidalia Onion and Vegetable Research Center in Lyons, GA was prepared according to standard University of Georgia Cooperative Extension Service recommendations with 750 pounds per acre of 10-10-10 applied preplant and incorporated. Each watermelon plot consisted of 10 hills planted with a five feet within-row spacing of triploids, which was planted on 24 Apr. 2002. Each plot was isolated from other plots by at least 36 feet. Transplants of 'Companion (6741)' were interplanted in each plot every second or fourth plant depending on the treatment. The experiments were arranged in a randomized complete block design with three replications. Triploid fruit from each plot was harvested on 11 July 2002 and yields recorded.

In the second experiment, 150-foot row of pollinizer plants were transplanted with a five-foot in-row spacing. Adjacent to this row were planted four 150-foot rows of triploid watermelon plants with the same in-row spacing. The between-row spacing was six feet. This resulted in four triploid rows 6, 12, 18, and 24 feet away from the pollinizer row. Fruit were harvested on 11 July 2002 from each triploid row in 50-foot increments and weights recorded separately.

Weed control consisted of Sonolan herbicide applied over-the-top at a one quart per acre rate. In addition, Sandea herbicide was spot sprayed to control nut sedge at the 0.75 oz per acre rate.

Finally, a single application of Quadris fungicide was applied just before vining (approximately three weeks after planting) at a rate of 11 oz per acre. No insecticides were used.

Results and Discussion

There was no difference in yield based on the density of pollinizer plants in a plot (Table 1). Currently, Seminis Seed Co. is recommending that 'Companion' be planted every second plant, but this data suggests that placing a pollinizer every fourth plant will work just as well. NeSmith and Duval (2001) reported that distances up to 19 feet from the pollinizer would be adequate for pollination. In discussions with the company, they indicated they wished to err on the side of caution. For growers, their decision concerning pollinizer density, in light of these findings, may be dictated by the cost of using this technology. It should, however, be pointed out that these decisions should be made on more than one year's worth of data.

In the second experiment, distances up to 12 feet from pollinizer plants showed no reduction in yield (Table 2). This study suggests that 1 in 3 rows should be pollinizers, which is the current recommendation. NeSmith and Duval (2001) used a narrower between-row spacing of 4.9 feet compared to our 6-foot spacing. This narrower between-row spacing may be critical in determining the ratio of polllinizer to triploid plants.

Currently many growers use a relatively wide between-row spacing with a narrower in-row spacing. This saves on plastic mulch costs and allows for the use of overhead irrigation. Field configurations of nine feet between-row and three feet in-row are typical. Generally, having 24-27 square feet per plant regardless of the between-row or in-row spacing should result in adequate melon size and yield. The wide between-row spacing may have a disadvantage for triploid production because of the distance to pollinizers. Configurations that place pollinizers in-row rather than in separate rows may require less pollinizers for adequate pollination.

Clearly there is still work to be done to optimize pollinizer density and the selection of the pollinizer type may play a role in this optimization.

Literature Cited

Doherty, B.A., N. Dykes, J.C. McKissick. 2002. 2001 Georgia farm gate value report. Univ. of Ga. Rep. AR-02-02.

NeSmith, D.S. and J.R. Duval. 2001. Fruit set of triploid watermelons as a function of distance from a diploid pollinizer. HortScience. 36:60-61.

Table 1. Evaluation of short-vine pollinizer density.

Treatments	Yield (lbs/plot)	No. of fruit/plot
Every Second Plant	240	15
Every Fourth Plant	268	18
P>F	0.658	

Table 2. Effect on triploid (seedless) watermelon yield based on distance from pollinizer plants.

Distance From Pollinizers (ft)	Yield/plot (lbs)
6	380
12	288
18	110
24	127
R^2	0.814
CV	58%
Fisher's Protected LSD	108

SULFUR SOURCE OR TYPE OF APPLICATION HAS NO EFFECT ON CANTALOUPE YIELD OR FOLIAR NUTRIENT STATUS

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Introduction

Soils in south Georgia are generally very low in sulfur. This fact has been an advantage for onion growers because sulfur-containing precursors are the source of the hot or pungent flavor in onions. For other vegetables sulfur deficiency can be problematic particularly on the sandy soils of south Georgia. Deficiency will usually appear early in the crop cycle and may be corrected as roots grow into deeper layers where sulfur has accumulated. During periods of high rainfall sulfur deficiency can also become prevalent. University of Georgia soil testing routinely recommends that sulfur be applied at 10 pounds per acre for most vegetables (Plank, 1989). Many dry and water soluble fertilizer formulations are available that can supply the necessary sulfur. Sulfur sources include elemental sulfur, ammonium sulfate, gypsum (calcium sulfate), Epsom salts (magnesium sulfate), potassium sulfate, and sulfur-coated urea. In addition, there are complete premium grade fertilizers that not only include N-P-K, but also secondary and micronutrients.

Some growers routinely apply 5 pounds per acre of sulfur as a foliar spray of Epsom salts to cantaloupes. This experiment was conducted to evaluate this practice.

Materials and Methods

Three-week-old transplants of ‘Athena’ cantaloupe were transplanted on 25 April 2002 at the Vidalia Onion and Vegetable Research Center (VOVRC) in Lyons, Ga. The soil at this location is a Tifton soil (Fine-loamy, siliceous, thermic Plinthic Paleudults). The experiment was arranged in a randomized complete block design with 3 replications. Each plot consisted of 10 transplants planted 3 feet apart in the row with 6 feet between rows. Fertilization consisted of 750 pounds per acre of 10-10-10 applied preplant and incorporated. This was followed by 750 pounds per acre of 10-10-10 applied 4 weeks after transplanting. Weed control followed University of Georgia extension service recommendations. No pesticides were applied for insect or disease control.

Treatments consisted of no sulfur application, gypsum applied preplant and Epsom salts applied as a foliar spray 4 weeks after transplanting. The gypsum was applied at a rate of 10 pounds of actual sulfur per acre. The Epsom salts was applied at a rate of 5 pounds actual sulfur per acre.

Melons were harvested as they ripened on 26 June, 1 and 3 July 2002. Foliar samples were collected on 9 July 2002 and analyzed for nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur.

Results and Discussion

Yield, number of melons, and foliar nutrient levels are listed in Table 1. There were no differences in yield, number of melons, or any of the measured foliar nutrient levels. None of the plants in the study showed any signs of sulfur deficiency nor were foliar sulfur levels below the sufficiency range of 0.20-0.50% (Maynard and Hochmuth, 1997).

Foliar nitrogen levels ranged from 3.15% for treatments with Epsom salts to 4.02% with no sulfur. The sufficiency range for nitrogen is 3.5 to 4.5%. Phosphorus levels were between 0.32% and 0.35%, which is well within the sufficiency range of 0.25 and 0.40%. Potassium levels ranged from 1.95% to 2.67%, which was also within the sufficiency range of 1.8 to 4.0%. Calcium levels ranged from 3.56% to 4.45%, which has a sufficiency range of 1.8 to 5.0%. All magnesium levels were well above the sufficiency range of 0.30-0.40%.

Soils at the VOVRC are somewhat heavier than what is found throughout south Georgia. A heavier soil will generally have more sulfur and a greater ability to hold sulfur in the root zone. This may explain why we did not see any sulfur deficiency in those plants not treated with sulfur.

In addition, foliar applications of fertilizer may have as much an effect due to that portion of the material that comes in contact with the soil and is available to plant roots as is absorbed by the leaves. Leaves are inefficient organs for nutrient uptake whereas roots are designed specifically for this purpose. Foliar application of micronutrients may have a benefit to quickly remedy a deficiency problem, but it is not recommended as a routine method of fertilizer application.

In conclusion, growers should soil test their fields and follow soil test recommendations. Apply recommended nutrients as recommended for the specific crop and at the recommended times with the recommended rates. Foliar applications of nutrients should be limited to emergency situations of documented micronutrient deficiency.

Literature Cited

Maynard D.N. and G.J. Hochmuth. 1997. Knott's Handbook for Vegetable Growers 4th ed. John Wiley and Sons, Inc., New York.

Plank, C.O. (ed.) 1989. Soil Test Handbook for Georgia. University of Georgia.

Table 1. Effect of sulfur fertilizer source on cantaloupe yield.

Treatments	Yield/plot (lbs)	No. of melons	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Calcium (%)	Magnesium (%)	Sulfur (%)
No sulfur	39.1	6	4.02	0.32	2.67	3.56	0.55	0.50
$CaSO_4$	55.3	9	3.54	0.35	2.12	5.25	0.76	0.56
$MgSO_4$	76.2	13	3.15	0.32	1.95	4.45	0.71	0.56
P>F	0.505	0.483	0.105	0.934	0.251	0.390	0.280	0.408
CV	70%	41%	14%	26%	25%	38%	24%	21%

Yield Responses of Tomatillo (*Physalis ixocarpa* Brot.) Grown on

Color Plastic Film Mulches in Georgia

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Introduction

Tomatillo (*Physalis ixocarpa* Brot.) is a popular solanaceous crop in Latin America and it has an increasing popularity and market potential in the U.S. Crops such as tomato, bell pepper and eggplant respond favorably to production on plastic mulch in Georgia. There is presently little information on tomatillo production in Georgia. The objective of this study was to evaluate the response of two tomatillo cultivars (Toma Verde and Verde Puebla, both from Seminis) to colored plastic film mulches (black, reflective silver, gray, and bare soil). Tomatillo seedlings were grown in flats and transplanted to the field four weeks after transplanting in spring and fall 2000. Tomatillo transplants were planted to the field at 2-ft spacing in a single row per bed. The experimental plot consisted of 25-ft long, 3-ft wide bed formed on 6-ft centers. Fertilization, irrigation (drip) and management of pests and diseases were similar to those recommended by the Cooperative Extension Service of Georgia for tomato. Plants were excised at the soil level, enclosed individually in plastic bags and kept at 54 ^{o}F until their fruit fresh weight (yield) was determined.

Mean fruit yield in the spring and fall were 6.0 and 3.9 ton/acre, respectively. Within the same season, there were differences in fruit yield between cultivars and among mulches. In both seasons, total fruit yield was higher in >Toma Verde= than in >Verde Puebla=. In the spring there were no differences in total yield among mulches, while in the fall total yield was among the lowest in bare soil. Data pooled from the two seasons showed yield differences among mulches were related with the mean seasonal root zone temperature under mulch. In both cultivars, total yield decreased with decreasing mean seasonal values of root zone temperatures for the mulches (data not shown), which suggests that tomatillo is probably more sensitive to high temperatures compared to tomato. Presence of TSWV was observed in the spring but not in the fall season with incidence of TSWV (mean = 5.7%) not being affected by plastic mulches and cultivars. The infection of TSWV was confirmed by ELISA.

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Table 1. Total yield (ton/acre) of tomatillo plants as affected by cultivar and plastic film mulch during the 2000 Spring and Fall seasons.

Treatment	Spring	Fall
Cultivar		
Toma Verde	4.32 b	3.04 b
Verde Puebla	7.64 a	4.84 a
Mulch		
Bare	6.00 a	1.80 b
Black	5.60 a	3.60 ab
Gray	6.56 a	5.32 a
Silver	5.72 a	5.00 a

[z] Means separated within columns by Fisher = protected LSD test (P #0.05).

EFFECTS OF NATURIZE ON FALL PEPPER YIELD AND QUALITY

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Introduction

Bell pepper plots were established at the Coastal Plain Experiment Station in Tifton, Georgia to determine the effects that a Naturize product would have on yield and fruit quality. The product consists of microorganisms and micronutrients. Bell pepper variety "Camelot" (Seminis Seed Co.) transplants were commercially produced in polystyrene trays at a local plant farm. The transplants were planted into plastic-mulched beds on September 2, 2002. The plots had been treated with methyl bromide (200lb/A 67%) the previous spring and squash had been grown as a first crop on the same plastic. The soil type was a Tifton sandy loam (fine-loamy siliceous thermic Plinthic Kandiudults) soil. Elevation at the CPES is 382 feet. Peppers were planted in an arrangement of two rows per bed with beds spaced 72 inches apart from center to center. Plots consisted of two rows of 25 plants per row spaced 12 inches apart.

The test consisted of five treatments: 1) 2 quarts/A at transplanting + 2 quarts/A 14 days later; 2) 2 quarts/A at transplanting + 2 quarts/A 14 & 28 days later; 3) 2 quarts/A at transplanting + 2 quarts/A 14 days later with 75% fertilizer; 4) 2 quarts/A at transplanting + 2 quarts/A 14 days later with 50% fertilizer; and 5) an untreated check. The experiment was arranged in a Randomized Complete Block Design with four replications.

The equivalent of a 2 quart per acre rate was applied around each plant at transplanting in treatments 1-4. The same amount was applied in the same fashion 14 days later for treatments 1-4. Treatment three received the same treatment 14 days after the second application. All fertilization was applied through the drip irrigation system. However, treatments one, two and five received additional fertilizer applications around each plant. Treatment three received similar treatments on some occasions. This was done so that treatments three and four would end up with only 75% and 50%, respectively of the total fertilizer applied. Total fertilizer application amounted to approximately 150 pounds nitrogen and potassium per acre as the full rate. Applications were made with a 7-0-7 liquid fertilizer material. Plots were treated with recommended insecticide sprays as needed. Irrigation was applied daily through the drip system.

Peppers were harvested on November 20, 2002. Data was taken on yield by grade, marketability, fruit length, fruit width and average fruit weight of jumbo grade peppers. Since a killing frost occurred on November 29, only one harvest was accomplished. Yields were generally low due to smaller plant size and only one harvest. However, peppers had a nice crown set of fruit which accounted for those harvested.

Data are presented in Table 1. The application of two quarts at transplant and 14 days later with full fertilizer appeared to produce the best yield and the greatest percentage of marketable fruit. There were slight differences in individual fruit sizes.

Table 1. Yield by grade, total marketable yield, average fruit size and percent marketability of bell peppers treated with a Naturize product and untreated peppers at Tifton, Georgia in 2002.

Treatment	Yield (25# cartons)/Acre Jumbo	U.S. No. 1	Total Marketable[1]	Average Jumbo Fruit Weight (g)	Average Jumbo Fruit Length (in)	Average Jumbo Fruit Width (in)	Percent Marketable (%)
Naturize 1[2]	115.9 a	170.5 a	286.4 a	188.3 ab	3.0 b	3.0 a	80.8 a
Naturize 2[3]	94.5 a	132.2 a	226.8 ab	189.6 ab	3.5 ab	3.0 a	72.6 ab
Naturize 3[4]	103.5 a	144.1 a	247.6 ab	198.1 a	3.5 ab	2.75 a	72.8 ab
Naturize 4[5]	97.05 a	128.0 a	225.0 ab	174.6 b	3.25 ab	3.0 a	69.4 b
Untreated	79.08 a	112.8 a	191.9 b	174.7 b	3.75 a	2.75 a	77.6 ab
Mean of Test	98.01	137.51	235.52	185	3.4	2.9	74.64
L.S.D. (0.1)	37.05	63.3	66.68	22.84	0.67	0.51	10.73
C.V. (%)	24.54	29.88	18.38	8.01	12.88	11.35	9.33

[1]Total of Jumbo and U.S. No. 1. Plots consisted of a single row with two rows per bed and 25 plants per row spaced 12 inches apart.

[2]2qt/A at transplanting + 2qt 14 days later in drip

[3]2 qt/A at transplanting + 2qt 14 & 28 days later in drip

[4]2 qt/A at transplanting + 2qt 14 days later in drip-75% fertilizer

[5]2qt/A at transplanting + 2qt 14 days later-50% fertilizer

EFFECTS OF NUTRA-PARK LPE COMPOUND ON FALL BELL PEPPER

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Introduction

"Camelot" variety (Seminis Seed Co.) bell pepper transplants were commercially produced in 200-cell polystyrene trays at a local greenhouse. The transplants were planted into plastic-mulched beds on September 2, 2002 at the Coastal Plain Experiment Station (CPES) in Tifton, Georgia. The plots had been treated with methyl bromide (200lb/A 67%) the previous spring and squash had been grown as a first crop on the same plastic. The soil type was a Tifton sandy loam (fine-loamy siliceous thermic Plinthic Kandiudults) soil. Elevation at the CPES is 382 feet. Peppers were planted in an arrangement of two rows per bed with beds spaced 72 inches apart from center to center. Plots consisted of two rows of 30 plants per row spaced 12 inches apart. Plots were 30 feet in length with three feet between plots. The planting was arranged in a Randomized Complete Block Design with eight replications.

Normal cultural practices were used for bell pepper grown with plasticulture in Georgia. Since second crop plastic was used, all fertilization was applied through the drip irrigation system. Application rates ranged from 1.0 pounds nitrogen and potassium per acre per day for the first two weeks up to 2.5 pounds/acre/day at the peak requirement times of fruit set and enlargement. Total nutrients applied included approximately 165 pounds of N and K applied as a 7-0-7 analysis soluble fertilizer. Fungicide and insecticide applications were made according to current University of Georgia recommendations. Irrigation was applied daily.

The Nutrapark compound was applied with a CO_2 pressurized backpack sprayer with a single-row aluminum boom at a rate of 200 ppm. The boom was equipped with three nozzles, one over the row center and one on each side of the row. Treatments were applied on 6 November, 2002. Treated plots were compared to an untreated check.

Pepper were harvested at maturity on November 20, 2002. Data was taken on yield by grade, marketability, fruit length, fruit width and average fruit weight of jumbo and U.S. No. 1 grade peppers. Since a killing frost occurred on November 29, only one harvest was accomplished. Yields were generally low due to smaller plant size and only one harvest. However, peppers had a nice crown set of fruit which accounted for those harvested. Data are presented in Tables 1 and 2.

Results

Yield of jumbo grade peppers was slightly greater in the treated plots than in untreated plots although not significantly (p=0.05). Yields of U.S. No. 1 grade pepper and U.S. No. 2 (Select) pepper were both greater in the treated plots, but again the difference was not significant. Jumbo size peppers were only slightly larger in individual fruit weight in the treated plots.

Fruit length and width were almost identical in the treated and untreated pepper. Total yield of jumbo and U.S. No. 1 grade peppers were greater in treated plots, but not significantly so. Untreated peppers had a slightly higher percentage of marketable fruit than treated peppers, but this difference also was not significant. The Nutrapark compound showed a tendency to improve fruit size and yield, however, since the data were not significant, there should be additional testing to evaluate this product.

Table 1. Yield by grade and average fruit size of bell peppers treated with Nutrapark compound and untreated peppers at Tifton, Georgia in 2002.

	Yield (pounds)/Acre			Average Fruit Size (g)	
Treatment	Jumbo	U.S. No. 1	U.S. No. 2	Jumbo Grade	U.S. No. 1
Untreated	3238	3241	1829	174.7	138.3
Nutrapark[Z]	3247	3456	2405	183.9	127.3
Mean of Test	3242	3348	2117	179.3	132.8
L.S.D. (0.05)	1835	628	1249	24.1	7.4
C.V. (%)	25.15	8.33	26.22	5.97	2.49

[Z] Nutrapark treatment applied at 200 ppm 14 days prior to harvest.

Table 2. Fruit dimensions and marketability of bell peppers treated with Nutrapark compound and untreated peppers at Tifton, Georgia in 2002.

Treatment	Fruit Characteristics		Marketability	
	Fruit Length (inches)	Fruit Width (inches)	Total Marketable Yield[1] (pounds)	Percent[2] Jumbo/US1
Untreated	3.31	2.55	6478	78.6
Nutrapark[Z]	3.28	2.54	6702	73.6
Mean of Test	3.29	2.55	6590	76.1
L.S.D. (0.05)	0.23	0.25	1504	13.5
C.V. (%)	3.04	4.4	10.14	7.9

[1]Total of Jumbo, U.S. No. 1. [2]Percent of Jumbo and U.S. No. 1. [Z] Nutrapark treatment applied at 200 ppm 14 days prior to harvest.

USE OF RECYCLED GYPSUM BOARD ON BELL PEPPER

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Bell pepper plots were established at the Coastal Plain Experiment Station in Tifton, Georgia to determine the effectiveness of using recycled gypsum board as a substitute for agricultural gypsum. Agricultural gypsum is commonly used to increase the calcium levels in soils. Bell pepper was used as the test crop since it has a high calcium requirement for optimum growth and yield. Gypsum board is a common product taken from demolished buildings and there is currently very little use for the board and disposal is expensive. However, since the board is composed of mainly paper and gypsum, the use of the board in agricultural land is currently under investigation.

Methods

The test consisted of five treatments: 1) recycled gypsum board applied at 500 lb./A; 2) recycled gypsum board applied at 1000 lb./A; 3) recycled gypsum board applied at 1,500 lb./A; 4) agricultural gypsum applied at 1000 lb./A; and 5) an untreated check. The experiment was arranged in a Randomized Complete Block Design with four replications.

The treatments were applied along with the base fertilizer and tilled into the bed prior to laying plastic mulch. Plastic mulch and drip irrigation tubes were installed over the beds which were fumigated with methyl bromide. Containerized pepper transplants were commercially produced at a local greenhouse. Peppers were planted into the field at the Coastal Plain Experiment Station (elev. 382 feet) in Tifton, Georgia on April 25, 2002 into a Tifton sandy loam (fine-loamy siliceous thermic Plinthic Kandiudults) soil. Plots consisted of two side-by-side rows on a plastic mulch-covered bed with 19 plants in each row and 12 inches between plants. Beds were spaced six feet apart from center to center. Plots were 19 feet in length with three feet between plots.

Base fertilization consisted of 500 pounds 10-10-10 and remaining fertilization was applied through the drip irrigation system. Application rates ranged from 1.0 pounds nitrogen and potassium per acre per day for the first two weeks up to 2.5 pounds/acre/day at the peak requirement times of fruit set and enlargement. Total nutrients applied included approximately 165 pounds of N and K with the drip irrigation injections applied as a 7-0-7 analysis soluble fertilizer. Fungicide and insecticide applications were made according to current University of Georgia recommendations. Irrigation was applied daily.

Peppers were harvested on July 15 and July 25, 2002. Data was taken on yield by grade, marketability, fruit length, fruit width and average fruit weight of jumbo grade peppers. Yields were generally low due to the late planting date.

Results

Data are presented in Tables 1 and 2. Overall there was little difference among the treatments. This would tend to lead to the conclusion that recycled gypsum board could be used as a suitable replacement for agricultural gypsum. There were no differences among treatments for yield of jumbo, U.S. No. 1 or U.S. No. 2 grade peppers. (Table 1) However, it should be noted that peppers grown with the recycled gypsum board had greater yields than the control or agricultural gypsum plots in the primary classifications of jumbo and U.S. No. 1. Total marketable yield was significantly greater where 500 lb./A recycled gypsum was used than in the untreated check. The number of jumbo and U.S. No. 1 fruit were greater in recycled gypsum board treatments than in the untreated or agricultural gypsum treatments. Only the 500 lb./A rate was significantly greater, however, and that being in the jumbo size and only as compared to the agricultural gypsum.

There were no significant differences found among treatments for marketability or average weight of jumbo or U.S. No. 1 grade pepper. Average fruit length also was not significantly different among treatments. There were some significant differences among treatments for average fruit width as peppers produced using agricultural gypsum had fruit with greater width than those using 500 lb./A recycled gypsum board.

There is no viable explanation why the treatment using 500 lb./A recycled gypsum board would perform any better than those with 1000 lb./A agricultural gypsum when the 1000 and 1500 lb./A treatments were not different. However, the lack of difference is probably the key element discovered in this trial. Since there is no deleterious effect of using recycled gypsum board instead of agricultural gypsum, then it is apparent that the recycled material can be used as a suitable substitute for agricultural gypsum thus creating a viable use for the product providing it can be obtained for a competitive cost.

Table 1. Yield by grade, total marketable yield and average fruit number of bell peppers

treated with recycled gypsum board at three rates, agricultural gypsum and a control at Tifton, Georgia in 2002.

Treatment	Yield (28# cartons)/Acre[1] Jumbo	U.S. No. 1	Total Jum/US #1	U.S. No. 2	Total Marketable	Average No. Jumbo Fruit #/A	Average No. U.S. No. 1 Fruit #/A
Recyled 1[2]	644 A	596 A	1240 A	396 A	1636 A	45852 A	58460 A
Recycled 2[3]	612 A	600 A	1212 A	300 A	1516 AB	42032 AB	53112 A
Recycled 3[4]	448 A	640 A	1088 A	500 A	1588 AB	32860 AB	53112 A
Ag Gypsum[5]	360 A	424 A	784 A	376 A	1160 AB	26364 B	41648 A
Untreated	396 A	396 A	792 A	280 A	1072 B	294.24 AB	35916 A
Mean of Test	491.6	531.2	1022.8	370.4	1393.2	35308	48452
L.S.D. (0.1)	294.0	301.6	485.6	286.4	543.2	18437.2	23218.0
C.V. (%)	38.8	36.9	30.8	50.2	25.3	33.9	31.1

[1]Plots consisted of a single row with two rows per bed and 19 plants per row spaced 12 inches apart.

[2]500 lb/A recycled gypsum board

[3]1000 lb/A recycled gypsum board

[4]1500 lb/A recycled gypsum board

[5]1000 lb/A agricultural gypsum

Table 2. Percent marketability, average fruit weight, average fruit length and average fruit width of bell peppers treated with recycled gypsum board at three rates, agricultural gypsum and a control at Tifton, Georgia in 2002.

Treatment[1]	% Marketable	% Jumbo + U.S. No. 1	Avg. Wt. Jumbo Fruit (g)	Avg. Wt. U.S. No. 1 Fruit (g)	Avg. Fruit Length (cm)	Avg. Fruit Width (cm)
Recyled 1[2]	79.2 A	60.3 A	173.2 A	137.0 A	8.1 A	6.9 B
Recycled 2[3]	77.7 A	60.7 A	186.7 A	140.9 A	8.9 A	7.4 AB
Recycled 3[4]	82.9 A	58.6 A	174.2 A	155.7 A	7.8 A	6.8 B
Ag Gypsum[5]	78.2 A	53.4 A	171.5 A	126.9 A	9.0 A	7.8 A
Untreated	71.9 A	51.7 A	183.2 A	146.5 A	8.5 A	7.0 B
Mean of Test	78.0	56.9	177.8	141.4	8.5	7.2
L.S.D. (0.1)	17.21	22.29	37.09	37.23	1.07	0.75
C.V. (%)	14.3	25.4	13.5	17.1	8.2	6.8

[1]Plots consisted of a single row with two rows per bed and 19 plants per row spaced 12 inches apart.

[2]500 lb/A recycled gypsum board

[3]1000 lb/A recycled gypsum board

[4]1500 lb/A recycled gypsum board

[5]1000 lb/A agricultural gypsum

EFFECT OF K-TIONIC ON SPRING-BELL PEPPER PRODUCTION

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Introduction

K-tionic is a nutrient uptake promoter manufactured by Grupo Bioquimico Mexicano (GBM) that consists of 25% fulvic organic complex. It is recommended on all crops for use in conjunction with a balanced fertilization program to promote and optimize nutrient uptake. It is supposed to increase soil cation exchange capacity and buffering capability to enhance nutrient availability. Since it is marketed to Georgia growers, K-tionic was tested on bell pepper during spring production to determine its effects on plant growth, pod characteristics and marketable yield.

Methods

"Camelot" variety (Seminis Seed Co.) bell pepper transplants were commercially produced in 200-cell polystyrene trays at a local greenhouse. Peppers were planted into the field at the Coastal Plain Experiment Station (elev. 382 feet) in Tifton, Georgia on April 25, 2002 into a Tifton sandy loam (fine-loamy siliceous thermic Plinthic Kandiudults) soil. Plots consisted of two side-by-side rows on a plastic mulch-covered bed with 19 plants in each row and 12 inches between plants. Beds were spaced six feet apart from center to center. Plots were 19 feet in length with three feet between plots. The planting was arranged in a Randomized Complete Block Design with five replications.

Normal cultural practices were used for bell pepper grown with plasticulture in Georgia. Base fertilization consisted of 500 pounds 10-10-10 and remaining fertilization was applied through the drip irrigation system. Application rates ranged from 1.0 pounds nitrogen and potassium per acre per day for the first two weeks up to 2.5 pounds/acre/day at the peak requirement times of fruit set and enlargement. Total nutrients applied included approximately 165 pounds of N and K with the drip irrigation injections applied as a 7-0-7 analysis soluble fertilizer. Fungicide and insecticide applications were made according to current University of Georgia recommendations. Irrigation was applied daily.

K-tionic was applied through the drip irrigation system at a rate of two quarts/acre at planting with an additional two quarts/acre applied at the beginning of fruiting. Treated plots were compared to an untreated check.

Pepper were harvested two times at maturity on July 5 and July 19, 2002. Data were collected on marketable yield, percent marketability, plant height, plant width, and pod characteristics including width, length, wall thickness, size, number of locules and smoothness. Results are summarized in Tables 1 and 2.

Results

Overall yields were somewhat low due to the later planting date. Total marketable yield, U.S. No. 1 yield and jumbo yield were all greater in the pepper treated with K-tionic, although not significantly. Jumbo size peppers were only slightly larger in individual fruit weight in the untreated plots. Percent marketability was not different.

Fruit length also tended to be greater in treated pepper, but not significantly so. Fruit width was identical in both treatments. The percentage of fruit that were either Jumbo or U.S. No. 1 was slightly greater in the treated pepper, but again the difference was not significant. K-tionic showed a tendency to improve fruit size and yield, however, since the data were not significant, there should be additional testing of this product.

Table 1. Yield by grade, total marketable yield and average fruit size of bell peppers treated with K-tionic and untreated peppers at Tifton, Georgia in 2002.

	Yield (28# cartons)/Acre			Average Fruit Size (g)	
Treatment	Jumbo	U.S. No. 1	Total Marketable[1]	Jumbo Grade	U.S. No. 1
Untreated	267.1	218.3	485.4	229.3	185.8
K-tionic[Z]	287.8	230.2	517.9	253.2	167.2
Mean of	277.5	224.3	501.7	241.3	176.5
L.S.D. (0.1)	96.2	16.0	83.3	59.9	59.4
C.V. (%)	19.74	4.06	9.46	14.14	19.18

[1]Total of Jumbo, U.S. No. 1. [Z]K-tionic applied at two quarts/A at planting and two quarts/A at fruiting.

Table 2. Fruit size and marketability of bell peppers treated with K-tionic and untreated peppers at Tifton, Georgia in 2002.

	Fruit Characteristics		Marketability	
Treatment	Fruit Length (cm)	Fruit Width (cm)	Percent[2] Jumbo/US1	Percent Marketable (%)
Untreated	8.48	7.20	64.4	87.6
K-tionic[Z]	8.60	7.20	61.9	87.4
Mean of Test	8.54	7.20	63.1	87.5
L.S.D. (0.1)	0.52	0.44	6.1	1.7
C.V. (%)	3.43	3.47	5.50	1.13

[2]Percent of Jumbo and U.S. No. 1. [Z]K-tionic applied at two quarts/A at planting and two quarts/A at fruiting.

ROW ARRANGEMENT AND SEEDING RATE EFFECTS ON SNAP BEAN

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Introduction

Fresh market snap bean production contributes over $28 million to the agricultural economy in Georgia and encompasses over 16,000 acres. Growers have traditionally used single-row planting schemes using four to five seed/foot of row to produce snap beans. However, with the advent of twin-row planters for peanuts, many growers have the capacity to plant snap beans in twin rows. The objective of this study was to evaluate twin rows vs single rows and optimum seeding rates to maximize snap bean yield and pod quality.

Methods

Plots were established in the spring of 2002 in a commercial snap bean planting in Chula, Georgia. Fertilization, irrigation, pest control and other cultural practices were applied by the grower according to his standard production methods. The experiment was set up as a Randomized Complete Block Design in a Split-Plot arrangement. 'Bronco' variety (Seminis Seed Co.) snap beans were seeded on April 4, 2002 into single and twin rows, which served as the main plots. Single rows were approximately 36 inches apart and there was approximately 10 inches between twin rows with one set of twins every 36 inches. Each of these plots was then split and planted at six, seven and eight seed per foot. Planting density served as the sub-plot. Plots were 500 feet long and 36 feet wide and were replicated four times.

Data were collected on plant density, length and width of largest leaf, pod length and pod width prior to harvest. Density and leaf measurements were made on a five-foot section of each plot. Pod data was collected from a sub-sample of pods taken from five plants in each plot. Plots were harvested mechanically by a custom harvesting crew on May 27 and 28.The center four beds of each plot were harvested, dumped into a wagon and weighed with portable truck scales. Data were subjected to analysis of variance using the SAS system and means separated using LSD (0.05).

Results

Snap beans planted in single rows had significantly higher yields than those planted in twin rows (Table 1). Leaves and pods tended to be larger in single rows than in twin rows (Table 2), although these differences were not significant. There were a greater number of plants per five-foot section in the twin rows than in single rows. Different seeding rates did not produce any significant differences. However, there clearly was a tendency to have shorter and thicker pods with lower seeding rates.

Based on these findings, growers should not switch to twin-row plantings. One of the pitfalls of this type of production was that the beans produced a split crop. Beans in the upper half of the plant in twin rows were ready to harvest when those lower in the canopy were still immature. This caused the yield to be much lower since these immature beans were not collected by the harvester and would not be marketable.

There were no clear findings on seeding rate. There was no tendency for more lodging with increased seeding rate (data not shown). Yields were not significantly different and plant characteristics were virtually the same. However, the pods produced in the lower seeding rates would have been more marketable than pods at the highest rate. Additional work on seeding rates is needed to more clarify the proper rates to be used in commercial production. However, although additional work will be done, it appears that twin-row production is not a viable possibility in snap beans.

Table 1. Yield and number of plants of snap beans by number of rows and seeding rate at Chula, Georgia in 2002.

Rows	Seed/Foot	Yield	Number of Plants
1		710 A	17.8 A
2		574 B	26.8 A
L.S.D. (0.05)		82.5	12.8
	6	640 A	21.6 A
	7	616 A	21.8 A
	8	670 A	23.6 A
L.S.D. (0.05)		149	3.01
Mean		642	22.3
C.V. (%)		21.58	12.58

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

Table 2. Average pod length, average pod width, average leaf length and average leaf width of snap beans by number of rows and seeding rate at Chula, Georgia in 2002.

Rows	Seed/Foot	Pod Length	Pod Width	Leaf Length	Leaf Width
1		9.79 A	0.65 A	5.51 A	4.02 A
2		8.76 A	0.51A	5.15A	3.65 A
L.S.D. (0.05)		1.69	0.18	5.33	0.59
	6	8.95 A	0.61 A	5.3 A	3.88 A
	7	9.43 A	0.59 A	5.3 A	3.86 A
	8	9.45 A	0.54 A	5.4 A	3.77 A
L.S.D. (0.05)		2.14	0.12	0.77	0.60
Mean		9.28	0.58	5.33	3.84
C.V. (%)		12.27	20.46	13.40	14.55

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

Variety Evaluation

EXPERIMENTAL COLLARD LINES COMPARE WELL TO TOP BUNCH

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Introduction

Georgia continues to be the nation's leading producer of collard greens. The most popular variety for many years has been 'Top Bunch' (Sakata Seed Co.). This is one of the newer varieties and has been around for many years. In other words, new collard varieties are not frequently introduced. This study was done to compare two new experimental lines from Seminis Seed Co. to the standard variety 'Top Bunch'.

Methods

One commercially-available and two experimental collard varieties were compared at the Coastal Plain Experiment Station (elev. 382 feet) in Tifton, Georgia in the spring of 2002. Collard plants were greenhouse-grown in 200-cell polystyrene containers at the experiment station. Collards were planted into plastic-mulch covered beds on March 26, 2002. The beds were fumigated at the time plastic was installed with methyl bromide. The soil was a Tifton sandy loam (fine-loamy siliceous thermic Plinthic Kandiudults). Plots were single rows, 12 feet in length with 12 plants per plot. Beds were on six-foot centers and there were two rows of collards per bed. The planting was arranged in a Randomized Complete Block Design with four replications.

Normal cultural practices were used for collard production in Georgia. Base fertilizer consisted of 1000 pounds/A of 10-10-10 incorporated prior to plastic installation. Additional applications were made through the drip irrigation system for a total of 225 pounds N and K during the season Fungicide and insecticide applications were made according to current University of Georgia recommendations. Irrigation was applied as needed.

Collards were harvested at maturity on June 13, 2002. Data were collected on marketable yield, plant height, canopy width, leaf length and leaf width. Results are summarized in Table 1.

Results

The Seminis experimental line ‘Hybrid #10' yielded almost 50% greater than the standard ‘Top Bunch’ or the other Seminis line - ‘Hybrid #19' (Table 1). Average bunch weight was significantly greater in ‘Hybrid #10' than in either of the other varieties. The two experimental lines produced taller plants than ‘Top Bunch’, but only ‘Hybrid #19' was significantly different.

Plant width, leaf length and leaf width were not significantly different among the three hybrids. However, ‘Top Bunch’ did produce a wider plant canopy than the two experimental lines and produced an overall shorter, but wider leaf. Leaf length and width were measured on the largest leaf of each plant. The Seminis experimental line ‘Hybrid #10' appears to be a very good yielding hybrid. ‘Hybrid #19' compared favorably with ‘Top Bunch’, but the growth habit of the variety was taller with less dense leaves.

Table 1. Yield and plant characteristics of three varieties of collards at Tifton, GA in 2002.

Variety	Company	Yield/Acre (Tons)	Bunch Wt. (lbs.)	Plant Height (in.)	Plant Width (in.)	Leaf Length (in.)	Leaf Width (in.)
Hybrid #10	Seminis	25.4 A	3.53 A	20.1 AB	17.7 A	9.45 A	14.7 A
Hybrid #19	Seminis	17.1 B	2.38 B	23.7 A	18.9 A	8.73 A	14.6 A
Top Bunch	Sakata	17.7 B	2.45 B	16.4 B	19.9 A	7.38 A	15.2 A
Mean		20.1	2.78	20.1	18.8	8.52	14.8
C.V. (%)		21	20.4	15.7	10.6	14.4	11.2
LSD (0.05)		7.29	0.98	5.46	3.45	2.13	2.87

PHENOMENAL PUMPKIN YIELDS RECORDED IN GEORGIA VARIETY TRIALS

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Introduction

Yields were outstanding in the 2002 Georgia pumpkin variety trial due to a very favorable growing season. Storage quality was less than average, however, due to late rains. Among the new varieties tested was a new introduction from Harris Moran Seed Company. HMX 6689 (now called 'Aladdin') was one of the leading varieties in the 2002 trial and should make a good addition to the market in the 25-35 pound class. A separate trial was conducted in 2002 on speciality pumpkins to more accurately reflect differences among these varieties. Miniature and white pumpkins were included in this separate trial. Although, some varieties have now been in the Georgia trial for five to six years, many of the ones tested in 2002 were being evaluated in Georgia for the first or second time. Excellent yields were the trend, but growers should keep in mind that yields in these small plot trials are greater than would be expected in large field production. However, the comparison between varieties remains valid.

Methods

Twenty-four commercially-available pumpkin varieties and two experimental lines were compared at the Georgia Mountain Branch Experiment Station (elev. 1900 feet) in Blairsville, Georgia. Eight commercially-available speciality pumpkins were evaluated at the same location in a separate field. All pumpkins were field-seeded on June 12, 2002 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 12 feet between rows. The plantings were arranged in a Randomized Complete Block Design with three replications each.

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 side dress 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 University of Georgia recommendations. Irrigation was applied as needed.

Pumpkins were harvested at maturity on October 1-2, 2002. Data were collected on yield, fruit number and weight, rind color, rind texture and fruit shape. Results are summarized in Tables 1 and 2.

Results

Overall yields were exceptional. Individual pumpkin weights were generally lower than those expected according to commercial variety descriptions. Conditions were generally favorable for pumpkins with dry conditions throughout most of the season. However, late rains reduced the storage quality of the crop. A late outbreak of downy and powdery mildew caused some defoliation, however, most pumpkins had achieved maximum size by that time. Also, a timely fungicide application virtually arrested the disease problem. "Prizewinner" produced the greatest yield and largest fruit size among all varieties; it was the only "giant" size variety in the test and the only pumpkin that averaged over 25.1 pounds.

Many of the large- and medium-sized varieties produced yields and fruit numbers within the range of acceptability in north Georgia. There were really no poor performers in the test, although 'Autumn King' and 'Pankow's Field' probably trailed most other varieties. They did not produce yields and fruit numbers per acre that were competitive with other similarly-sized pumpkins. 'Gold Gem', 'Gold Stirke', 'Gold Rush' and 'HMX 6689' were all superior performers among the 20-25-pound pumpkins.

Among pumpkins in the 10-20-pound range, 'Aspen', Gold Bouillon', 'Gold Standard', 'HMX 0681', 'Magic Lantern', 'Merlin', 'Mother Lode', 'Pro Gold #500', 'Sorceror' and 'Pro Gold # 200' were the best performers with yields above 70,000 pounds per acre. Among pumpkins in the five to 10-pound range, 'Autumn Gold' was the best performer. In the two to five-pound size class, 'Pro Gold #100' outperformed the other varieties tested.

In the miniature trial, "Jack-B-Quick' and 'Jack-Be-Little' both were superior to 'Munchkin'. "They produced the greatest fruit numbers and yield. 'Lumina' had a much higher yield and fruit number than 'Casper' among the white pumpkins, although 'Casper' produced slightly larger fruit.

Marketability was exceptional at harvest for most varieties. Among smaller pumpkins, 'Pro Gold #100' had less than 85% marketability. All others were greater than 93%. In the larger trial, 'Gold Rush' (85%) and 'Ol' Zeb's' (87%) had the lowest marketability. All others were above 90% marketable. The variance among varieties for rind color and rind texture were in accordance with variety descriptions. 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.

Overall, 'HMX 6689' was the most exceptional performer. It achieved a size of just over 25 pounds on average with over 4,000 fruit per acre. The yield of over 100,000 pounds per acre was second only to 'Prizewinner' - a much larger variety. This new introduction from Harris Moran Seed Company has been named 'Aladdin'. It produce fruit as large as 43 pounds and has an excellent deep orange rind color with a strong stem. Among the many excellent varieties on the market today, this should be a good choice for growers wanting a large-fruited pumpkin.

Table 1. Yield, number, marketability and horticultural characteristics of 26 varieties of pumpkins grown at Blairsville, GA in 2002.

Variety	Sponsor	No. Fruit/ A	Yield[2] (lb/Acre)	Fruit Wt (lbs.)	Percent Market-able	Wt Large	Wt Small	Rind[3] Color	Fruit[4] Shape	Rind[5] Text-ure
Aspen	Rupp	4311	78877	17.9	91.1	33.0	7.1	1.3	3.0	2.0
Autumn Gold	Twilley	8697	75391	8.7	95.5	13.0	4.1	1.7	2.7	2.0
Autumn King	Rupp	2949	67344	23.4	96.2	38.8	9.3	2.0	4.0	2.0
Gold Bullion	Rupp	6353	90909	14.8	97.7	26.2	7.7	2.3	3.0	2.0
Gold Gem	Rupp	4311	85948	20.5	99.4	36.5	8.2	1.7	3.3	2.3
Gold Standard	Rupp	5974	80858	13.5	98.4	22.5	7.2	1.3	2.3	2.0
Gold Strike	Rupp	4008	84398	20.5	93.0	39.9	6.7	2.3	3.7	2.0
Gold Rush	Rupp	3101	79005	25.1	84.6	43.0	14.1	2.3	4.0	2.3
HMX 0681	H. Moran	5823	79595	13.7	96.1	23.0	4.8	3.0	3.0	2.3
HMX6689	H. Moran	4084	102737	25.5	94.4	43.0	12.4	1.0	3.0	2.0
Jackpot	H. Seeds	3630	65786	18.0	91.1	27.4	6.7	2.3	2.8	2.0
Jumpin' Jack	Rupp	3328	71678	21.7	91.1	42.6	8.1	2.0	3.7	2.0
Magic Lantern	H. Moran	5143	75663	14.7	100.0	23.0	6.5	1.0	2.7	2.3
Merlin	H. Moran	5294	65325	12.3	100.0	22.3	5.4	1.3	2.7	2.0
Mother Lode	Rupp	4159	76532	18.6	94.8	29.5	7.7	2.0	4.0	2.0
Mystic Plus	H. Moran	5748	30840	5.3	99.3	17.6	3.1	1.0	2.0	2.3
Ol' Zeb's	Rupp	3630	62156	17.3	87.3	33.5	8.8	1.3	3.0	1.7
Orange	Twilley	6504	31483	4.8	94.9	6.7	2.7	1.7	2.0	2.7
Oz	H. Moran	11646	39219	3.4	97.2	4.8	1.9	2.7	2.7	2.7
Pankow's Field	H. Seeds	4386	56817	12.8	96.2	20.4	5.6	2.0	3.0	1.7
Prizewinner		2345	177008	75.3	100.0	119.0	33.3	2.7	1.7	2.7
Pro Gold #500	A&C	4084	77493	18.9	96.9	31.9	6.3	2.0	3.0	2.0
Pro Gold #510	A&C	3554	69999	20.1	95.6	34.2	7.8	2.0	4.0	1.7
Pro Gold #200	A&C	4916	76994	15.8	97.1	24.7	8.0	2.0	3.7	2.0
Sorceror	H. Moran	6504	76472	11.8	95.9	21.4	3.7	1.3	2.3	2.3
Touch of Aut.	Rupp	14520	35445	2.4	99.2	4.1	0.7	2.3	2.0	2.3
Mean of Test		5346.2	73614.2	17.6	95.5	29.7	7.6	1.9	2.9	2.1
L.S.D. (0.05)		2032.5	33127	3.4	9.4	9.1	5.4	0.8	0.9	0.8
C.V. (%)		23.18	27.44	11.84	5.99	18.69	42.98	26.06	20.02	21.36

One-row plot, 16 ft. long x 12 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. H=Harris.

Table 2. Yield, number, marketability and horticultural characteristics of eight

varieties of miniature and white pumpkins grown at Blairsville, GA in 2002.

Variety	Sponsor	No. Fruit/A	Yield[2] (lb/Acre)	Fruit Wt (lbs.)	Percent Market-able	Wt Large	Wt Small	Rind[3] Color	Fruit[4] Shape	Rind[5] Texture
Casper	Rupp	2647	21274	8.0	94.0	12.0	1.4	4.0	2.0	2.3
Jack-B-Quick	Rupp	20948	9385	0.4	99.8	0.8	0.2	2.7	1.0	2.0
Jack-Be-Little	Twilley	18377	7033	0.4	99.9	0.6	0.2	2.7	1.0	2.0
Lil Ironsides	Harris Moran	12024	27898	2.3	98.6	3.7	1.6	2.0	2.0	2.7
Lumina	Rupp	4235	30847	7.1	93.6	14.4	1.0	5.0	2.0	3.0
Munchkin	Harris Moran	15503	6474	0.4	97.5	0.6	0.2	2.3	1.0	2.0
Pick-a-Pie	Rupp	6277	33555	5.3	97.6	7.5	3.0	1.3	2.5	1.7
Pro Gold #100	Twilley	10285	27422	2.7	84.3	4.0	0.9	2.0	3.0	3.0
Mean of Test		11287	20459	3.3	95.7	5.4	1.1	2.8	1.8	2.3
L.S.D. (0.05)		6772	9671	1.3	6.3	0.9	0.7	1.4	0.8	0.6
C.V. (%)		34.26	26.96	22.90	3.75	10.30	35.16	28.20	24.17	15.86

One-row plot, 16 ft. long x 12 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

WATERMELON AND CANTALOUPE VARIETY TRIALS, 2002

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Introduction

Watermelon are an important crop in Georgia accounting for the largest share of planted vegetable acres at just over 34,000 acres in 2001. Nationally, 156,900 acres of watermelon were harvested in 2001. Georgia production then accounts for 22% of the watermelons produced in the United States. The majority of watermelons grown in Georgia are grown in the spring with a sizable amount produced on bareground (over 60%).

Variety trials for both watermelon and cantaloupe have been an important part the extension research efforts at the University of Georgia. This year, two watermelon trials were conducted, one at the Vidalia Onion and Vegetable Research Center (VOVRC) in Lyons, GA and another on-farm trial in Crisp County. In addition, a cantaloupe variety trial was conducted at the VOVRC.

Materials and Methods

Seed for both the VOVRC and Crisp Co. trials were planted in the greenhouse at the Bamboo Farm and Coastal Garden in Savannah, GA. Seventy-two cell trays were tilled with Metromix 300 peat based media. Watermelon were seeded between 3/20-27/02 and cantaloupe were seeded 3/20 or 4/3/02. Care was taken so that the triploid watermelon seed were not over watered to insure a high germination rate. All transplants received one application of Peters 20-20-20 at 200 ppm after emergence.

Watermelon seedlings were transplanted to their final spacing at the VOVRC on 4/24/02 and cantaloupe plants were transplanted on 4/25/02. Watermelon plants were transplanted to their final spacing in the Crisp County trial on 4/25/02.

Land at the VOVRC was prepared according to standard University of Georgia Cooperative Extension Service recommendations with 750 pounds per acre of 10-10-10 applied preplant and incorporated. Each watermelon plot consisted of 10 hills planted five feet within-row and six feet between-row. Cantaloupe plots also consisted of 10 hills with an in-row spacing of three feet and a between-row spacing of six feet. There was a two foot alley in-row between plots. Both experiments were arranged in a randomized complete block design (RCBD) with four replications.

Weed control at the VOVRC consisted of Sonolan herbicide applied over-the-top at one quart per acre rate. In addition, Sandea herbicide was spot sprayed to control nut sedge at the 0.75 oz per acre rate.

Finally, a single application of Quadris fungicide was applied just before vining (approximately three weeks after planting) at a rate of 11 oz per acre. No insecticides were used.

The experiment in Crisp County consisted of a RCBD with three replications. Each plot consisted of 12 plants arranged in two rows of six plants with a between row spacing of six feet and an in-row spacing of four feet, nine inches. Soil was prepared for planting and had 60 lbs of actual N-P-K incorporated preplant. An additional 50 lbs of N and K were added at first vining (approximately four weeks after planting).

Weed control consisted of Curbit herbicide applied over-the-top at 1.5 pints per acre right after planting. Three weeks after planting Basagran was applied at a rate of 1.5 pints per acre with 1 pint of crop oil. Finally, Alanap was applied three times at pre-vining, 2-3 foot runners, and late post-emergence at a rate of 3 quarts per acre at each application.

Disease control consisted of weekly applications alternating Bravo/Mankocide and Folicur/Mankocide. No insecticides were used.

Data were analyzed using ANOVA and an adjusted LSD was calculated for yield and soluble solids. The LSD was adjusted by dividing the probability by five before calculating. This minimizes the type I error rate for up to five comparisons between the means.

Results and Discussion

The yield ranged from 26,612 to 69,395 pounds per acre for the watermelon trial at the VOVRC with RWM 8074-VP having the highest yield while #1075 had the lowest (Table 1). The top five varieties including RWM 8074-VP include #5031, Celebration, Carnival, and Sugar Slice. Variety #5031 and Sugar Slice are triploids. Of the 32 varieties in the trial at the VOVRC, 15 or almost half were triploids. This continues a trend of increasing triploid production in Georgia.

The description listed in table 1 is the seed company listing for that particular variety. The top 3 varieties with percent of yield with melon sizes greater than 20 pounds included RWM 8074-VP, Jamboree, and Rojo Grande. The top 3 varieties with the greatest percent of yield in the 20-30 pound class were Jamboree, Rojo Grande, and AU-Allsweet BL. The top 5 varieties with the greatest percent of yield in the 10-20 pound class are all triploids and include Sweet Slice, Cooperstown, #7187 HQ, #5244, and #7177 HQ. Triploids have generally been small round melons, but recently we have seen more oblong types on the market. Table 2 lists characteristics of the varieties in the trial.

This list is sorted by soluble solids (percent sugar). Sugar content ranged from 9.3 to 11.6%. Varieties #5244, Ole', WX207, Cooperstown, and Gold Strike were among the sweetest varieties in the trial. Gold Strike was also the only yellow fleshed variety in the trail.

Taking a page from the University of Florida's trials we have included a flesh color rating which attempts to give an idea of how pleasing the flesh color is within the particular color. Color of course is a very subjective characteristic, but listing the color may not have given much information. Flesh color in commercial watermelon varieties can range from pink to dark red to an occasional yellow or orange variety. There is a genetic component to color obviously so some varieties will be pink and never develop a dark red color. The dark red color is considered more desirable, but pink is perfectly acceptable. The color listing (red/pink or pink/red) reflects the preponderance of one color over the other for the melons that were cut.

The fruit type reflects our assessment of the type of melon the particular variety produces. These fruit types are based on older standard varieties that most growers and researchers are familiar with. For those not familiar with them, the Crimson Sweet is a round melon in the 15-25 pound class with a striped rind. An Allsweet type is a small oblong melon (20-30 lbs) with a dark green rind and light green or yellow stripe. The flesh tends to be dark red. A Jubilee type is a large oblong melon (>25 lbs) with a striped rind. An icebox type is small (10-15 lbs) melon that may have one of several different rind patterns. As the name implies the melon is small enough to fit into a refrigerator.

Along with fruit length and width, we record rind thickness. Generally triploids because of their genetics will have a thicker rind then diploid melons. A thicker rind is desirable for shipping since it is less prone to breakage. It is not very desirable, however, for marketing where a thin rind is more pleasing and indicates a greater portion of the flesh is edible.

A second trial was held at an on-farm location in Crisp County, GA. This trial consisted of only 10 diploid varieties. Only the yield and count was recorded for each plot (Table 3). Yields ranged from 44,972 to 88,572 pounds per acre with the highest yield from Dulce. Dulce had a significantly higher yield than Rojo Grande.

A cantaloupe trial was held at the VOVRC (Table 4 & 5). Cantaloupe production in Georgia continues to be dominated by Eastern shipping type melons such as Athena. These melons are picked at full maturity and have good post-harvest keeping quality.

The highest yielding variety was ACX 4757 with 55,460 pounds per acre yield. This is an Eastern type with high sugars and pleasing flesh color. Athena continues to do well with large fruit and good yields. Most growers and seed companies use this variety as the standard to compare against.

Table 1. Watermelon Variety Trial, 2002
Vidalia Onion and Vegetable Research Center, Lyons, GA.

Entry	Company	Description	Yield (lbs/acre)	Melon =10 lb
RWM 8074-VP	Rogers	Allsweet Seeded	69,395	1
#5031	Seminis	Triploid	60,450	9
Celebration	Rogers	Allsweet Seeded, RWM 8052-VP	59,369	1
Carnival	Rogers	Hybrid Seeded, RXW 118 -VP	56,519	4
Sugar Slice	Willhite	Triploid	54,319	11
Jamboree	Rogers	Allsweet Seeded, RWM 8036	53,495	1
Ole'	Willhite	Hybrid	52,189	0
AU-Producer-98	Auburn University	Diploid Crimson Sweet	52,069	6
#7167	Abbott&Cobb	Super Seedless/ Hybrid Triploid	51,659	22
WX255	Willhite	Hybrid	51,593	13
Montreal	Sunseed	Diploid	49,357	8
Tri-X 313	Rogers	Red Seedless	48,609	12
AU-3	Auburn University	ZYMV Tolerance?	47,045	7
Pinata	Willhite	Hybrid	46,457	3
Revolution	Sunseed	Triploid	45,890	11
WX207	Willhite	Hybrid	45,440	6
#7177 HQ	Abbott&Cobb	Super Seedless HQ / Hybrid Triploid	44,235	3
Tri-X Brand Palomar	Rogers	Red Seedless	43,829	32
Cooperstown	Seminis	Triploid	43,640	11
Sweet Slice	Willhite	Triploid	42,732	6
RWT 8096-VP	Rogers	Red Seedless	42,239	7
#7187 HQ	Abbott&Cobb	Super Seedless HQ / Hybrid Triploid	41,730	11
Festival	Willhite	Hybrid	40,881	3
AU-Allsweet-BL	Auburn University	Diploid Allsweet	40,616	4
Gold Strike	Willhite	Hybrid	39,977	7
#5244	Abbott&Cobb	Summer Sweet / Hybrid Triploid	38,917	15
Dulce	Willhite	Hybrid	36,496	4
Seedless Sangria	Rogers	Allsweet Seedless, RWT 8108-VP	34,354	2
Rojo Grande	Willhite	Hybrid	34,235	0
Imagination	Rogers	Red Seedless, RWT 8089-VP	27,530	49
#1075	Seminis	Triploid	26,612	7
		R^2	0.264	
		CV	39%	
		Adjusted LSD (p=0.05)	30,922	

Entry	Flesh	Flesh	Fruit	Widt	Rind	Fruit Type	Soluble
#5244	Red/Pink	3	10.8	8.5	0.9	Crimson Sweet	11.6
Ole'	Red	3.6	15.3	9.1	0.8	Allsweet	11.4
WX207	Red/Pink	3.1	16.2	8.9	0.8	Jubilee	11.4
Cooperstown	Pink/Red	2.7	10.5	8.9	0.8	Crimson Sweet	11.3
Gold Strike	Yellow	3.6	12.8	8.8	0.7	Allsweet	11.3
Imagination	Red	3.3	8.3	8.5	0.9	Icebox	11.3
Sweet Slice	Red/Pink	2.8	10.2	8.9	0.9	Crimson Sweet	11.3
Revolution	Red/Pink	2.7	10.9	8.1	0.8	Blocky Crimson Sweet	11.3
Sugar Slice	Red	3.1	10.1	9.1	1	Crimson Sweet	11.3
Rwt 8096-VP	Red/Pink	2.6	10.7	8.9	1	Crimson Sweet	11.2
Rojo Grande	Red/Pink	3.7	15.8	8.4	0.9	Allsweet	11.1
Tri-X Brand Paolmar	Red	3.1	9	9.1	0.9	Small Crimson Sweet	11.1
Dulce	Red/Pink	3	15.9	8.9	1	Allsweet	11
Montreal	Pink/Red	2.3	13.6	9.4	1	Allsweet	11
Carnival	Red	3.5	14.7	9.6	0.7	Jubilee	10.8
Celebration	Red	3.1	12.3	8.8	0.9	Allsweet	10.8
#7167	Red	2.6	9.9	8.4	0.8	Crimson Sweet	10.7
Festival	Red	3.3	15.2	9.1	0.8	Allsweet	10.7
Pinata	Red/Pink	2.6	14.5	9.1	0.8	Allsweet/Jubilee	10.6
#1075	Red	2.5	10.5	9.4	1	Crimson Sweet	10.6
Tri-X 313	Red/Pink	2.6	11.2	8.8	0.9	Small Allsweet/Crimson	10.6
#7177 HQ	Pink/Red	2.3	10.8	9	0.9	Crimson Sweet	10.4
#7187 HQ	Pink/Red	2.6	10.5	9	1	Crimson Sweet	10.4
Jamboree	Red	3	15.7	8	0.8	Allsweet	10.4
AU-3	Pink/Red	2.2	11.5	11	0.9	Crimson Sweet	10.3
RWM 8074-VP	Red	3.6	15.9	8.8	0.7	Allsweet	10.1
AU-Allsweet-BL	Pink	1.6	14.2	8.9	1	Allsweet	10.1
#5031	Red/Pink	2.9	1.7	8.7	0.9	Crimson Sweet/Allsweet	10
AU-Producer-98	Red/Pink	3.3	11.1	9.8	0.8	Crimson Sweet	9.9
Seedless Sangria	Red	2.2	13.9	8.3	0.9	Allsweeet/Jubilee	9.9
WX255	Red/Pink	3.3	12.8	8.7	0.8	Allsweet	9.3

z1-5 Scale with 1-poor color, 5-excellent color

R2 0.331
CV 9%

Adjusted LSD ($p \leq 0.05$) 1.5

Table 3. Watermelon Variety Trial, 2002   On-farm, Crisp County

	Yield (lbs/acre)	Average Fruit Weight (lbs)
Dulce	88572	25
Festival	79731	23
Gold Strike	71975	22
Carnival	71894	24
Celebration	69333	24
Ole	66441	22
Montreal	65695	24
Jamboree	59645	23
WX255	59274	17
Rojo Grande	44.972	21
R^2	0.458	
CV	25%	
Adjusted LSC ($p \leq 0.05$)	34552	

Table 4. Cantaloupe Variety Trial, 2002

Variety	Source	Yield (lbs/acre)	Number of fruit (No./acre)	Fruit Weight (lbs)
ACX 4757	Abbott & Cobb	55460	9317	6
Athena	Rogers	37468	5566	6.7
AC-89-55 MI	Auburn U.	37135	12403	3
RML 8793-VP	Rogers	36778	12221	3
Odyssey	Sunseed	36500	6111	6
AC-82-37-RNL	Auburn U.	34836	5808	6
ACX 3908	Abbott & Cobb	32991	14399	2.3
AC-75-1A	Auburn U.	29324	7563	3.9
	R^2	0.346		
	CV	33%		
	Adjusted LSD ($p \leq 0.05$)	23426		

Table 5. Cantaloupe Variety Trial, 2002.

	Flesh						
Variety	Length (in.)	Width (in.)	Thickness (in.)	Fruit Type	Color Rating[z]	Color	Soluble Solids (%)
AC-82-37-RNL	7	6	1.5	Western	2.8	Orange	10.6
ACX 4757	8.3	6.6	1.8	Eastern	3.3	Orange	10.5
ACX 3908	8.7	7.3	2.4	Eastern	3	Orange	10.3
AC-89-55 MI	7.5	6.4	1.8	Eastern	3.4	Orange	10.2
Athena	7.2	6.4	2.1	Eastern	3.3	Orange	9.9
Odyssey	7.7	6.7	2.1	Eastern	3.4	Orange	9.8
RML 8793-VP	5.6	5.2		Western	2.7	Orange	9.2
AC-75-1A	5.1	5		Western	3	Orange	7.7
						R^2	0.31
						CV	17%

[z]Color Rating- 1-5 with 1-poor color, 5-excellent color

Adjusted LSD ($p \leq 0.05$)

3.0

SELECTION OF *CUCURBITA MOSCHATA* WITH INCREASED DISEASE RESISTANCE FOR PRODUCTION OF PUMPKIN TYPE PHENOTYPES.

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Introduction

Pumpkins are an important crop in the U.S. particularly for fall production associated with Halloween. Pumpkin production is suitable for north Georgia fall production, but has not been successful in south Georgia. Diseases such as mosaic virus complexes, Phytophthora crown and fruit rot, and powdery mildew preclude the production of fall pumpkins in south Georgia. *Cucurbita moschata* is known to have a high level of resistance particularly to mosaic virus complexes (Superak et al., 1993). In fact virus resistance in some summer squash varieties is due to interspecific crosses with *C. moschata*. Butternut squash is the most widely known squash from this species, but there are a wide variety of additional shapes and colors within this species. This diversity of shapes and colors coupled with its increased disease resistance made it an ideal candidate for selection of pumpkin fruit types adapted for south Georgia production.

Materials and Methods

Seed of *C. moschata* were obtained from Brazil in 1996 and again in 1999 at which time a process of recurrent phenotypic selection was started. This resulted in seven selections from the 2001 season, which were made at the Coastal Plain Experiment Station. These were designated 01-3, 01-5, 01-7, 01-13, 01-15, 01-19, and 01-22. Seed from these selections were increased at the Vidalia Onion and Vegetable Research Center (VOVRC) in Lyons, GA during the 2002 season. Seed from the 2001 selection were grown in the greenhouse at the Bamboo Farm and Coastal Garden during the winter of 2002-03. Three 3-gallon pots with 2 plants each from these selections were planted and grown in a commercial potting mix. Flowers from these plants were sibbed (crossed within plants of the same selection) or selfed (pollinated on the same plant). Individual fruits were given a designation of 01-XX #XX #X where the 01-XX was the original 2001 selection designation, the #XX was the specific plant from that selection, and the #X was the specific fruit on that plant.

Individual fruit from these crosses were photographed, weighed and their shape and color noted. Seed was collected and saved individually from each fruit. The best fruit based on size and color have been planted for further selection at the VOVRC.

Results and Discussion

Thirty-three fruit were generated from the 7 selections from 2001 (Table 1). These fruit ranged in shape from round to elongate with several having a flattened oval shape with deep sutures (Figure 1). Colors ranged from a deep burnt orange color to an orange-tan color. Weights ranged from just under a pound to almost 17 pounds. It should be noted that planted grown on a trellis in a greenhouse will tend to produce smaller fruit then under field conditions.

Eleven of the best entries from the greenhouse crosses have been planted at the VOVRC for further selection under field conditions (Table 1). The best fruit collected from this spring/summer planting will be grown this fall for further selection and evaluation. The fall selection and evaluation will be the most critical for assessing these selections under the high disease pressure found in south Georgia.

Literature Cited

Superak, T.H., B.T. Scully, M.M. Kyle, and H.M. Munger. 1993. Interspecific transfer of plant resistance in Cucurbita, p. 217-236. In: M.M. Kyle (ed.). Resistance to viral diseases of vegetables genetics & breeding. Timber Press, Portland, Ore.

Table 1. Selfed and/or sibbed fruit weights from the controlled greenhouse crosses, 2002-03.

Entry	Weight (lbs)	Planted 2003
01-22 #1A#1	16.9	X
01-19 #1#1	9.6	X
01-22 #1B#2	9.4	
01-13 #2B#2	8.2	X
01-13 #2B#1	7.9	X
01-5 #1	6.5	X
01-13#2B#3	6.3	X
01-13 #3B#1	5.7	X
01-13 #1B#1	5.1	X
01-13 #2A#1	4.4	
01-19 #2#1	4.3	X
01-19 #3#2	3.9	X
01-15 #1B#2	3.9	
01-15 #1B#1	3.7	
01-22 #1B#1	3.7	
01-7 #1	3.7	X
01-22 #1A#2	3.7	
01-3 #3#1	3.5	
01-3 #1#1	3.2	
01-19 #2#1	3.2	
01-22	3.0	
01-15 #1B#3	2.9	
01-22 #1A#3	2.9	
01-22 #1A#4	2.6	
01-5 #2	2.2	
01-13 #3B#3	2.1	
01-15 #3A#1	2.1	

01-19 #3#1	1.7
01-13 #3B#2	1.7
01-19 #3#3	1.6
01-19 #1#1	1.5
01-5 #1	1.4
01-7 #2#1	1.0

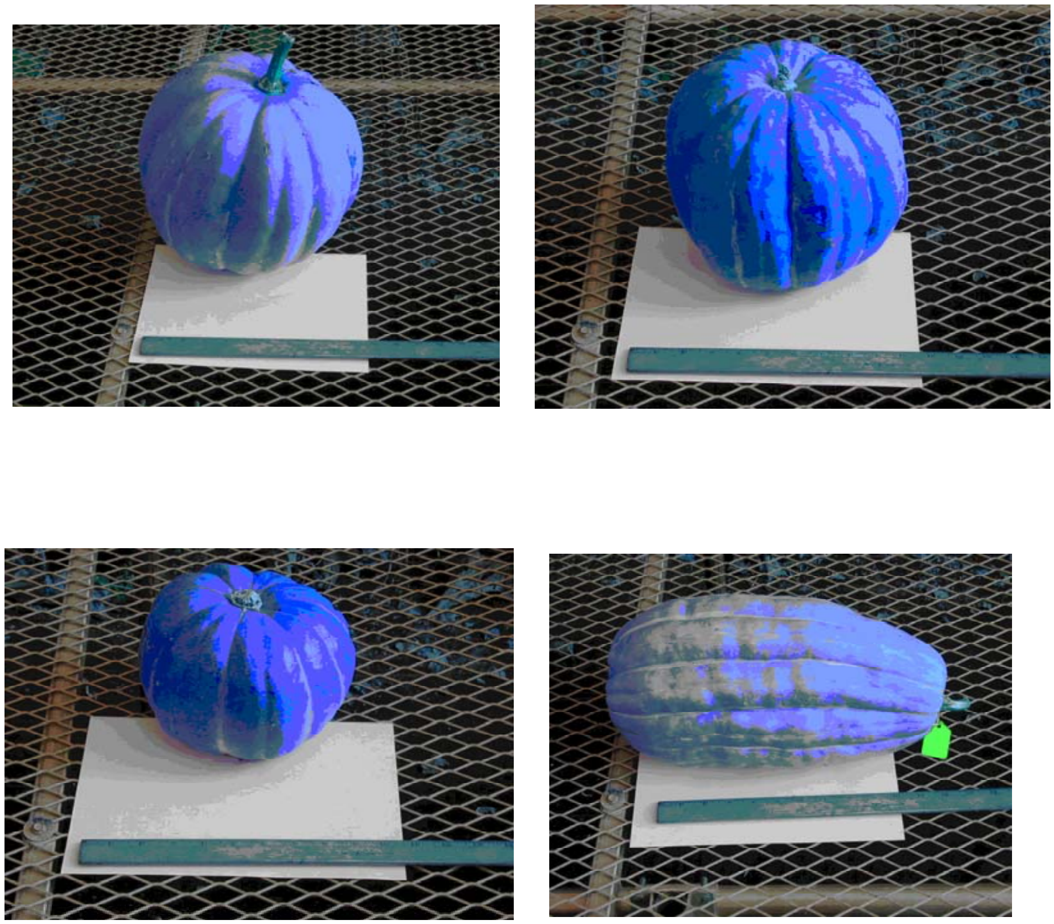

Figure 1. Examples of fruit from controlled greenhouse crosses. Clockwise from upper left: 01-22 #1A#1, 01-19 #1#1, 01-22 #1B#2, 01-13 #1B#1 (Note: ruler in picture is 18 inches).

HOT PEPPER VARIETIES VARY GREATLY

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Introduction

Hot pepper acreage has been on the increase in Georgia over the past several years. Hot pepper plots were established at the Coastal Plain Experiment Station in Tifton, Georgia to evaluate differences in varieties and suitability for production in Georgia. Nine varieties of varying types were evaluated. They included: 'Jaladuro'-a jalapeno, 'Volcano'-a Hungarian hot wax type, 'HMX 3676'-an experimental line, 'Picante'-a jalapeno, 'Habanero', 'Peppadew'-a new introduction from South Africa most similar to cherry types, 'Inferno'-a Hungarian hot wax, 'HMX 3677'-an experimental jalapeno line, and 'Tuxtlas'-a serrano type.

Methods

Hot pepper plants were seeded and grown in 200-cell polystyrene containers in a greenhouse at the Coastal Plain Experiment Station according to University of Georgia recommended practices. Base fertilizer was applied to the field and tilled into the bed prior to laying plastic mulch. Plastic mulch and drip irrigation tubes were installed over the beds which were fumigated with methyl bromide. Peppers were planted into the field at the Coastal Plain Experiment Station (elev. 382 feet) in Tifton, Georgia on April 25, 2002 into a Tifton sandy loam (fine-loamy siliceous thermic Plinthic Kandiudults) soil. Plots consisted of two side-by-side rows on a plastic mulch-covered bed with 12 plants in each row and 12 inches between plants. Beds were spaced six feet apart from center to center. Plots were 12 feet in length with three feet between plots and were arranged in a Randomized Complete Block Design with four replications.

Base fertilization consisted of 500 pounds 10-10-10 and remaining fertilization was applied through the drip irrigation system. Application rates ranged from 1.0 pounds nitrogen and potassium per acre per day for the first two weeks up to 2.5 pounds/acre/day at the peak requirement times of fruit set and enlargement. Total nutrients applied included approximately 165 pounds of N and K with the drip irrigation injections applied as a 7-0-7 analysis soluble fertilizer. Fungicide and insecticide applications were made according to current University of Georgia recommendations. Irrigation was applied daily.

Peppers were harvested on July 22, August 2 and August 15, 2002. Data were taken on yield, marketability, fruit length, fruit width and average fruit weight. Yields were somewhat low due to the late planting date. The two latest maturing varieties, Habanero and Peppadew, were only harvested on the last date and thus yields are particularly low for those varieties and should only be used as an indication of first harvest yields for those varieties.

Results

Data are presented in Tables 1 and 2. Comparison between types is not particularly useful. However, the data were analyzed all as one set since there were not sufficient varieties of each type included to make a good analysis separately. HMX 3677 was the highest yielding variety among the jalapeno types but the difference was not significant. The same was true for percent marketability. The average fruit size was greatest for Jaladuro among these types. Fruit length was similar among these varieties, but HMX 3677 produced fruit with greater width.

Volcano yielded significantly greater than Inferno among the Hungarian hot wax types. Yield of large size peppers was similar between the two but Volcano had a higher percentage marketable fruit. The fruit size for Inferno was greater, but not significantly so. Fruit length was greater for Volcano, but shape and width were similar between the two.

Habanero and Peppadew, which could be considered similar type peppers, were very similar to each other in all yield, size and marketability variables. Tuxtlas was the only serrano type in the test but was similar in yield to all but the highest yielding jalapeno and Hungarian hot wax varieties.

Overall, Volcano and HMX 3677 were the highest yielding varieties, but only significantly greater than Peppadew, Habanero and Tuxtlas. Those two varieties also had the greatest percent marketability. Any of these peppers would produce adequate yields to be considered for use in Georgia.

Table 1. Yield of large and medium sizes, total marketable yield, percent marketability and average fruit size of nine varieties of hot peppers at Tifton, Georgia in 2002.

Variety	Yield (15# cartons)/Acre[1] Large	Medium	Total Lg/Med	Percent Marketable (%)	Percent Large Fruit (%)	Average Wt. Large Fruit (g)	Average Wt. Medium Fruit (g)
Jaladuro	414 AB	420 BC	835 ABC	88.7 A	40.8 A	37.1 BC	28.9 B
Volcano	594 A	746 A	1340 A	90.9 A	40.4 A	44.3 AB	37.6 A
HMX 3676	476 A	347 BCD	823 ABC	88.0 A	50.1 A	42.1 B	29.0 B
Picante	379 A	283 BCD	662 BCD	86.1 AB	46.9 A	26.8 D	21.0 CD
Habanero	74 B	50 D	124 D	88.8 A	53.8 A	13.3 E	8.4 E
Peppadew	101 B	168 CD	269 CD	89.4 A	32.8 A	12.8 E	14.5 DE
Inferno	472 A	227 BCD	698 BCD	78.8 B	51.1 A	52.0 A	29.5 B
HMX 3677	587 A	497 AB	1084 AB	90.4 A	40.8 A	30.3 DC	23.0 BC
Tuxtlas	348 AB	218 BCD	566 CD	87.1 AB	52.9 A	11.0 E	10.7 E
Mean of Test	383	328	711	87.6	45.5	30	22.5
L.S.D. (0.1)	360.7	303.4	628.3	8.7	21.5	9.1	7.4
C.V. (%)	64.6	63.3	60.5	6.8	32.4	20.8	22.5

[1]Plots consisted of a single row with two rows per bed and 12 plants per row spaced 12 inches apart.

Table 2. Average fruit length, width, shape and color of nine varieties of hot peppers at Tifton, Georgia in 2002.

Variety[1]	Company	Average Fruit Length (cm)	Average Fruit Width (cm)	Fruit Shape[2]	Fruit Color[3]
Jaladuro	United Genetics	6.4 C	3.8 AB	3.0 D	8.0 A
Volcano	Harris Moran	15.6 A	4.1 A	6.0 A	3.0 D
HMX 3676	Harris Moran	6.4 C	2.5 C	2.8 D	8.0 A
Picante	Harris Moran	6.4 C	3.2 BC	3.0 D	8.0 A
Inferno	Seminis	11.8 B	4.1 A	5.0 B	6.8 B
HMX 3677	Harris Moran	7.6 C	4.5 A	4.0 C	8.0 A
Tuxtlas	Seminis	7.6 C	2.9 C	5.0 B	6.0 C
Mean of Test		8.8	3.6	4.1	6.8
L.S.D. (0.1)		3.7	0.8	0.3	0.3
C.V. (%)		28.2	15.8	4.6	2.8

[1]Plots consisted of a single row with two rows per bed and 12 plants per row spaced 12 inches apart.

[2]Based on the scale of: 1=blocky wrinkled; 2=globose; 3=conical short; 4=bullet shaped; 5=conical elongate/smooth; 6=conical elongate/wrinkled; 7=cyclindrical.

[3]Based on the scale of: 6=light green-8=dark green; 3=light yellow-5=dark yellow; 7=orange; 8=red; 9=chocolate; 10= black; 1=other.

Summer Squash Variety Evaluation - 2002

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Introduction

Summer squash production accounts for almost 12,000 acres of Georgia's vegetable acreage and contributes over $56 million to the Georgia economy. Production occurs throughout the state, but mostly 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. Some of the varieties currently produced have resistance or tolerance to at least two and in most cases three of the four major squash viruses. There is one variety that has resistant to all four major squash viruses. Some of the virus resistance/tolerance has been obtained through genetic modification while other varieties have been developed through traditional means. Varieties with the precocious yellow gene are also used by Georgia growers. Continual evaluation of squash varieties is necessary to determine which varieties produce acceptable levels of yield and quality under Georgia conditions.

Methods

Seven zucchini, five yellow crookneck and six yellow straightneck squash varieties were compared at the Vidalia Onion and Vegetable Research Center (elev. 250 feet) near Lyons, Georgia. All varieties were commercially available except for one zucchini line and two yellow straightneck lines that were still in the experimental stage of development. Squash varieties were field-seeded on 5 April, 2002 into an Irvington loamy sand soil (Fine-loamy, siliceous, thermic Plinthic Fragiudults). Plots consisted of two side-by-side rows with zucchini spaced 24 inches between plants and yellow spaced 18 inches between plants. Plots were 12 feet in length. The planting was arranged in a Randomized Complete Block Design with four replications.

Normal cultural practices were used for bare ground squash production in Georgia. Base fertilizer consisted of 400 pounds/A of 10-10-10 incorporated prior to planting. Additional fertilizer was through two side dressed applications of 300 pounds/A of 10-10-10 each. Ethafluralin (0.75 lb a.i./A) was applied pre-emergence for weed control. Fungicide and insecticide applications were made according to current University of Georgia recommendations. Irrigation was applied through an overhead system as needed.

Squash were harvested on June 17, 24, 27, and July 1, 9 and 12, 2002. Data were collected on yield by grade, early yield by grade, percent marketability, average fruit weight and fruit number. Results are summarized in Tables 1-12.

Results

A higher percentage of squash fell into the medium and jumbo grades than would be expected under grower conditions since harvests were not conducted as often. Among zucchinis, 'HMX 8714', 'Cashflow' and 'Tigress' produced the highest yields of fancy and medium squash (Table 1), although only 'Independence II' was significantly lower than the rest. 'Cashflow' produced the greatest early yield (Table 2). 'Dividend', 'Golden Rod' and 'Cashflow' had the highest percentage of marketability while 'Independence II' had the lowest (Table 3). 'HMX 8714' and 'Golden Rod' produced the greatest number of fancy fruit (Table 4). 'Dividend' and 'Independence II' produced the lowest total number of fruit.

Among yellow crookneck, 'Destiny III', 'Supersett' and 'Gentry' produced the highest yields of fancy and medium fruit (Table 5). Only 'Predlude II' was significantly less than 'Destiny III', however. There were no significant differences among varieties for early yields (Table 6). 'Supersett' had a greater percent marketability than any of the other varieties (Table 7). 'Supersett' and 'Gentry' produced the greatest numbers of fancy and total fruit (Table 8). However, only 'Dixie' and 'Prelude II' produced significantly lower numbers of total fruit than 'Supersett'.

Among yellow straightneck, 'Cougar' and 'XPT 1832' produced the highest yield of fancy and medium squash (Table 9) with similar results for early yield (Table 10), although there were no significant differences among varieties for yield. All varieties produced statistically similar marketability levels, but 'Cougar' and 'Enterprise' had noticeably lower marketability (Table 11). 'XPT 1832', 'Cougar' and 'Multipik' produced the greatest numbers of fancy fruit (Table 12), but only 'Enterprise' was significantly lower than 'XPT 1832'. Similar trends were true for total fruit numbers, also.

Table 1. Season yield by grade and combined fancy and medium yield of zucchini squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Season Yield (21-lb boxes/A)			
Variety	Fancy	Medium	Jumbo	Total Fan/Med
Cashflow	173 AB	330 A	219 BCD	502 AB
Dividend	147 AB	216 A	134 CD	363 AB
Golden Rod	189 AB	199 A	88 D	389 AB
HMX 8714	235 A	324 A	425 A	558 A
Independence II	91 B	197 A	307 ABC	288 B
Spineless Beauty	167 AB	293 A	339 AB	460 AB
Tigress	182 AB	321 A	437 A	503 AB
Mean	169	269	278	437
CV (%)	41.6	48.8	46.7	38.3
L.S.D. (0.05)	104.4	194.7	193.1	248.9

Harvests occurred on June 17, 24,27, and July 1, 9 and 12, 2002. Planting date: April 5, 2002. Plot size: 12 plants per plot (two rows of six) on 36" X 24" spacing.

Table 2. Early* yield by grade and combined fancy and medium yield of zucchini squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Early Yield (21-lb boxes/A)			
Variety	Fancy	Medium	Jumbo	Total Fan/Med
Cashflow	120 AB	194 A	74 B	313 A
Dividend	64 BC	112 A	64 B	177 B
Golden Rod	115 AB	132 A	74 B	247 AB
HMX 8714	129 A	139 A	200 AB	268 AB
Independence II	46 C	120 A	164 AB	166 B
Spineless Beauty	97 ABC	140 A	141 AB	236 AB
Tigress	79 ABC	112 A	281 A	191 B
Mean	93	135	143	228
CV (%)	41.5	43.9	76.8	34.7
L.S.D. (0.05)	57.2	88.3	162.8	117.8

Early* harvests occurred on June 17, 24 and 27, 2002 .

Table 3. Percent marketability by weight of early and season harvests and average weight of fancy and medium grade zucchini squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

Variety	Percent Marketable Season (%)	Percent Marketable Early (%)	Average Fancy Weight (g)	Average Medium Weight (g)
Cashflow	66.9 ABC	79.8 A	181 AB	394 A
Dividend	75.1 AB	74.9 A	207 A	438 A
Golden Rod	78.8 A	74.6 A	139 B	381 A
HMX 8714	55.9 ABCD	57.5 AB	221 A	471 A
Independence II	42.1 D	43.9 B	180 AB	355 A
Spineless Beauty	55.1 BCD	59.4 AB	203 A	446 A
Tigress	51.0 CD	44.5 B	198 A	483 A
Mean	60.7	62.1	190	424
CV (%)	25.5	25.3	17.0	26.1
L.S.D. (0.05)	23	23.4	47.9	164.7

Table 4. Early and season fruit number by grade of zucchini squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Season Harvest			*Early Harvest		
Variety	Fancy	Medium	Jumbo	Fancy	Medium	Jumbo
Cashflow	8924 ABC	7865 A	3176 BC	6050 ABC	4991 A	1361 B
Dividend	6806 BC	4991 A	2118 C	3176 C	2874 A	1210 B
Golden Rod	13310 A	5793 A	1815 C	8319 A	4432 A	1664 B
HMX 8714	10436 AB	6504 A	5415 AB	6806 AB	3630 A	3146 AB
Independence II	4689 C	5294 A	3933 ABC	2723 C	3781 A	2571 AB
Spineless Beauty	7714 BC	6201 A	4689 AB	4235 BC	3176 A	2118 AB
Tigress	8773 ABC	5899 A	5596 A	4840 ABC	3025 A	3933 A
Mean	8665	6078	3820	5164	3701	2286
CV (%)	39.9	37.6	41.1	46.3	52.9	62.1
L.S.D. (0.05)	5139.7	3392.3	2332	3548.4	2909.8	2110.4

Harvests occurred on June 17, 24,27, and July 1, 9 and 12, 2002. Planting date: April 5, 2002. Plot size:

12 plants per plot (two rows of six) on 36" X 24" spacing. *Early harvest includes the first three harvests.

Table 5. Season yield by grade and combined fancy and medium yield of yellow crookneck squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Season Yield (30-lb boxes/A)			
Variety	Fancy	Medium	Jumbo	Total Fan/Med
Destiny III	148 A	332 A	159 AB	480 A
Dixie	157 A	195 A	195 AB	352 AB
Gentry	156 A	268 A	213 A	424 AB
Prelude II	136 A	164 A	215 A	301 B
Supersett	193 A	259 A	68 B	452 AB
Mean	158	243	170	402
CV (%)	25.6	44.7	49.6	27.4
L.S.D. (0.05)	62.4	167.7	129.8	169.6

Harvests occurred on June 17, 24,27, and July 1, 9 and 12, 2002. Planting date: April 5, 2002. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing.

Table 6. Early* yield by grade and combined fancy and medium yield of yellow crookneck squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Early Yield (30-lb boxes/A)			
Variety	Fancy	Medium	Jumbo	Total Fan/Med
Destiny III	101 A	171 A	57 AB	272 A
Dixie	92 A	126 B	118 A	217 A
Gentry	76 A	148 AB	83 AB	224 A
Prelude II	99 A	118 B	121 A	216 A
Supersett	110 A	143 AB	21 B	252 A
Mean	95	141	80	236
CV (%)	26.8	19.6	58.6	16.3
L.S.D. (0.05)	39.4	42.5	72	59.1

Early* harvests occurred on June 17, 24 and 27, 2002. Planting date: April 5, 2002. 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 and average weight of fancy and medium grade yellow crookneck squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

Variety	Percent Marketable Season (%)	Percent Marketable Early (%)	Average Fancy Weight (g)	Average Medium Weight (g)
Destiny III	69.8 B	82.4 AB	120 AB	318 A
Dixie	62.5 B	62.8 C	128 A	224 A
Gentry	67 B	74.7 ABC	103 C	232 A
Prelude II	61.1 B	65.9 BC	110 BC	215 A
Supersett	85 A	91.1 A	112 BC	227 A
Mean	69.1	75.4	115	243
CV (%)	14.0	16.7	8.1	30.1
L.S.D. (0.05)	14.9	19.3	14.3	112.9

Early* harvests occurred on June 17, 24 and 27, 2002. Planting date: April 5, 2002. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing.

Table 8. Early and season fruit number by grade of yellow crookneck squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Season Harvest			*Early Harvest		
Variety	Fancy	Medium	Jumbo	Fancy	Medium	Jumbo
Destiny III	16940 AB	13310 AB	5596 AB	12100 A	9680	2420 B
Dixie	16789 B	11798 B	7260 A	10890 A	8319 BC	5294 A
Gentry	20268 AB	15881 A	7563 A	11041 A	10739 A	3328
Prelude II	16789 B	10436 B	8682 A	12403 A	8016 C	5596 A
Supersett	23595 A	15579 A	2571 B	14520 A	10285 AB	1210 B
Mean	12191	9408	3570	18876	13401	6334
CV (%)	30.4	15.0	45.5	23.1	15.3	36.6
L.S.D.	6728.4	3155.2	3576.1	5715.5	2174.3	2500

Harvests occurred on June 17, 24,27, and July 1, 9 and 12, 2002. Planting date: April 5, 2002. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing. *Early harvest includes the first three harvests.

Table 9. Season yield by grade and combined fancy and medium yield of yellow straight neck squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Season Yield (30-lb boxes/A)			
Variety	Fancy	Medium	Jumbo	Total Fan/Med
Cougar	207 AB	428 A	314 A	636 A
Enterprise	155 B	322 A	232 AB	477 A
Liberator II	223 AB	289 A	93 B	512 A
Multipik	237 AB	267 A	117 AB	504 A
XPT 1832	258 A	285 A	66 B	543 A
XPT 46020767	214 AB	224 A	123 AB	438 A
Mean	216	302	157	518
CV (%)	29.3	45.3	85.8	34.3
L.S.D. (0.05)	95.2	206.4	203.7	268.1

Harvests occurred on June 17, 24,27, and July 1, 9 and 12, 2002. Planting date: April 5, 2002. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing.

Table 10. Early* yield by grade and combined fancy and medium yield of yellow straight neck squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Early Yield (30-lb boxes/A)			
Variety	Fancy	Medium	Jumbo	Total Fan/Med
Cougar	120 A	240 A	167 A	360 A
Enterprise	111 A	218 AB	152 AB	329 A
Liberator II	141 A	177 AB	66 AB	318 A
Multipik	142 A	153 AB	82 AB	295 A
XPT 1832	170 A	158 AB	25 B	328 A
XPT 46020767	116 A	131 B	91 AB	247 A
Mean	133	179	97	313
CV (%)	33.5	36.2	87.7	30.8
L.S.D. (0.05)	67.4	97.7	128.6	145.1

Early* harvests occurred on June 17, 24 and 27, 2002. Planting date: April 5, 2002. 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 and average weight of fancy and medium grade yellow straight neck squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

Variety	Percent Marketable Season (%)	Percent Marketable Early (%)	Average Fancy Weight (g)	Average Medium Weight (g)
Cougar	69.0 A	72.7 AB	139 AB	314 AB
Enterprise	67.8 A	72.0 AB	139 AB	404 A
Liberator II	81.6 A	84.4 AB	153 AB	279 AB
Multipik	83.7 A	82.1 AB	131 B	246 B
XPT 1832	88.1 A	93.7 A	119 B	252 B
XPT 46020767	81.1 A	71.0 B	175 A	303 AB
Mean	78.5	79.3	143	300
CV (%)	19.8	18.6	18.7	33
L.S.D. (0.05)	23.5	22.2	40.2	149.1

Early* harvests occurred on June 17, 24 and 27, 2002. Planting date: April 5, 2002. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing.

Table 12. Early and season fruit number by grade of yellow straight neck squash at the Vidalia Onion and Vegetable Research Farm in Lyons, Georgia in 2002.

	Season Harvest			*Early Harvest		
Variety	Fancy	Medium	Jumbo	Fancy	Medium	Jumbo
Cougar	20721 ABC	17696 A	9423 A	12251 B	13008 A	5475 A
Enterprise	15170 C	12675 AB	7109 AB	11193 B	8440 AB	5143 AB
Liberator II	19360 BC	13764 AB	3176 B	13008 B	9529 AB	2118 AB
Multipik	24775 AB	14611 AB	4235 AB	14187 B	10376 AB	3328 AB
XPT 1832	29343 A	15276 AB	2118 B	20873 A	9983 AB	1059 B
XPT 46020767	19058 BC	10436 B	3933 AB	10890 B	6806 B	3176 AB
Mean	21404	14076	4999	13734	9690	3383
CV (%)	27.6	33.8	82.7	29.8	34.2	82.9
L.S.D. (0.05)	8888	7165.5	6226.9	6160	4993.5	4224.7

Harvests occurred on June 17, 24,27, and July 1, 9 and 12, 2002. Planting date: April 5, 2002. Plot size: 16 plants per plot (two rows of eight) on 36" X 18" spacing. *Early harvest includes the first three harvests.

NEW AND OLD VARIETIES PROVE GOOD IN PEPPER EVALUATION

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Introduction

Green bell pepper continues to be one of the Georgia's most valuable vegetable commodities. While the acreage has been nearly steady over the past few years, the varieties have begun to change considerably. The primary reason for some of this change has been the introduction of pepper varieties resistant to Tomato Spotted Wilt Virus. In 2002, there were two resistant varieties available to growers. There are of course other newer pepper varieties that have various desirable characteristics. Many new pepper varieties have increased resistance to Bacterial Leaf Spot for example. This trial was conducted as part of the ongoing program to periodically evaluate varieties of various vegetable crops from which more appropriate and relevant variety recommendations can be made.

Methods

Containerized green bell pepper transplants were commercially grown by a local plant producer in the greenhouse. The field was prepared by applying base fertilizer and tilling it into the bed prior to laying plastic mulch. Plastic mulch and drip irrigation tubes were installed over the beds which were fumigated with methyl bromide. Peppers were planted into the field at the Coastal Plain Experiment Station (elev. 382 feet) in Tifton, Georgia on March 25, 2002 into a Tifton sandy loam (fine-loamy siliceous thermic Plinthic Kandiudults) soil. Two side-by-side rows of pepper were planted on a plastic mulch-covered bed. Plots consisted of a single row with 12 plants in each row and 12 inches between plants. Beds were spaced six feet apart from center to center. Plots were 12 feet in length with three feet between plots and were arranged in a Randomized Complete Block Design with four replications.

Base fertilization consisted of 500 pounds 10-10-10 and remaining fertilization was applied through the drip irrigation system. Application rates ranged from 1.0 pounds nitrogen and potassium per acre per day for the first two weeks up to 2.5 pounds/acre/day at the peak requirement times of fruit set and enlargement. Total nutrients applied included approximately 165 pounds of N and K with the drip irrigation injections applied as a 7-0-7 analysis soluble fertilizer. Fungicide and insecticide applications were made according to current University of Georgia recommendations. Irrigation was applied daily.

Peppers were harvested on May 30, June 7, June 24 and July 12, 2002. Data were taken on yield, marketability, fruit length, fruit width and average fruit weight. Data was analyzed with the SAS system.

Results

Data are presented in Tables 1 and 2. Fancy and U.S. No. 1 are the two most marketable grades of pepper. "Wizard X3R" and "HMX 0640" produced the greatest yields of these grades of pepper (Table 1). Only "Lexington" was significantly lower than these two varieties, however. The same was true when peppers were compared for all marketable grades combined (Table 1). "Stiletto" was the only variety that produced a particularly low level of marketability (Table 1). It was significantly lower than five other varieties in the trial. When percentage of fruit in the Fancy and U.S. No. 1 grades was measured, "Crusader" and "Stiletto" were significantly lower than "Colossal" (Table 1).

Average fruit weight of Fancy grade fruit varied some with varieties. "Camelot" produced heavier fruit on average than "Lexington" and "Stiletto" (Table 2). Average fruit length varied considerably with "Camelot" producing significantly longer pods than either "Peninsula", "SPP 7117", "Stiletto" or "Wizard X3R" (Table 2). Only "Peninsula" had fruit with significantly less width than other peppers (Table 2). There were no differences among varieties for fruit smoothness and fruit shape as might be expected. However, fruit color did vary with "Crusader" and "Camelot" producing the darkest green fruit and "Stiletto" the lightest (Table 2).

Table 1. Yield by grade and percent marketability of 11 varieties of bell peppers at Tifton, Georgia in 2002.

Variety	Yield (28# cartons)/Acre[1]					Percent Marketable	Percent Fancy & U.S. No. 1 Fruit
	Fancy Boxes/A	U.S. No. 1 Boxes/A	U.S. No. 2 Boxes/A	Total Marketable Boxes/A	Fancy & U.S. No. 1 Boxes/A	(%)	(%)
Brigadier	420 AB	495 AB	405 B	1320 AB	915 AB	83.9 AB	57.1 ABC
Camelot	405 AB	481 AB	497 AB	1383 AB	886 AB	86.4 AB	55.5 ABC
Colossal	470 A	497 AB	375 B	1343 AB	968 AB	89.0 A	64.8 A
Crusader	353 AB	409 B	578 A	1340 AB	762 AB	85.9 AB	48.5 C
HMX 640	427 AB	631 A	460 AB	1518 A	1058 A	87.5 A	60.6 AB
Lexington	317 AB	389 B	373 B	1078 B	706 B	85.3 AB	56.0 ABC
Peninsula	383 AB	500 AB	477 AB	1360 AB	883 AB	87.7 A	56.9 ABC
Red Knight	321 AB	494 AB	392 B	1207 AB	815 AB	85.9 AB	57.7 ABC
SPP 7117	399 AB	502 AB	512 AB	1413 AB	901 AB	88.7 A	56.4 ABC
Stiletto	269 B	497 AB	392 B	1158 AB	766 AB	80.6 B	53.6 BC
Wizard X3R	476 A	549 AB	469 AB	1493 A	1024 A	87.5 A	59.8 AB
Mean of Test	385	495	448	1328	880	86.2	57
L.S.D. (0.1)	186.7	181.5	157.9	363.3	300.4	6.5	10.4
C.V. (%)	33.5	25.4	24.4	18.9	23.6	5.2	12.7

[1]Plots consisted of a single row with two rows per bed and 12 plants per row spaced 12 inches apart.

Table 2. **Average fruit length, width, weight, shape, smoothness and color of 11 varieties of bell peppers at Tifton, Georgia in 2002.**

Variety	Company	Average Fancy Fruit Wt. (g)	Average U.S. No. 1 Fruit Wt. (g)	Average Fruit Length (cm)	Average Fruit Width (cm)	Fruit Smooth[1]	Fruit Shape[2]	Fruit Color[3]
Brigadier	Syngenta	182 AB	124 A	9.0 AB	7.5 A	1.5 A	5.8 A	6.2 AB
Camelot	Seminis	185 A	124 A	9.3 A	7.9 A	1.4 A	5.8 A	6.5 A
Colossal	Sygenta	168 ABC	123 A	8.8 AB	7.3 A	1.6 A	5.85 A	6.4 A
Crusader	Sygenta	171 ABC	133 A	8.5 ABC	7.7 A	1.3 A	5.7 A	7.1 A
HMX 640	Harris	169 ABC	129 A	8.4 BC	7.6 A	1.5 A	5.85 A	6.2 AB
Lexington	Seminis	141 C	119 AB	8.5 ABC	7.4 A	1.5 A	5.8 A	6.3 A
Peninsula	Harris	169 ABC	125 A	7.9 C	5.8 B	1.3 A	5.8 A	6.3 A
Red Knight	Seminis	171 ABC	131 A	8.7 ABC	7.2 AB	1.6 A	5.7 A	6.2 AB
SPP 7117	Seminis	166 ABC	93 B	7.9 C	7.2 AB	1.6 A	5.85 A	6.4 A
Stiletto	Syngenta	153 BC	124 A	8.4 BC	7.5 A	1.4 A	5.8 A	6.1 B
Wizard X3R	Seminis	166 ABC	128 A	7.9 C	7.2 AB	1.3 A	5.8 A	6.2 AB
Mean of Test		167	123	8.5	7.3	1.4	5.8	6.2
L.S.D. (0.1)		30.7	30	0.85	1.44	0.42	0.33	1.31
C.V. (%)		12.7	16.9	6.96	13.6	20.7	4.06	14.6

[1]Based on the scale of 1=rough (lobes prominent) to 3=smooth (lobes not prominent).[2]Based on the scale of: 1=linear; 2=globose; 3=oblate; 4=conical elongate; 5=conical blunt; 6=blocky.

[3]Based on the scale of: 6=light green-8=dark green; 3=light yellow-5=dark yellow; 2=red; 1=other.

Weed Control

WATERMELON RESPONSE TO SANDEA APPLIED OVER-THE-TOP OF PLASTIC PRIOR TO TRANSPLANTING

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Introduction

Plastic mulch is widely used in watermelon production. Commercial growers often prepare watermelon beds by laying plastic mulch several days ahead of transplanting. Plastic is an effective means of controlling most weeds. However, nutsedge (*Cyperus* sp.) often penetrates the plastic within days of being laid. Nutsedge is surprisingly competitive with watermelons and those plants emerging through the plastic prior to transplanting need to be controlled. Unfortunately, tools available that offer control of nutsedge in watermelon are limited. Sandea, a relatively new vegetable herbicide, would be an effective tool to apply over plastic prior to watermelon transplanting for the control of nutsedge. However, watermelon tolerance to Sandea previously applied to plastic is unknown, thus a study was conducted.

Materials and Methods

Fourteen inch plastic beds were prepared using a six foot row spacings on the Marty Bloodworth farm in Wilcox County, Georgia. The field was heavily infested with yellow nutsedge (*Cyperus esculentus*). The experimental design was a randomized complete block with four replications and plot size was one bed by 30 feet including ten watermelon plants. Strategy was applied to the bed shoulders and row middles of all plots for general maintenance of weeds other than nutsedge. Four treatments were broadcast over-the-top of the plastic one day prior to transplanting. Treatments included Sandea at 0, 0.5, 0.75, and 1.0 oz of product per acre. All Sandea treatments included a non-ionic surfactant at 0.25% v/v. Treatments were applied with a CO_2 backpack sprayer equipped with flat fan nozzles applying 10 GPA. Plots were transplanted April 5, 2002 with a water wheel to 5244 seedless and Slice-n-Serve varieties. No rainfall or irrigation was applied to rinse the chemical from the plastic. A 1.03 inch rain occurred 5 days after transplanting. Plots were evaluated at one (April 11,2002) and four (May 3, 2002) weeks after application for crop stunting and yellow nutsedge control. Visual estimates of weed control and crop stunting were based on a scale of 0% equaling no injury or nutsedge control and 100% equaling complete crop death or nutsedge control. Watermelon runner lengths were also measured.

Results and Conclusions

Applying Sandea prior to watermelon transplanting caused severe watermelon injury (Table 1). Regardless of Sandea rate, watermelons were visually stunted 70 to 80% and runner lengths were reduced by 66 to 82% at one week after transplanting when compared to non-treated control. By four weeks after transplanting, watermelon vines were still 35 to 67% smaller than the non-treated control. Sandea should not be applied overtop of plastic prior to transplanting watermelons. Further research is being conducted to evaluate if Sandea can be washed from the plastic prior to transplanting.

As expected, yellow nutsedge that had emerged through the plastic at time of applying Sandea was controlled effectively. Regardless of rate, yellow nutsedge control ranged from 77 to 88% at one week after treatment and 89 to 93% at four weeks after treatment.

Table 1. Watermelon Response to Sandea Applied Over Plastic Prior to Planting.

Trt #	Treatment Name	Rate	Rate Unit	Yellow nutsedge control (%) Apr 11, 2002	Watermelon stunting (%) Apr 11, 2002	Watermelon runner length (inches) April 11, 2002	Yellow nutsedge control (%) May 3, 2002	Watermelon runner length (inches) May 3, 2002
1	Sandea	0.5	oz/acre	78.8 a	70.0 b	3.25 b	88.8 a	22.38 b
	NIS	0.25	% V/V					
2	Sandea	0.75	oz/acre	88.8 a	80.0 a	2.00 bc	92.5 a	14.06 c
	NIS	0.25	% V/V					
3	Sandea	1	oz/acre	88.8 a	80.0 a	1.75 c	92.5 a	11.44 c
	NIS	0.25	% V/V					
4	Non-treated			0.0 b	0.0 c	9.50 a	0.0 b	34.63 a
LSD (P = .05)				11.33	6.53	1.496	4.27	6.967
Standard Deviation				7.08	4.08	0.935	2.67	4.356
CV				11.06	7.1	22.68	3.9	21.12
Bartlett's X2				0.716	0.0	9.765	0.074	3.163
P (Bartlett's X2)				0.699	0.00*	0.021*	0.963	0.367

FALL VEGETABLE RESPONSE TO HALOSULFURON, METOLACHLOR, AND SULFENTRAZONE SPRING APPLIED UNDER PLASTIC

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Introduction

The use of polyethylene mulch has become more common for many different spring and fall vegetables, including seeded or transplanted pepper (*Capsicum annuum* L.), tomato (*Lycopersicon esculentum* L.), squash (*Cucurbita pepo* L.), watermelon (*Citrullus lanatis* L.), and cucumber (*Cucumis sativus* L.). Following the spring crop, fall planting of eggplant (*Solanum melongena* L.), squash, cabbage (*Brassica oleracea* L. variety capitata), cucumber, and tomato are made directly into the existing polyethylene-covered beds. Currently, spring prepared plasticulture beds depend on methyl-bromide (MBr) application for season long weed and pest control. Generally there are no rotation issues with MBr for fall vegetables. However, the use of MBr is scheduled to end in 2005 and cost for this product continue to increase in the interim. Season long suppression and control of plant pathogens, nematodes, and weeds must be considered when alternatives for MBr are researched. Current fumigant alternatives include cloropicrin (trichloronitromethane), telone (1,3-dichloropropene), and vapam (sodium methyldithiocarb). However, these products provide variable nutsedge species (*Cyperus* spp.) suppression. Current research in spring crops is focusing on potential MBr alternatives that include combinations of fumigants and herbicides (e.g. metolachlor, halosulfuron, and sulfentrazone). When applied as part of a weed management program for spring formed beds, herbicide injury to fall planted vegetables becomes a rotational issue. Among these concerns are: fall crop injury and yield loss, season-long weed control, herbicide rates, and potential negative interactions between these herbicides and fumigants. Therefore, a study was initiated to determine fall vegetable response following a spring application of Halosulfuron, metolachlor, and sulfentrazone applied under polyethylene mulch.

Materials and Methods

Spring applied fumigants included the following 10 treatments: 420 kg/ha MBr , 316 kg/ha cloropicrin, 113 kg/ha Telone II plus 168 kg/ha cloropicrin , 268 kg/ha vapam, 358 kg/ha vapam, 226 kg/ha Telone C-35, 452 kg/ha Telone C-35, 226 kg/ha Telone C-35 plus 179 kg/ha vapam, 226 kg/ha Telone C-35 plus 268 kg/ha vapamat 179 or 268 kg/ha, and a nontreated control. Randomized within these 10 fumigant treatments were 5 herbicide applications that included a nontreated control, 1.12 kg/ha metolachlor, 0.027 kg/ha halosulfuron, 0.28 kg/ha sulfentrazone, and 1.12 kg/ha metolachlor plus 0.027 kg/ha halosulfuron. A replicated spring pepper tolerance trial was terminated in August, plant debris removed, plastic painted white, and planted with transplanted eggplant, transplanted and seeded squash, seeded cucumber, and transplanted cabbage. Due to size limitations, only one fumigant treatment per vegetable species could be investigated. Crop injury and population density were evaluated for all crops. Crop height was evaluated for eggplant and cabbage, while plant diameters were measured for squash and cucumber. Crop plant biomass was measured with squash, cucumber, and cabbage (3 dates). Multiple eggplant fruit harvests (fruit number and biomass per ha) were made.

Results and Discussions

The fumigant X herbicide interaction was used as the error term for SAS analysis due to only one replication of fumigant per variable. There were no trends for variables for fumigant treatments, therefore data is presented for herbicide treatment only for all variables. Injury to eggplant, cucumber, transplanted- and seeded-squash ranged from 8 to 16% for halosulfuron, sulfentrazone, and metolachlor plus halosulfuron (Table 1). Cabbage injury was 4.4% or less for any herbicide treatment. Stand counts were not significant for any vegetable (Table 2). Vine length for cucumber and transplanted squash was significantly reduced by sulfentrazone relative to the nontreated control (Table 3). Greatest cabbage biomass for the three-harvest total was recorded with halosulfron, followed by metolachlor plus halosulfuron, sulfentrazone, metolachlor, and the nontreated check (Table 4.). Eggplant yield in terms of fruit number and kg/plant was significantly reduced by sulfentrazone relative to the nontreated control for the first and total season harvest (Table 5). In terms of tolerance, cabbage, eggplant, squash, and cucumber were tolerant to halosulfuron; cabbage and eggplant were tolerant to metolachlor; squash and cucumber were not tolerant to metolachlor nor sulfentrazone; and cabbage and eggplant exhibited responses to sulfentrazone that would warrant further investigation.

Table 1.Carryover injury from spring applied herbicides to fall planted vegetables, August 28, 2002.

Spring herbicide treatment[1]	Eggplant	Cabbage	Cucumber	Squash	
				Seeded	Transplant
	% injury[2]				
None	0	0	0	0	0
Metolachlor	10.6	1.1	5.6	12.2	15.0
Halosulfuron	9.4	0.0	11.1	9.4	14.4
Sulfentrazone	11.7	4.4	15.0	7.8	7.2
Metolachlor + halosulfuron	6.7	2.2	15.6	7.8	11.1
LSD[3]	NS	3.7	NS	NS	NS

[1]Herbicide treatments were applied in February 2002, average of 9 replications. Vegetables planted August 8, 2002.
[2]Injury scale 0 to 100% where 0 = none and 100 = complete death.
[3]NS = not significant at P=0.05.

Table 2. Stand for fall planted vegetables after spring applied herbicides, August 28, 2002

	Eggplant	Cabbage	Cucumber	Squash	
Herbicide treatment[1]				Seeded	Transplant
	plants/hectare				
None	15548	45315	41594	12226	16478
Metolachlor	16212	45448	41063	12492	15947
Halosulfuron	16212	45049	43986	12757	16212
Sulfentrazone	15946	44784	42126	13023	16212
Metolachlor + halosulfuron	15813	43986	41860	12890	16478
LSD[2]	NS	NS	NS	NS	NS

[1]Herbicide treatments were applied in February 2002, average of 9 replications. Vegetables planted August 8, 2002.
[2]NS = not significant at P=0.05.

Table 3. Fall planted vegetable plant height or vine length after spring applied herbicides, September 9, 2002.

Herbicide treatment	Eggplant	Cabbage	Cucumber	Squash	
				Seeded	Transplant
	cm/plant				
None	24.0	33	122	13.7	16.3
Metolachlor	24.5	34	112	15.0	15.6
Halosulfuron	23.2	32	115	14.4	15.2
Sulfentrazone	22.9	33	79	13.7	13.9
Metolachlor + halosulfuron	24	32	123	14.1	16.1
LSD[2]	NS	NS	27	NS	2.1

[1]Herbicide treatments were applied in February 2002, average of 9 replications. Vegetables plant August 8, 2002.
[2]NS = not significant at P=0.05.

Table 4. Fall planted vegetable plant biomass after spring applied herbicides.

Herbicide treatment[1]	Plant biomass – September 17, 2002		Cabbage biomass		
	Squash transplanted	Cucumber	October 9, 2002	October 28, 2002	November 6, 2002
	————g/plant ————		————kg/plant ————		
None	401	238	0.36	0.82	1.10
Metolachlor	335	215	0.34	0.94	1.15
Halosulfuron	342	247	0.52	1.17	1.51
Sulfentrazone	374	230	0.48	0.87	1.15
Metolachlor + halosulfuron	354	170	0.44	0.96	1.23
LSD[2]	NS	NS	0.11	0.17	0.24

[1]Herbicide treatments were applied in February 2002, average of 9 replications. Vegetables planted August 8, 2002.
[2]NS = not significant at P=0.05.

Table 5. Fall planted eggplant biomass after spring applied herbicides.

Herbicide treatment[1]	Harvest #1 Oct 2, 2002	Season total	Harvest #1 Oct 2, 2002	Season total
	———Fruit/plant ———		———kg/plant ———	
None	0.59	5.05	0.28	2.18
Metolachlor	0.49	5.02	0.26	2.16
Halosulfuron	0.66	5.33	0.29	2.24
Sulfentrazone	0.33	4.68	0.15	1.99
Metolachlor + halosulfuron	0.65	5.40	0.32	2.29
LSD[2]	0.23	NS	0.12	NS

[1]Herbicide treatments were applied in February 2002, average of 9 replications. Vegetables planted August 8, 2002.
[2]NS = not significant at P=0.05.

WHAT SOIL TEMPERATURES WILL KILL NUTSEDGE TUBERS?

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Introduction

In Georgia vegetable crop production, the foundation for pest management has been methyl bromide. However, methyl bromide is suspected to contribute to ozone depletion and its use is scheduled to cease in 2005. Nutsedge are among the most troublesome weeds of vegetable crops in the southern U.S. (Webster 2002; Webster and MacDonald 2001). There is concern that nutsedge will be unmanageable in crops requiring fumigation, as there are few alternatives to methyl bromide (Harrison and Fery 1998).

In crop production systems, purple and yellow nutsedge rely on tubers as the primary means of reproduction (Horowitz 1992; Lapham and Drennan 1990; Smith and Fick 1937). Purple nutsedge tuber production is initiated early in the growing season, approximately six to eight weeks after foliar emergence (correlates with flower production) (Hauser 1962). Five successive generations of purple nutsedge can occur within a growing season (Horowitz 1972). Over a growing season, approximately 100 purple nutsedge tubers and 6900 yellow nutsedge tubers were produced from one initial tuber (Hauser 1962; Rao 1968; Tumbleson and Kommedahl 1961). Successful management of purple and yellow nutsedge must eliminate tuber viability and/or inhibit new shoot and tuber production (Horowitz et al. 1983; Patterson 1998).

Treatments that use elevated temperature (e.g. solarization, steam, and electromagnetic radiation) have been proposed as alternatives to methyl bromide for management of various pests (Chellemi et al. 1993; Elmore 1991; Kumar et al. 1993; Mavrogianopoulos et al. 2000; Stapleton 2000). Exposure to 65˚ C (149 F) for 30 minutes will eliminate many economically important soil-borne plant pathogenic fungi, nematodes, insects, and weeds (Pullman et al. 1981). Death of organisms is dependent upon temperature and duration of exposure, also known as *thermal time* (Katan 1981). However, few studies have evaluated the relationship between lower temperatures and the duration required for effective pest control (Pullman et al. 1981; Stapleton 2000).

The use of polyethylene mulch to heat the soil to temperatures lethal to pests has been previously studied with variable success across a wide range of pests. Two weeks of solarization, in which the average maximum temperature did not exceed 49.5˚ C (121 F) at a depth of 2 inches, suppressed emergence of common purslane (*Portulaca oleracea* L), henbit (*Lamium amplexicaule* L.), and field bindweed (*Convolvulus arvensis* L.) >88% at eight months after treatment (Horowitz et al. 1983). A one week midsummer solarization in Mississippi using polyethylene mulch reduced seed viability of several weed species 53 to 95% (Egley 1983). Temperatures under the plastic mulch at a soil depth of 0.5 inches exceeded 60˚ C (140 F) for four hours (hr) during the middle afternoon. However, purple nutsedge suppression was variable, and in some instances, solarization treatment stimulated purple nutsedge emergence (Egley 1983). Elevated temperatures due to solarization were shown to increase the number of sprouting purple nutsedge tubers by 23% (Miles et al. 2002).

While solarization has reportedly reduced nutsedge populations (Chellemi et al. 1997) (Hejazi et al. 1980; Ricci et al. 2000) and the effect of temperature on tuber mortality has been investigated (Chase et al. 1999; Rubin and Benjamin 1983), little is known about the relationship between temperature, duration of exposure, and nutsedge tuber viability. The objectives of this study were to determine the relationship between temperature and duration of exposure on purple and yellow nutsedge tuber viability.

Materials and Methods

Tubers of purple and yellow nutsedge were pre-sprouted in potting media to ensure viability. Tubers were trimmed of roots and shoots and placed in disposable petri dishes between two moistened filter papers and the dish sealed with laboratory film. An experimental unit consisted of one petri dish with 25 tubers. Yellow nutsedge tubers used had an average weight of 0.22 oz. and diameter of 0.35 inches. Purple nutsedge tubers had an average weight of 0.50 oz. and the egg-shaped tubers had an average diameter of 0.31 inches and length of 0.47 inches.

Purple nutsedge tubers were placed in a heating chamber set at constant temperatures (± 1˚ C) at 35˚ C (95 F), 40˚ C (104 F), 45˚ C (113 F), 50˚ C (122 F), 55˚ C (131 F), 60˚ C (140), and 65˚ C (149 F), while yellow nutsedge treatments ranged from 35 to 60˚ C in 5˚ C increments. Treatments included exposure to each temperature for durations of 0, 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64, 128, and 256 hr. Following treatment, tubers were planted in 6 inch diameter pots filled with soil and watered as needed for 28 d. At the conclusion of the study, tubers were extracted from the soil media using a sieve. Viability of treated tubers was evaluated 28 d after treatment. Viable tubers were characterized by having at least one emerged shoot, those without shoots exhibited visible signs of decay.

Data were analyzed using analysis of variance. The critical duration of exposure at which nutsedge tuber viability was reduced 50% ($\boldsymbol{TT_{50}}$) was estimated using regression for each temperature.

Results and Discussion

Tuber viability. Viability of nutsedge tubers was reduced when exposed to treatments ≥45˚ C (113 F) (Figure 1). Yellow nutsedge tuber viability was more sensitive to thermal time than was purple nutsedge. Yellow nutsedge tuber viability was reduced by 50% ($\boldsymbol{TT_{50}}$) when exposed to 45˚ C (113 F) fo r 30 hr, 50˚ C (122 F) for 6 hr, and 55˚ C (131 F) for 0.3 hr (Table 1). Purple nutsedge had relatively higher $\boldsymbol{TT_{50}}$ values (as indicated by t-test) than yellow nutsedge: 71 hr at 45˚ C (113 F), 23 hr at 50˚ C (122 F), and 1.8 hr at 55˚ C (131 F) (Table 1). The $\boldsymbol{TT_{50}}$ for tuber viability at 60˚ C (140 F) was similar (0.4 to 0.5 hr) for both nutsedge. There were no detectable relationships between yellow and purple nutsedge tuber viability and duration of exposure at 35˚ C (95 F) and 40˚ C (104 F).

The duration of exposure required to kill all of the yellow nutsedge tubers was 16 hr for 50˚ C (122 F), 8 hr for 55˚ C (131 F), and 2 hr for 60˚ C (140 F) (Figure 1). Previous research conducted in a growth chamber indicated that 100% yellow nutsedge mortality was achieved after 6 d under alternating temperatures of 60/40˚ C (140/104 F) (each for 12 hr) (Hejazi et al. 1980). Death of all purple nutsedge tubers occurred after durations of 64 hr at 50˚ C (122 F), 16 hr at 55˚ C (131 F) and 60˚ C (140 F), and 0.5 hr at 65˚ C (149 F) (Figure 1). Previous research demonstrated that purple nutsedge tubers were killed when exposed to 50˚ C (122 F) for 96 hr, while 48 hr at 50˚ C (122 F) had no effect on tuber viability (Smith and Fick 1937). Tuber viability was also observed to be eliminated when purple nutsedge was exposed to ≥ 60˚ C (140 F) for 1 hr (Smith and Fick 1937). Purple nutsedge tuber mortality occurred after exposure to 90˚ C (194 F) for 0.5 hr, while exposure to 50˚ C (122 F) and 60˚ C (140 F) for 0.5 hr reduced tuber viability only 10 to 20 %, respectively (Rubin and Benjamin 1984). In the current study, nutsedge tubers were pre-germinated to ensure viability and minimize variability. However, this procedure may also have maximized tuber sensitivity to heat treatments relative to dormant tubers and could account for the differences among values reported in the literature and the current study.

Soil temperatures. Average maximum bare ground soil temperatures between 1991 and 2001 at Tifton, GA were highest in July (Hoogenboom 2003). Temperatures ranged from 31.9 to 37.5˚ C (89 to 100 F) at 2 inches, 29.0 to 34.3˚ C (84 to 94 F) at 4 inches, and 28.0 to 31.3˚ C (82 to 88 F) at 8 inches (Figure 2). Over this span, July 2001 had the highest average soil temperatures with the highest daily maximum of 38.3˚ C (101 F), 32.8˚ C (91 F), and 28.9˚ C (84 F) at 2, 4, and 8 inches, respectively (Figure 4). July 1998 had the lowest daily maximum soil temperatures over this span: 33.3˚ C (92 F), 29.8˚ C (86 F), and 28.8˚ C (84 F) at 2, 4, and 8 inches, respectively (Figure 3). These bare soil temperatures would not be adequate to reduce nutsedge tuber viability.

Black and clear polyethylene mulch raised soil temperatures at depths of 2 to 2.4 inches by 4 to 10˚ C and 10 to 11˚ C, respectively, relative to the bare soil control in Louisiana and Florida (Chase et al. 1999; Standifer et al. 1984). Soil temperatures were increased relative to non-mulched soil 10 to 14˚ C at 2 inches, 9 to 14˚ C at 4 inches, and 6 to 11˚ C at 8 inches in Israel using clear polyethylene (Rubin and Benjamin 1983). Solarization using clear polyethylene for five wk in Hawaii raised mean soil temperature at 6 inches by 5.8˚ C in the spring and 7.2˚ C in the summer relative to bare soil plots (Miles et al. 2002). Applying these temperature increases under clear polyethylene mulch to the Tifton soil temperature data would raise the maximum temperature at 2, 4, and 8 inches to ≤ 53˚ C (127 F), ≤ 49˚ C (120 F), and ≤ 43˚ C (109 F), respectively. Near the surface, these temperatures may begin to reduce nutsedge tuber viability. However, while clear polyethylene raises soil temperatures, its use can be problematic in vegetable crop production (personal observation). Light penetrates the clear polyethylene mulch, triggering the sharp-pointed sheath of leaves to unfurl and preventing nutsedge shoots from piercing the mulch (Chase et al. 1998). There is often enough light to support plant growth under clear mulch resulting in nutsedge plants lifting the mulch as they grow, potentially hindering crop production (Majek and Neary 1991).

Coupled with the difficulty in adequately increasing soil temperature, the distribution of nutsedge tubers in the soil profile poses a significant obstacle to the success of solarization in controlling nutsedge (Rubin and Benjamin 1983). Nutsedge tubers were distributed throughout the top 12 to 16 inches of the soil profile, with 99% of yellow and purple nutsedge tubers within the top 10 inches and 6.3 inches of the soil profile, respectively (Horowitz 1972; Siriwardana and Nishimoto 1987; Tumbleson and Kommedahl 1961). In addition, tubers that are not affected can quickly reinvade a treated area from adjacent non-treated row middles (Webster 2002).

While there is a significant effect of heat and duration of exposure on nutsedge tuber viability, application of these data to field situations may be limited using present technology. Mulches with various optical properties exist that allow for greater efficiency in raising soil temperatures (Chase et al. 1999; DeLuca et al. 1996; Ham et al. 1993; Mormile et al. 2001). However, it is not clear how effective these mulches would be in heating at least the top 6 inches of the soil profile for the prescribed thermal time interval. Future research should evaluate the cumulative effect of diurnally fluctuating sub-lethal temperatures on nutsedge tuber viability and new tuber production.

Conclusions:

1. Nutsedge tuber viability was reduced when temperatures ≥45˚ C (113 F).
2. Yellow nutsedge tubers were more sensitive (required shorter duration of exposure to reduce viability) to 45˚ C (113 F), 50˚ C (122 F), and 55˚ C (131 F) than purple nutsedge.
3. Tuber sensitivity to 60˚ C (140 F) was similar for both nutsedge.
4. With sufficient durations of exposure, both purple and yellow nutsedge tubers were killed at temperatures ≥50˚ C (122 F).
5. Application of these data to field situations in Georgia may be limited using present technology, as the soil temperature cannot be raised to high enough levels for acceptable solarization effects.

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I acknowledge the technical expertise and diligent efforts of Thomas E. Sklany in coordinating and conducting this study. In addition, Mr. Sklany supervised several student workers who processed samples in this study; I thank Aaron Wise, Josh Frost, and John Bennett for their assistance. I also acknowledge the efforts of Duncan McClusky and Emily Cheek of the Coastal Plain Experiment Station Library, Tifton, GA.

Literature Cited

Chase, C.A., T.R. Sinclair, D.O. Chellemi, S.M. Olson, J.P. Glireath and S.J. Locascio 1999. Heat-retentive films for increasing soil temperatures during solarization in a humid, cloudy environment. HortSci. 34: 1085-1089.

Chase, C.A., T.R. Sinclair and S.J. Locascio 1999. Effects of soil temperature and tuber depth on *Cyperus* spp. control. Weed Sci. 47: 467-472.

Chase, C.A., T.R. Sinclair, D.G. Shilling, J.P. Gilreath and S.J. Locascio 1998. Light effects on rhizome morphogenesis in nutsedges (*Cyperus* spp): implications for control by soil solarization. Weed Sci. 46: 575-580.

Chellemi, D.O., S.M. Olson, D.J. Mitchell, I. Secker and R. McSorley 1997. Adaptation of soil solarization to the integrated management of soilborne pests of tomato under humid conditions. Phytopathology. 87: 250-258.

Chellemi, D.O., S.M. Olson, J.W. Scott, D.J. Mitchell and R. McSorley 1993. Reduction of phytoparasitic nematodes on tomato by soil solarization and genotype. J. Nematol. 25: 800-805.

DeLuca, V., B. Immirizi, M. Malinconico, C. Manera and S. Mazza 1996. Comparison of the thermal efficiency of low density polyethylene and polyethyleneterephthalate films for soil solarization. J. Polym. Mater. 13: 329-333.

Egley, G.H. 1983. Weed seed and seedling reductions by soil solarization with transparent polyethylene sheets. Weed Sci. 31: 404-409.

Ham, J.M., G.J. Kluitenberg and W.J. Lamont 1993. Optical properties of plastic mulches affect the field temperature regime. J. Am. Soc. Hortic. Sci. 118: 188-193.

Harrison, H.F. and R.L. Fery 1998. Response of leading bell pepper varieties to bentazon herbicide. HortSci. 33: 318-320.

Hauser, E.W. 1962. Development of purple nutsedge under field conditions. Weeds. 10: 315-321.

Hauser, E.W. 1962. Establishment of nutsedge from space-planted tubers. Weeds. 10: 209-211.

Hejazi, M.J., J.D. Kastler and R.F. Norris 1980. Control of yellow nutsedge by tarping the soil with clear polyethylene plastic. Proc. West. Soc. Weed Sci. 33: 120-126.

Hoogenboom, G. 2003. Georgia automated environmental monitoring network. Univ. GA, Griffin. Accessed 14 April 2003. http://www.Georgiaweather.net.

Horowitz, M. 1972. Growth, tuber formation and spread of *Cyperus rotundus* L from single tubers. Weed Res. 12: 348-363.

Horowitz, M. 1992. Mechanisms of establishment and spreading of *Cyperus rotundus* - the worst weed of warm regions. Proc. First Int. Weed Cont. Congr. 1: 94-97.

Horowitz, M., Y. Regev and G. Herzlinger 1983. Solarization for weed control. Weed Sci. 31: 170-179.

Katan, J. 1981. Solar heating (solarization) of soil for control of soilborne pests. Ann. Rev. Phytopathol. 19: 211-236.

Kumar, B., N.T. Yaduraju, K.N. Ahuja and D. Prasad 1993. Effect of soil solarization on weeds and nematodes under tropical Indian conditions. Weed Res. 33: 423-429.

Lapham, J. and D.S.H. Drennan 1990. The fate of yellow nutsedge (*Cyperus esculentus*) seed and seedlings in soil. Weed Sci. 38: 125-128.

Majek, B.A. and P.E. Neary 1991. Selective wavelength transmitting mulch for yellow nutsedge control. Proc. Brighton Crop Prot. Conf. 1: 263-268.

Mavrogianopoulos, G.N., A. Frangoudakis and J. Pandelakis 2000. Energy efficient soil disinfestation by microwaves. J. Agr. Eng. Res. 75: 149-153.

Miles, J.E., O. Kawabata and R.K. Nishimoto 2002. Modelling purple nutsedge sprouting under soil solarization. Weed Sci. 50: 64-71.

Mormile, P., L. Petti, B. Immirzi, M. Malinconico, V. De Luca and C. Manera 2001. Optical characterization of polymeric films by a new methodological approach. Appl. Spectrosc. 55: 858-863.

Patterson, D.T. 1998. Suppression of purple nutsedge (*Cyperus rotundus*) with polyethylene film mulch. Weed Technol. 12: 275-280.

Pullman, G.S., J.E. DeVay and R.H. Garber 1981. Soil solarization and thermal death: a logarithmic relationship between time and temperature for four soilborne plant pathogens. Phytopathol. 71: 959-964.

Rao, J.S. 1968. Studies on the development of tubers in nutgrass and their starch content at different depths of soil. Madras Ag. J. 55: 18-23.

Ricci, M.D.F., D.L. De Almeida, M.D.A. Fernandes, R.D.D. Ribeiro and M.C.D. Cantanheide 2000. Effects of soil solarization on purple nutsedge population density and on productivity of vegetable crops under organic cultivation. Pesqui. Agropecu. Bras. 35: 2175-2179.

Rubin, B. and A. Benjamin 1983. Solar heating of the soil: effect on weed control and on soil-incorporated herbicides. Weed Sci. 31: 819-825.

Seefeldt, S.S., J.E. Jensen and E.P. Fuerst 1995. Log-logistic analysis of herbicide dose-response relationships. Weed Technol. 9: 218-227.

Siriwardana, G. and R.K. Nishimoto 1987. Propagules of purple nutsedge (*Cyperus rotundus*) in soil. Weed Technol. 1: 217-220.

Smith, E.V. and G.L. Fick 1937. Nutgrass eradication studies I. Relation of the life history of nutgrass, *Cyperus rotundus* L., to possible methods of control. Agron. J. 29: 1007-1013.

Standifer, L.C., P.W. Wilson and R. Porche-Sorbet 1984. Effects of solarization on soil weed populations. Weed Sci. 32: 569-573.

Stapleton, J.J. 2000. Soil solarization in various agricultural production systems. Crop Prot. 19: 837-841.

Tumbleson, M.E. and T. Kommedahl 1961. Reproductive potential of *Cyperus esculentus* by tubers. Weeds. 9: 646-653.

Webster, T.M. 2002. Nutsedge eradication: Impossible dream? National Nursery Proceedings - RMRS-P-000. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. (*In press*).

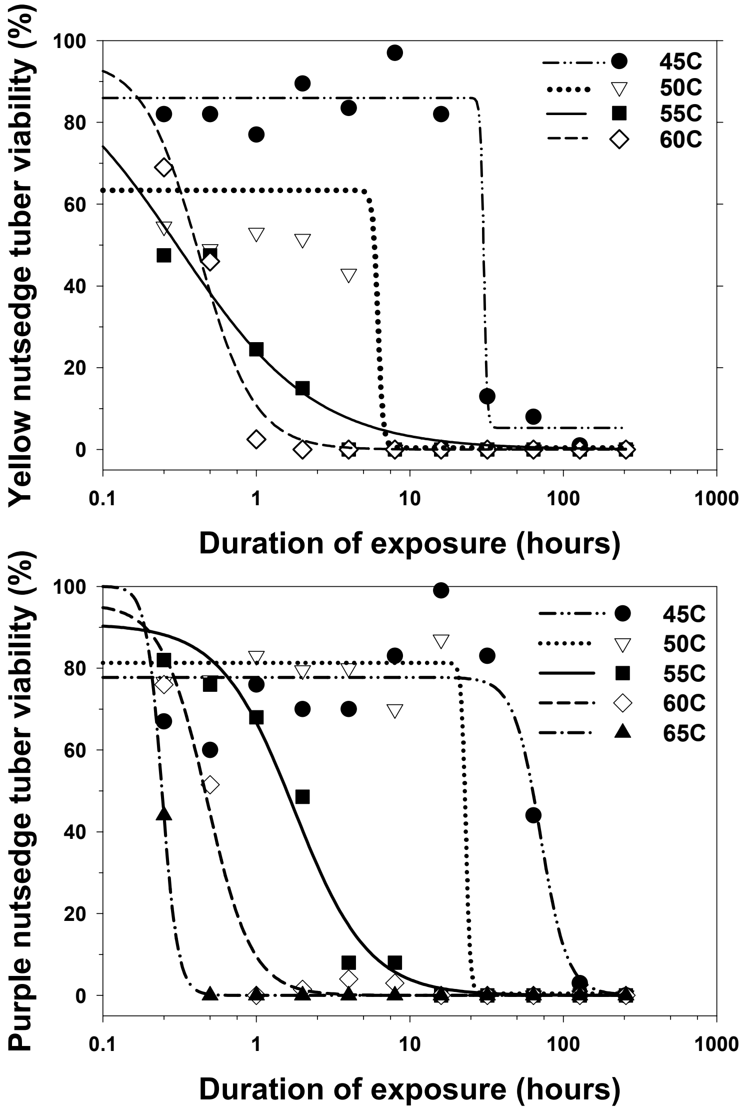
Webster, T.M. 2002. Weed survey - southern states: vegetable, fruit and nut crops subsection. Proc. South. Weed Sci. Soc. 55: 237-258.

Webster, T.M. and G.E. MacDonald 2001. A survey of weeds in various crops in Georgia. Weed Technol. 15: 771-790.

Table 1. The duration of exposure at each temperature required to reduce nutsedge tuber viability 50% ($\boldsymbol{TT_{50}}$). Asterisks indicate significant differences (evaluated by T-test) in $\boldsymbol{TT_{50}}$ values between species within a temperature treatment.

	Purple nutsedge	Yellow nutsedge
Temperature	$\boldsymbol{TT_{50}}$ (hours)	
45˚C (113 F)	71.2 (6.0)*	30.4 (9.4)*
50˚C (122 F)	23.2 (1.5)*	6.2 (1.1)*
55˚C (131 F)	1.8 (0.2)*	0.3 (0.1)*
60˚C (140 F)	0.5 (0.03)	0.4 (0.1)
65˚C (149 F)	0.2 (0.03)	——

Figure 1. The relationship between tuber viability and duration of exposure for several temperature treatments for both yellow and purple nutsedge.



Yellow nutsedge tuber viability (%)
Duration of exposure (hours)
45C
50C
55C
60C
Purple nutsedge tuber viability (%)
Duration of exposure (hours)
45C
50C
55C
60C
65C

Figure 2. Average daily maximum soil temperatures in Tifton, GA (Hoogenboom 2003).

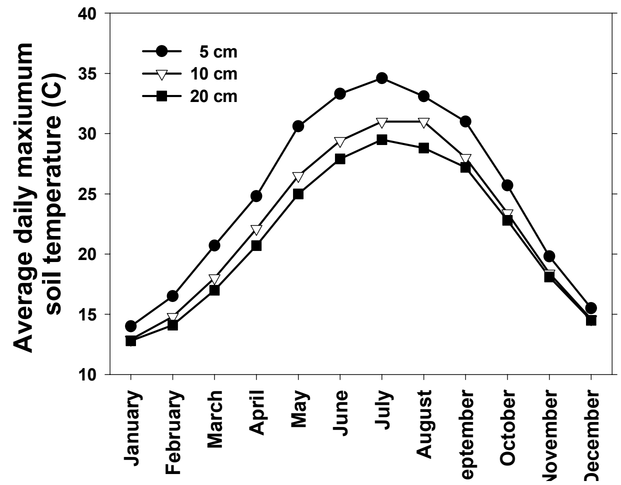
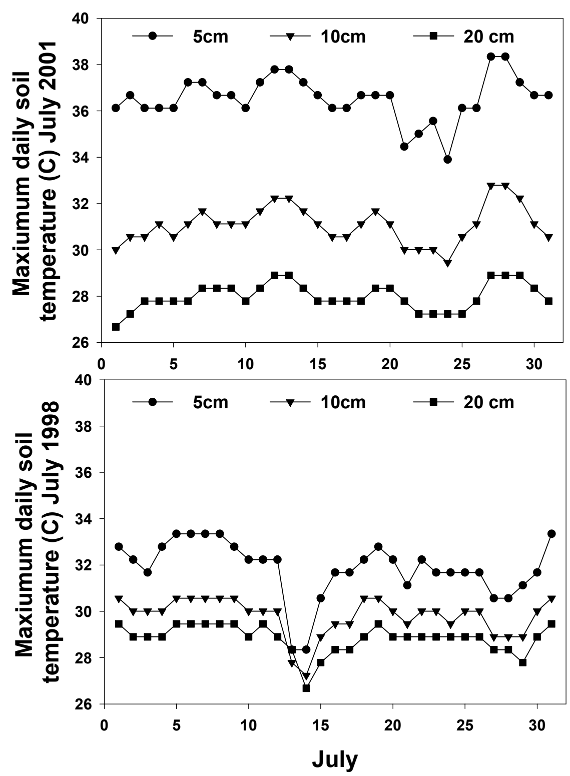


Figure 3. Daily maximum soil temperatures in July 2001 and July 1998 in Tifton, GA (Hoogenboom 2003).



A TALE OF TWO NUTSEDGES: DIFFERENTIAL EFFECTS OF POLYETHYLENE MULCH ON EARLY SEASON GROWTH OF PURPLE NUTSEDGE AND YELLOW NUTSEDGE

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Introduction

The impending elimination of methyl bromide in 2005 will leave many vegetable crops without suitable pest management alternatives (USDA-ARS 1999). Nutsedge are among the pests for which an effective alternative to methyl bromide has not yet been identified in many crops. Purple nutsedge (*Cyperus rotundus* L.) and yellow nutsedge (*Cyperus esculentus* L.) are the most troublesome weeds of vegetable crops in Georgia (Webster 2002; Webster and MacDonald 2001). Future pest management systems will need to incorporate a combination of tactics to manage weeds (especially nutsedge) in high-value vegetable crop production (Cardina et al. 1999; Patterson 1998). A greater understanding of the ecology of nutsedge in vegetable production systems will help us to devise appropriate management strategies.

The use of polyethylene mulch is common in fruiting vegetables and cucurbit production in Georgia. Suppression of the establishment of many grass and broadleaf weeds is one of the more significant benefits of polyethylene mulch (Patterson 1998). However, nutsedges are capable of penetrating the mulch and successfully competing with crops for resources (i.e. water, nutrients, space) (William 1976). Previous studies have documented that mulches can affect tuber production of yellow nutsedge (Majek and Neary 1991) and purple nutsedge (Patterson 1998), but no study has compared the two species in the same study. The objective of this study was to evaluate the growth, over a 16-week period, of a single yellow and purple nutsedge tuber and its progeny in black polyethylene, clear polyethylene, and non-mulched systems.

Materials and Methods

Greenhouse studies were conducted in Tifton, GA in 2001 and 2002. Pots (23 inch diameter, 9 inch height) were filled with sifted, sterilized soil (Dothan loamy sand). Each pot was covered with either black polyethylene mulch (1.25 mil), clear-colorless polyethylene mulch (1.25 mil), or had no mulch (non-mulched, bare-ground control). To establish the experimental units, a small hole was made in the mulch, through which a single presprouted purple nutsedge or yellow nutsedge shoot was transplanted, in the middle of each pot. There were six treatments (3 mulches by 2 species of nutsedge). The study was arranged as a randomized complete block design (blocked by initial nutsedge tuber biomass) with three replications, and was repeated over time. Pots were equipped with a drip irrigation line to facilitate watering under the mulch; pots were watered as needed.

Nutsedge shoots emerging through the mulches were monitored at least daily and marked with date of emergence for the duration of the study (16 weeks). At the conclusion of the study, wire mesh (7.1 holes/inch) stretched across wooden frame was used as a sieve to separate the tubers from the soil. Data that were collected from each treatment included: number and biomass of tubers, above-mulch shoot number and biomass, and below-mulch shoot number and biomass. Data were analyzed using analysis of variance and treatment means separated using Fisher's Protected $LSD_{0.05}$.

Results and Discussion

Tuber production. There were 366 yellow nutsedge tubers produced in the non-mulched control during the 16 weeks of the study (Table 1). Yellow nutsedge tuber production was similar to that in a field study in Minnesota (332 tubers produced in 16 weeks) (Tumbleson and Kommedahl 1961), but lower than observed in Griffin, GA (622 tubers in 17 weeks) (Hauser 1968). Yellow nutsedge growth was hindered by polyethylene mulch. Both clear and black mulch reduced yellow nutsedge tuber production nearly 50% relative to the non-mulched control (Table 1). Previous research determined that yellow nutsedge tuber populations were reduced 79% by clear mulch relative to the non-mulched control (Majek and Neary 1991). Yellow nutsedge tubers that were produced in the mulched treatments tended to be smaller (less biomass) than those in the non-mulched control.

The numbers of purple nutsedge tubers produced were similar among the mulch treatments and the non-mulched control (Table 1). Previous research demonstrated that purple nutsedge tuber populations were reduced 40% relative to the non-mulched control after 10 weeks of growth with opaque polyethylene (similar to black mulch used in our study) (Patterson 1998). In the current study, clear mulch had less purple nutsedge tuber biomass than the non-mulched control.

Purple nutsedge produced 74 to 88% fewer tubers than yellow nutsedge in each treatment (Table 1). Average biomass per tuber in the non-mulched control indicated that purple nutsedge tubers were approximately twice the mass of yellow nutsedge tubers. However, due to the high number of tubers, the sum of yellow nutsedge tuber biomass in the non-mulched control was more than double that of purple nutsedge. There were no differences in tuber biomass between species within a mulch treatment, illustrating the greater growth suppression of yellow nutsedge due to mulch.

Shoot production. The numbers of emerged yellow nutsedge shoots above black and clear mulches were reduced >96% relative to the number of shoots in the non-mulched control. There were no differences in above mulch yellow nutsedge shoot populations between mulches. Previous research determined that clear mulch had fewer above mulch shoot numbers than did black mulch (Majek and Neary 1991). In the current study, biomass of yellow nutsedge shoots above black mulch was less than the non-mulched control, but greater than that in the clear mulch. The number and biomass of yellow nutsedge shoots below the black mulch was greater than below clear mulch. These results support research results from New Jersey (Majek and Neary 1991).

There were no differences in the number of emerged purple nutsedge shoots among the mulch treatments. Previous research indicated that opaque mulch reduced purple nutsedge emergence through the mulch by 36 to 98% relative to the non-mulched control (Chase et al. 1999; Patterson 1998). However, in both of these studies, the mulch was laid over soil without nutsedge shoots protruding through the plastic. In the current study, the objective was to evaluate the growth of a single nutsedge tuber following its emergence through the mulch. Our data indicates that only 41% of the subsequently developed shoots that emerged were capable of piercing the black mulch (Table 1). The method that was used to establish these treatments may tend to underestimate the efficacy of the mulch treatments, as the first shoot did not need to pierce the mulch barrier. Purple nutsedge shoots growing above clear mulch had less biomass than the nontreated control. A similar number of purple nutsedge shoots and biomass grew below both black and clear mulches.

Conclusions:

1. The results of this study suggest that polyethylene mulches may suppress growth of yellow nutsedge more than purple nutsedge.
2. Both black and clear mulches reduced yellow nutsedge tuber production about 50% and shoot populations >96%.
3. There were few detectable differences in purple nutsedge growth between the non-mulched control and black or clear mulches.
4. Yellow nutsedge had more growth (366 tubers, 146 shoots) than purple nutsedge (66 tubers, 15 shoots) in the non-mulched control over the 16-week period of the study.

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I acknowledge the technical expertise and diligent efforts of Thomas E. Sklany in coordinating and conducting this study. I also acknowledge the assistance of Duncan McClusky and Emily Cheek of the Coastal Plain Experiment Station Library, Tifton, GA.

Literature Cited:

Cardina, J., T.M. Webster, C.P. Herms and E.E. Regnier. 1999. Development of weed IPM: levels of integration for weed management. 239-267 *in* Buhler, D.D., ed. Expanding the Context of Weed Management. Haworth Press, Inc.: New York.

Chase, C.A., T.R. Sinclair and S.J. Locascio 1999. Effects of soil temperature and tuber depth on *Cyperus* spp. control. Weed Sci. 47: 467-472.

Hauser, E.W. 1968. Yellow nutsedge - problems, research trends, and outlook. Proc. Northeast. Weed Cont. Conf. 22: 37-48.

Majek, B.A. and P.E. Neary 1991. Selective wavelength transmitting mulch for yellow nutsedge control. Proc. Brighton Crop Prot. Conf. 1: 263-268.

Patterson, D.T. 1998. Suppression of purple nutsedge (*Cyperus rotundus*) with polyethylene film mulch. Weed Technol. 12: 275-280.

Tumbleson, M.E. and T. Kommedahl 1961. Reproductive potential of *Cyperus esculentus* by tubers. Weeds. 9: 646-653.

USDA-ARS 1999. Administration extends deadline on methyl bromide ban to 2005. Methyl Bromide Alternatives Newsletter 5:1. Accessed 6 Jan. 2003. http://www.ars.usda.gov/is/np/mba/jan99/index.htm.

Webster, T.M. 2002. Weed survey - southern states: vegetable, fruit and nut crops subsection. Proc. South. Weed Sci. Soc. 55: 237-258.

Webster, T.M. and G.E. MacDonald 2001. A survey of weeds in various crops in Georgia. Weed Technol. 15: 771-790.

William, R.D. 1976. Purple Nutsedge - Tropical Scourge. HortSci. 11: 357-364.

Table 1. The effect of polyethylene mulch on the growth of a single nutsedge tuber and its progeny after 16 weeks.

		Tuber		Shoot number		Shoot biomass	
Species	Mulch	Population	Biomass	Above mulch	Below mulch	Above mulch	Below mulch
		No./plot	g/plot	No./plot		g/plot	g/plot
Purple	Black	47	17	10	14	8	6
	Clear	23	6	3	12	3	7
	None	66	24	15	N/A	11	N/A
Yellow	Black	179	20	6	73	17	17
	Clear	188	18	2	39	5	10
	None	366	60	146	N/A	36	N/A
$LSD_{0.05}$		71	13	16	9	5	4

WEED MANAGEMENT IN WATERMELON AND CANTALOUPE TRANSPLANTED ON POLYETHYLENE COVERED SEEDBEDS

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Introduction

Cucurbit crops are grown on approximately 11,000 A in Georgia, with watermelon and cantaloupe accounting for 62% of the cucurbit acreage. In previous years, much of the watermelon and cantaloupe acreage was direct seeded on freshly prepared seedbeds. Systems using hybrid cultivars seeded in greenhouses and transplanted on polyethylene covered seedbeds have recently become common. Currently, 57 and 35% of the cantaloupe and watermelon acreage, respectively, are being grown as transplants on polyethylene covered seedbeds. Hybrid seed are costly and transplanting reduces the risk of stand loss associated with direct seedings caused by an assortment of early-season production problems. Polyethylene covered seedbeds warm the soil, allowing for earlier planting and harvest during periods of historically premium commodity prices. Polyethylene covered seedbeds are generally fumigated with a broad-spectrum fumigant, particularly methyl bromide.

Methyl bromide fumigation controls most pests of cantaloupe and watermelon, including annual and perennial weeds, pathogenic fungi, bacteria, plant parasitic nematodes, and soil-inhabiting arthropods. Several weeks before seeding or transplanting, methyl bromide is injected approximately 8-in deep and immediately covered with a polyethylene tarp forming a finished seedbed approximately 12 to 60-in wide. Wider seedbeds are used for multiple crops during a growing season with drip irrigation, compared to narrower seedbeds used for one crop during a growing season with overhead irrigation. Approximately 51 and 74% of the transplanted cantaloupe and watermelon acreage, respectively, is on narrow polyethylene covered seedbeds and irrigated with overhead irrigation. Seedlings are transplanted through the polyethylene tarp two to four weeks after fumigation to allow fumigant dissipation.

Methyl bromide is thought to contribute to the depletion of stratospheric ozone. In anticipation of these findings, the U. S. Environmental Protection Agency initiated a mandatory phase-out of all methyl bromide containing fumigants by 2005. Acceptable alternatives to methyl bromide have been developed in vegetable crop transplant production and related cropping systems. Metham has been shown to be effective as methyl bromide in controlling many cool- and warm-season weeds. Sequentially applying metham with 1,3-D and/or chloropicrin improved the control of pathogenic fungi, bacteria, plant parasitic nematodes, and soil-inhabiting arthropods.

These studies inferred that growers could customize the fumigant combination according to the pests present in the soil. For example, metham alone is an excellent herbicide capable of killing dormant weed seed and fungicide. Furthermore, 1,3-D and/or chloropicrin are poor herbicides but effective nematicides. Coupled with the innate differential selectivity of the fumigants are the different types of application for optimum efficacy. Metham is chisel applied 8-in deep for control of root diseases of peanut, but provides little weed control when applied in this manner. In contrast, metham applied as spray and incorporated to a depth of 3-in gives excellent weed control, but is less effective on root diseases than chiseled applications.

There are few herbicides registered for use on watermelon and cantaloupe. In general terms, annual grasses can be effectively controlled with ethalfluralin, bensulide, sethoxydim, or clethodim. Troublesome dicot weeds such as annual morningglories (*Ipomoea* spp.), smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.], common cocklebur (*Xanthium strumarium* L.), sicklepod [*Senna obtusifolia* (L.) Irwin & Barneby], and Florida beggarweed [*Desmodium tortuosum* (Sw.) DC] cannot be controlled by any of the herbicides currently registered for use on watermelon or cantaloupe. Similarly, neither yellow nutsedge (*Cyperus esculentus* L.) nor purple nutsedge (*C. rotundus* L.) can be adequately controlled in these crops.

In 1998, trials were initiated with cantaloupe and watermelon to develop a weed management system for these crops transplanted on polyethylene covered seedbeds. Furthermore, these trials were also designed to study the role of metham fumigation, a proven alternative to methyl bromide, for weed management in these crops.

Materials and Methods

Irrigated field trials were conducted at the Coastal Plain Experiment Station Ponder Farm from 1998 to 2001. Cantaloupe trials were conducted in 1998, 1999, and 2001. Watermelon trials were conducted 1998 and 2001. All trials in 2000 were terminated due to uncontrollable foliar diseases of cantaloupe and watermelon that confounded all data. Soils were a Tifton loamy sand (fine-loamy, kaolinitic, thermic Plinthic Kandiudults), composed of the following fractions 1998 and 1999 - 86% sand, 8% silt, and 6% clay with 0.2% organic matter; 2001 - 88% sand, 6% silt, and 6% clay with 0.6% organic matter

The experimental design was a split-plot with four replications. Main plots were preplant soil fumigation; metham and a nonfumigated control. The entire experimental area was irrigated to field capacity one day prior to fumigation. Metham was sprayed and incorporated in the designated treatments with a modified power tiller using the implement described by Johnson and Webster (2001). Nondiluted metham was sprayed and incorporated at 80 gal./A (broadcast basis) in a 24-in band at a ground speed of 2 mi/h. Black polyethylene tarp (1 mil thick and 24-in wide) was spread in a separate operation using a mulch layer[1].

Sub-plots were herbicide systems in watermelon and cantaloupe; ethalfluralin (1.0 pt/A) PRE, ethalfluralin PRE followed by glyphosate (1.0 qt/A) POST-SHIELDED, and a nontreated control. Additional treatments were added in 1999 and 2001 to achieve better control of yellow nutsedge. These additional treatments were ethalfluralin plus halosulfuron (⅔ oz/A) PRE and ethalfluralin plus halosulfuron PRE followed by glyphosate POST-SHIELDED. The PRE treatments were applied immediately after transplanting. All PRE herbicides were applied with a tractor-mounted plot sprayer pressurized with CO_2, calibrated to deliver 25 gal/A with off-center nozzle tips[2] directing spray onto the edges of the polyethylene covered seedbed and into the row middles. The width of the treated swath was approximately 18-in. The POST-SHIELDED treatments were applied with a tractor mounted PTO-powered sprayer, with hoods[3] mounted on a rigid frame that used gauge wheels to stabilize the sprayer. The hoods were 28-in wide and had three overlapping nozzles inside each hood, with a total output of 25 gal/A at 22 lb/in^2. The hoods were attached to the rigid frame using articulating mounts that allowed the hood height to adjust according to topography of the field. Nylon brushes[4] were added to the bottom edges of the hoods to prevent spray from drifting under the hoods and keep the hoods from tearing the polyethylene tarp covering the seedbeds.

Main plots in both crops were 6-ft. wide and 20-ft long, with crops established in one row centered in the middle of the plot. Watermelon plots had a 12-ft. fallow border on either side of the drill for the crop's aggressive vine growth. The fallow border areas were kept weed free with tillage until vine encroachment. Cantaloupe, a crop with less aggressive vine growth than watermelon, did not require a fallow border between adjacent plots.

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[1]Pro-Junior Series mulch layer; Buckeye Tractor Company; P. O. Box 123; Columbus Grove, OH 45830.

[2]TeeJet® OC-03 spray tips; Spraying Systems Co.; P.O. Box 7900; Wheaton, Illinois 60189-7900.

[3]RedBall Hooded Sprayer; Custom Ag Products, inc.; Benson, MN 56215.

[4]Sealeze Corporation; 8000 Whitepine Rd.; Richmond, VA 23237.

'Cordele®'[5] (1998 and 1999) and 'Vienna®'[7] (2001) cantaloupe and 'Stargazer®'[7] watermelon were seeded in Speedling®[6] trays in a greenhouse in mid-March, which was concurrent with the time of fumigation and laying the polyethylene tarp in the field. Cantaloupe and watermelon seedlings were transplanted three weeks after fumigation. Seedlings were established in the field using a Kennco®[7] transplanter that cut holes in the polyethylene tarp and transplanted in one operation. Cantaloupe seedlings were spaced 22-in apart, while watermelon seedlings were spaced 36-in apart. Plots were irrigated as needed with a solid set sprinkler system. Cultural practices and pest management decisions were based on recommendations from the Georgia Cooperative Extension Service.

Visual estimates of weed control and crop injury were taken mid-season each year. Yields were measured by harvesting mature fruits from the entire plot at multiple intervals, depending on the continued presence of marketable fruits. The number and weight of cantaloupe and watermelon fruits were recorded by harvest date.

Due to differences in growing conditions and weed species among years, data were not pooled. Within each year, data were subjected to analysis of variance to determine sources of variation and significant interactions. Difference in treatment means were determined using the Fisher's Protected Least Significant Difference Test at $P \leq 0.05$.

Results and Discussion

Weed control. Florida pusley (*Richardia scabra* L.) was present in cantaloupe nontreated plots in 1998 and 1999 at approximately 10 and 2 plants/ft^2, respectively. Most of the Florida pusley were present in the row middles and some occasionally in the transplant hole. No Florida pusley emerged through the polyethylene tarp. All of the PRE weed control systems effectively controlled Florida pusley, including ethalfluralin alone (Table 1). The addition of halosulfuron PRE or glyphosate POST-SHIELDED was not necessary for adequate Florida pusley control. Regardless of the herbicides used, metham fumigation did not improve Florida pusley control compared to nonfumigated plots.

Smallflower morningglory was present in cantaloupe in 1998 and 1999 at approximately 1 plant/ft^2 both years. As was the case with Florida pusley, smallflower morningglory was present in row middles or occasionally in the transplant hole. Ethalfluralin alone did not adequately control smallflower morningglory. The sequential application of ethalfluralin PRE followed by glyphosate POST-SHIELDED improved smallflower morningglory control. In 1999, the addition of halosulfuron PRE provided a

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[5]Seminis Inc.; 2700 Camino del Sol; Oxnard, CA 93030-7967.

[6]Hummert International, Earth City, MO 63045.

[7]Kennco Manufacturing Inc., Ruskin, FL 33570.

slight increase in smallflower morningglory control, but not as much as glyphosate POST-SHIELDED. Generally, metham fumigation did not improve smallflower morningglory control compared to nonfumigated plots. Smallflower morningglory was unable to penetrate the polyethylene tarp, without respect to fumigation.

Smooth pigweed (*Amaranthus hybridus* L.) was present in watermelon in 1998 and 2001. All of the PRE weed control systems effectively controlled smooth pigweed, including ethalfluralin alone (Table 2). The addition of halosulfuron PRE or glyphosate POST-SHIELDED was not necessary for adequate smooth pigweed control. Metham fumigation did not improve smooth pigweed control, compared to nonfumigated plots.

Crowfootgrass [*Dactyloctenium aegyptium* (L.) Willd.], southern crabgrass [(*Digitaria ciliaris* (Retz.) Koel.], and Texas panicum (*Panicum texanum* Buckl.) were present in some of the trials (Tables 1 and 2). Any of the PRE treatments which included ethalfluralin effectively controlled these annual grasses in cantaloupe and watermelon. Metham fumigation did not improve control of any of the annual grasses compared to nonfumigated plots. As seen with the dicot weeds, the annual grasses did not emerge through the polyethylene tarp and were present primarily in the row middles in the nontreated controls.

Yellow nutsedge was present in both crops 1999 and 2001 at approximately 10 and 2 plants/ft^2, respectively. The most consistent and effective yellow nutsedge control in cantaloupe and watermelon was a system of metham fumigation, followed by either halosulfuron PRE or glyphosate POST-SHIELDED (Tables 1 and 2). Yellow nutsedge has been successfully controlled in several cucurbit crops with halosulfuron, applied PRE and POST, although preplant fumigation was not evaluated in those trials. In our trials, yellow nutsedge control with either halosulfuron PRE or glyphosate POST-SHIELDED was inconsistent without metham fumigation. In the absence of herbicides, metham fumigation provided only partial control of yellow nutsedge. Clearly, effective control on yellow nutsedge in cantaloupe and watermelon will require an integrated system of metham fumigation and either halosulfuron PRE or glyphosate POST-SHIELDED. Relying strictly on one tactic for yellow nutsedge control will result in escapes.

The ratings reflect a visual composite of weed control on the polyethylene covered seedbeds and row middles. Most of the yellow nutsedge present in plots fumigated with metham were in the row middles, which were not fumigated. Very little yellow nutsedge emerged through the polyethylene tarp in plots fumigated with metham, indicating good to excellent control of yellow nutsedge with metham applied using the modified power tiller developed by USDA-ARS at the Coastal Plain Experiment Station in Tifton, GA (Figure 1).

<u>Visual injury</u>. Cantaloupe was not significantly injured by metham fumigation or any of the herbicide treatments in 1998, 1999, and 2001 (Table 1). Injury was observed, but was sporadic and nonsignificant. Watermelon was not injured by metham fumigation or any of the herbicide treatments in 1998 (Table 2). However, some of the herbicide treatments

stunted watermelon in 2001. The most injurious treatment to watermelon in 2001 was ethalfluralin plus halosulfuron, despite precise application onto the shoulders of the polyethylene covered seedbed and with no contact onto the cucurbit seedlings. Ethalfluralin applied after transplanting is an acceptable time of application, without significant injury. Wells (1999) significantly injured watermelon with halosulfuron PRE, although those applications were to direct seeded watermelon. Our results demonstrate an overall acceptable level of crop safety by applying PRE herbicides to the shoulders of the polyethylene covered seedbeds and avoiding direct contact with cantaloupe and watermelon seedlings.

Cantaloupe yield. Cantaloupe yields (number of fruits/A) were not affected by the interactive effects of metham fumigation and herbicide systems for weed control throughout the duration of the trial (Table 3). Similarly, cantaloupe yields expressed as weight of fruits/A were not affected (data not shown). Marketable cantaloupe fruits were harvested multiple times to determine if treatments affected maturity. Data from each of the harvest dates showed no effect of metham fumigation and herbicide systems on cantaloupe maturity (data not shown). Size of cantaloupe fruits (lb/fruit) were not consistently affected by metham fumigation and herbicide treatments throughout the duration of the trial (Table 3). Fruit size was significantly smaller only in 1999 in the nonfumigated, nontreated control compared to any of the herbicide treatments in the nonfumigated plots.

Watermelon yield. Watermelon yields (number of fruits/A) were not affected by the interactive effects of metham fumigation and herbicide treatments (Table 4). Similarly, yields expressed as weight of fruits/A were not affected (data not shown). Marketable watermelon fruits were harvested multiple times to determine if treatments affected maturity. Data from each of the harvest dates showed no effect of metham fumigation and herbicide treatments on watermelon maturity (data not shown). Size of watermelon fruits were not affected by metham fumigation and herbicide treatments throughout the duration of the trial (Table 4).

The lack of cantaloupe and watermelon yield response to weed control was not expected, considering the extraordinary weed densities encountered each year. These results suggest that transplanted cantaloupe and watermelon grown on polyethylene-covered seedbeds are quite competitive with weeds and the polyethylene tarp itself may be an effective weed control practice. The only weed to penetrate and emerge through the polyethylene tarp was yellow nutsedge. All the dicot weeds and annual grasses in these trials were unable to penetrate the polyethylene tarp. In addition, transplant holes were punched through the polyethylene tarp concurrent with transplanting cantaloupe and watermelon seedlings. This appears to have helped minimize incidence of weeds emerging through the transplant hole, compared to transplant holes present for several days or weeks prior to planting. A rapidly growing cucurbit seedling has a decided competitive advantage with newly emerged weeds in this system. Rapidly growing cucurbit crops have been recognized as being highly competitive with weeds. The rapid crop growth seen in systems of cucurbit transplants on polyethylene covered seedbeds gives growers opportunities to manage many troublesome weed species, including yellow nutsedge, with minimal dependence on herbicides.

It was beyond the scope of this trial to compare weed control strategies for direct seeded versus transplanted cucurbits and bare ground versus polyethylene-covered seedbeds. However, inferences can be made that weed control in cucurbits transplanted on polyethylene-covered seedbeds will be assisted by the mechanical barrier provided by the polyethylene tarp. With the weed densities and species diversity encountered in these trials, weed control efforts outside those provided by the polyethylene tarp were generally not needed.

It is possible that under different conditions, additional weed control would be needed. Metham fumigation effectively controlled all species under the polyethylene tarp, including yellow nutsedge. Ethalfluralin PRE, halosulfuron PRE, and glyphosate POST-SHIELDED effectively controlled the species encountered in these trials, without excessive crop phytotoxicity and delays in maturity. Halosulfuron PRE and glyphosate POST-SHIELDED have the potential to significantly broaden the weed control spectrum available to cucurbit growers if granted registration. The occasional stunting of cantaloupe and watermelon from halosulfuron PRE was not expressed in yield reduction or delayed maturity. It appears that the weed control benefits of halosulfuron PRE in transplanted cantaloupe and watermelon compensate for the risks of phytotoxicity in these cropping systems.

Regardless of weed control options employed by cucurbit growers, the most successful approach is an integration of cultural practices (such as using transplants on polyethylene covered seedbeds) and judicious use of fumigants and herbicides tailored for the pests present. Optimum growing conditions and production practices are necessary for maximizing the substantial crop competition benefits. Properly applying PRE and POST-SHIELDED herbicides on the edges of the polyethylene covered seedbeds will optimize weed control efficacy and minimize crop phytotoxicity.

Acknowledgments

We acknowledge the technical contributions of Daniel R. Evarts in these trials. Mr. Evarts was solely responsible for the design and construction of the modified equipment used for preplant fumigation and herbicide application in these trials, along with overall field operations. Seminis Inc. graciously provided the cantaloupe and watermelon seeds used in these trials.

Literature Cited

Anonymous. 1998. Scientific assessment of ozone depletion: 1998 - executive summary. World Meteorological Organization Global Ozone Research and Monitoring Project. Report No. 44.

Cline, W. O. and M. K. Beute. 1986. Effect of metam sodium, peanut genotype and inoculum density on incidence of *Cylindrocladium* black rot. Peanut Sci. 13:41-45.

Csinos, A. S., W. C. Johnson, III, A. W. Johnson, D. R. Sumner, R. M. McPherson, and R. D. Gitaitis. 1997. Alternative fumigants for methyl bromide in tobacco and pepper transplant production. Crop Protection 16:585-594.

Csinos, A. S., D. R. Sumner, W. C. Johnson, III, A. W. Johnson, R. M. McPherson, and C. C. Dowler. 1999. Methyl bromide alternatives in tobacco, tomato and pepper transplant production. Crop Protection (In press).

Doherty, B. A. and W. O. Mizelle, Jr. 2001. 2000 Vegetable Survey. Georgia Fruit and Vegetable Growers News. Summer 2001.

Grey. T. L., D. C. Bridges, and D. S. NeSmith. 2000. Tolerance of cucurbits to the herbicides clomazone, ethalfluralin, and pendimethalin. II. watermelon. HortScience. 35:637-641.

Johnson, W. C., III and T. M. Webster. 2001. A modified power-tiller for metham application on cucurbit crops transplanted to polyethylene covered seedbeds. Weed Technol. 15:387-395.

Mitchem, W. E., D. W. Monks, and R. J. Mills. 1997. Response of transplanted watermelon (*Citrullus lanatus*) to ethalfluralin applied PPI, PRE, and POST. Weed Technol. 11:88-91.

Monks, D. W. and J. R. Schultheis. 1998. Critical weed-free period for large crabgrass (*Digitaria sanguinalis*) in transplanted watermelon (*Citrullus lanatus*). Weed Sci. 46:530-532.

Nerson, H. 1989. Weed Competition in muskmelon and its effects on yield and fruit quality. Crop Protection. 8:439-443.

Noling, J. W. and J. O. Becker. 1994. The challenge of research and extension to define and implement alternatives to methyl bromide. Suppl. J. Nem. 26:573-586.

Teasdale, J. R. and R. B. Taylorson. 1986. Weed seed response to methyl isothiocyanate and metham. Weed Sci. 34:520-524

USDA. 1999. Administration extends deadline on methyl bromide ban to 2005. Methyl Bromide Alternatives 5:1.

Webster, T. M., A. S. Csinos, A. W. Johnson, C. C. Dowler, D. R. Sumner, and R. L. Fery. 2001. Methyl bromide alternatives in a bell pepper-squash rotation. Crop Protection. 20:605-614.

Wells, J. J. 1999. Yellow nutsedge control in summer vegetables and development of glyphosate-tolerant spinach. PhD Dissertation. University of Arkansas. 127 p.

Table 1. Visual estimates of weed control and crop injury in transplanted cantaloupe on polyethylene covered seedbeds at Tifton, GA.

	1998			1999					2001		
	RCHSC[1]	IAQTA[1]	Injury	RCHSC	IAQTA	CYPES[1]	PANTE[1]	Injury	CYPES	DIGSP[1]	Injury
	%			%					%		
Metham fumigation											
Ethalfluralin	90	69	0	95	92	78	95	0	76	90	0
Ethalfluralin/glyphosate	94	85	0	95	93	95	94	0	79	90	0
Ethalfluralin + halosulfuron	-	-	-	95	95	95	95	2	88	90	1
Ethalfluralin + halosulfuron/glyphosate	-	-	-	95	94	95	95	7	89	90	0
Nontreated	43	64	0	73	70	75	68	0	73	48	3
Nonfumigated											
Ethalfluralin	93	85	0	90	88	77	94	0	54	90	5
Ethalfluralin/glyphosate	95	93	0	95	95	78	92	2	55	90	3
Ethalfluralin + halosulfuron	-	-	-	93	90	82	88	2	56	90	4
Ethalfluralin + halosulfuron/glyphosate	-	-	-	95	95	92	95	0	60	90	10
Nontreated	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)	5	14	-	7	7	14	11	ns	16	2	6

[1]Abbreviations: CYPES, yellow nutsedge, *Cyperus esculentus* L.; DIGSP, southern crabgrass, *Digitaria ciliaris* (Retz.) Koel.; IAQTA, smallflower morningglory, *Jacquemontia tamnifolia* (L.) Griseb.; PANTE, Texas panicum, *Panicum texanum* Buckl.; RCHSC, Florida pusley, *Richardia scabra* L

Table 2. **Visual estimates of weed control and crop injury in transplanted watermelon on polyethylene covered seedbeds at Tifton, GA.**

	1998			2001			
	AMACH[1]	DTTAE	Injury	CYPES	AMACH	DIGSP	Injury
	----------- % -----------			----------------------- % -----------------------			
Metham fumigation							
Ethalfluralin	95	95	0	76	89	90	5
Ethalfluralin/glyphosate	95	95	0	89	90	90	6
Ethalfluralin + halosulfuron	-	-	-	89	90	90	13
Ethalfluralin + halosulfuron/glyphosate	-	-	-	89	90	90	0
Nontreated	50	50	0	90	70	40	0
Nonfumigated							
Ethalfluralin	91	94	0	80	90	90	11
Ethalfluralin/glyphosate	95	95	0	71	90	90	3
Ethalfluralin + halosulfuron	-	-	-	85	89	90	18
Ethalfluralin + halosulfuron/glyphosate	-	-	-	88	90	90	13
Nontreated	0	0	0	0	0	0	0
LSD (0.05)	8	7	-	12	10	1	12

[1]AMACH, smooth pigweed, *Amaranthus hybridus* L.; CYPES, yellow nutsedge, *Cyperus esculentus* L.; DIGSP, southern crabgrass, *Digitaria ciliaris* (Retz.) Koel.; DTTAE, crowfootgrass, *Dactyloctenium aegyptium* (L.) Willd.

Table 3. Effect of weed control with metham fumigation and herbicides on transplanted cantaloupe yield at Tifton, GA.

	Total Yield[1]			Fruit Size		
	1998	1999	2001	1998	1999	2001
	------------------ no/A ------------------			----------------- lb/fruit ---------------		
Metham fumigation						
Ethalfluralin	5900	2420	5900	1	1.1	1.9
Ethalfluralin/glyphosate	4810	4960	5450	1.1	1.2	1.9
Ethalfluralin + halosulfuron	-	2780	6810	-	1.2	1.8
Ethalfluralin + halosulfuron/glyphosate	-	3510	5990	-	1.2	1.7
Nontreated	3900	2300	5450	0.8	1.1	1.8
Nonfumigated						
Ethalfluralin	5170	3510	5630	1.1	1.4	1.7
Ethalfluralin/glyphosate	5720	4360	6170	1.1	1.3	1.7
Ethalfluralin + halosulfuron	-	3750	5900	-	1.3	1.4
Ethalfluralin + halosulfuron/glyphosate	-	3270	5530	-	1.3	1.8
Nontreated	3810	2780	5530	0.8	1	1.7
LSD (0.05)	ns	ns	ns	ns	0.2	ns

[1]Total yield from multiple harvest dates; 1998, four harvests; 1999, two harvests; 2001, three harvests.

Table 4. Effect of weed control with metham fumigation and herbicides on transplanted watermelon yield at Tifton, GA.

	Total Yield[1]		Fruit Size	
	1998	2001	1998	2001
	------- no/A -------		----- lb/fruit -----	
Metham fumigation				
Ethalfluralin	2810	3000	5.2	5.8
Ethalfluralin/glyphosate	4170	3810	5.4	5.9
Ethalfluralin + halosulfuron	-	2720	-	6
Ethalfluralin + halosulfuron/glyphosate	-	3090	-	6
Nontreated	2450	1810	4.9	5
Nonfumigated				
Ethalfluralin	3090	3000	5.3	6
Ethalfluralin/glyphosate	3180	3270	5.4	6.5
Ethalfluralin + halosulfuron	-	2180	-	5.8
Ethalfluralin + halosulfuron/glyphosate	-	2630	-	5.9
Nontreated	2720	910	5.2	4.2
LSD (0.05)	ns	ns	ns	1.5

[1]Total yield from three harvest dates.

Figure 1. Overall view of Ferguson Tillervator® modified for banded applications of metham in transplanted cantaloupe and watermelon on polyethylene covered seedbeds. Notable features include: gang of C-shaped tines set to till a band width of 24-in, gauge wheels to stabilize depth of tillage, a single flood-jet spray tip spraying a band 24-in wide, metal shield protecting the spray pattern from disruption by tilled soil, fluted coulter, a single in-row subsoil shank with mounting bracket allowing clearance beneath PTO shaft, hiller disks to shape seedbeds after tillage, and steel plate to seal the tilled seedbed with a light crust. A complete description of this tiller is published in Weed Technol. 15:387-395 (2001). This tiller was designed and constructed by Mr. Dan Evarts, USDA-ARS.

Economics
&
Marketing

FRESH-MARKET VEGETABLE OUTLOOK

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Introduction

Fresh vegetable production and marketing continues to be a rapidly growing industry. This fast-paced industry is also plagued with several problems and risks at every stage of production and marketing. Farmers are faced with labor problems, pests, diseases, numerous restrictions and high cost of production to say the least. On the other hand, there are very limited market windows. The available regional and international opportunities are extremely competitive. This study is aimed at (a) analyzing various market trends and outlook, (b) review of the import and export trends and (c) analysis of production practices.

Material and Methods

Pertinent information to meet the objectives of this study will be from the collection of secondary data. The Economic Research Service of the United States Department of Agriculture (USDA) and the National Agricultural Statistics Service, USDA will be the main source of information. Furthermore, descriptive statistics such as graphs and/or time-series will be used to illustrate specific objectives of this study.

Results and Discussions

The United States vegetable industry experienced a 4.3% drop in harvested area in 2003 compared with 2002. There was a slight increase in the production of fresh vegetables and melon, processing and potatoes respectively. The others category in this study includes such vegetables as sweet potatoes, dry peas, lentils and mushrooms (Table 1).

Table 1: U.S. Vegetable Industry Production Trend

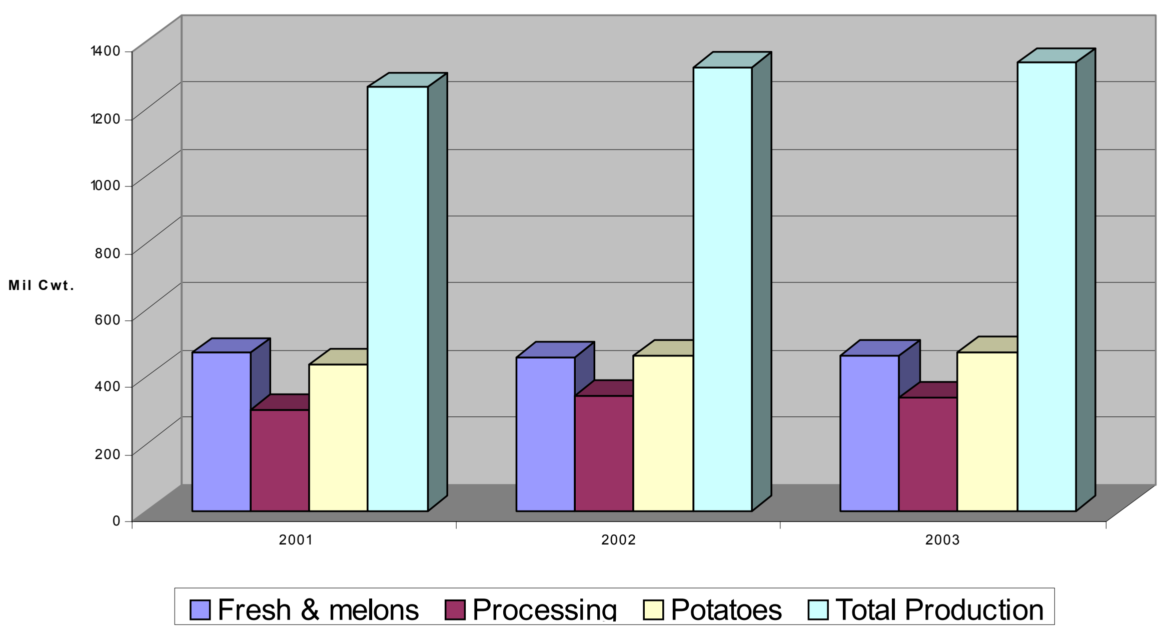
Items	Unit	2001	2002	2003
Area harvested	1,000 ac	6,336	6,865	6,567
Fresh & Melon	1,000 ac	2,038	1,934	1,943
Processing	1,000 ac	1,334	1,349	1,340
Potatoes	1,000 ac	1,222	1,268	1,265
Dry beans	1,000 ac	1,249	1,727	1,400
Other	1,000 ac	494	587	620

Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17

On the other hand, there was a 1% increase in total production from 1,322 to 1,335 million acres (Figure 1). Total production includes fresh vegetables and melon, processing, potatoes, dry beans and others, i.e. sweet potatoes, dry peas, lentils and mushrooms.

Due to the shortage in acreage harvested, the slight increase in production had no impact on the total vegetable crop value (Table 2). Year 2002 was a much better year for the vegetable industry with a 4.2% increase in value compared with 2001. Fresh vegetables, melons and potatoes together contributed 59.2% and 20.6% of the total vegetable crop value respectively in 2003. According to ERS report (2003), watermelon is still the number one crop in the United States in terms of planted area, production and per capita consumption.

Figure 1: United States Vegetable Production, 2001 – 2003 (million cwt).



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17

There was an increase in imported vegetable value in 2002 compared with 2001 (Table 3). There was no change in 2003 compared with 2002. Fresh vegetables and melons still command 56% of total import value while processing commands 21.7%. Others category include mushrooms, dry peas, lentils, sweet potatoes and vegetable seeds.

Table 2: U.S. Vegetable Industry Crop Value Trend, 2001-2003

Items	Unit	2001	2002	2003
Vegetable Crop value	$ million	14,927	15,550	15,461
Fresh & melons	$ million	8,967	9,282	9,150
Processing	$ million	1,325	1,404	1,395
Potatoes	$ million	3,058	3,151	3,200
Dry beans	$ million	426	520	500
Others	$ million	1,151	1,193	1,216

Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17

Import and Export Trend

The United States Vegetable Industry had a negative trade balance in 2003, with $4.8 million import recorded (Table 3) compared with $3.4 million export. Negative balances have been reported for the past three years. Fresh vegetables and melons represent 36.2% of U.S. export value compared with 25% of processing value.

Table 3: U.S. Vegetable Industry, Import Trade, 2001-2003

Items	Unit	2001	2002	2003
Imported Vegetables	$ million	4544	4814	4831
Fresh & melons	$ million	2,592	2,614	2,725
Processing	$ million	1,020	1,189	1,050
Potatoes	$ million	523	575	630
Dry beans	$ million	51	67	53
Others	$ million	357	369	373

Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17

The United States Imported more processed vegetables in 2001 through 2003 than it exported. On the other hand, the U.S. exported more potatoes and dry beans during the same years than it imported. There was no difference in the value of imported and exported mushroom, dry peas, lentils, sweet potatoes and vegetable seeds.

Table 4: U.S. Vegetable Industry, Export Trade, 2001-2003

Items	Unit	2001	2002	2003
Exported Vegetables	$ million	3212	3274	3366
Fresh & melons	$ million	1,183	1,204	1,220
Processing	$ million	815	798	848
Potatoes	$ million	700	723	710
Dry beans	$ million	176	180	189
Others	$ million	338	369	400

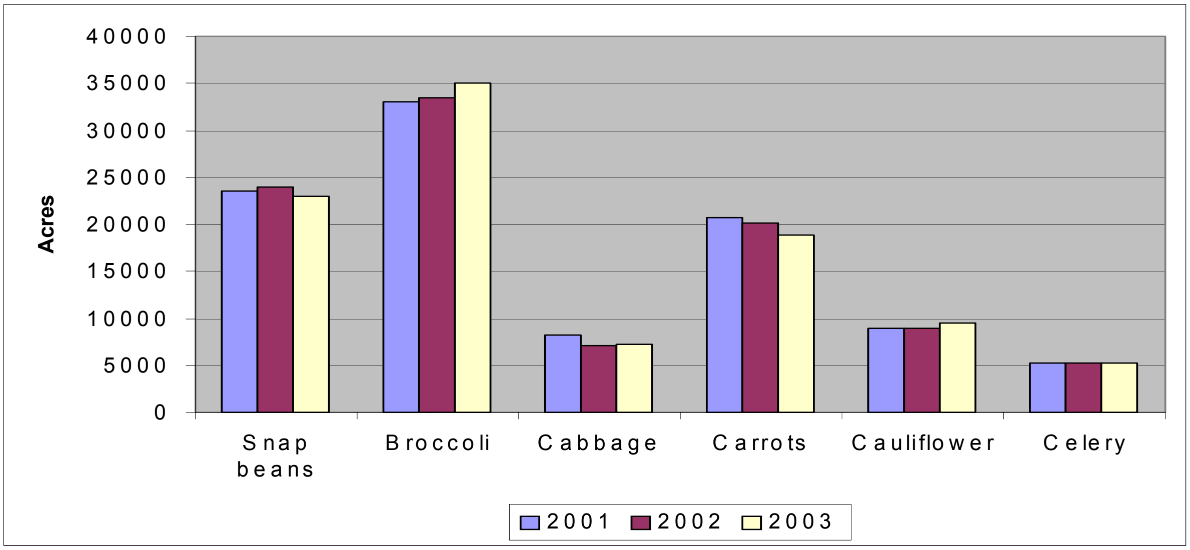
Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April

Production Trend

Production areas for snap beans and carrots during spring-season fresh market, decreased in 2003 compared with the previous year whereas there was an increase in broccoli planted acreage (Figure 2). Cabbage, cauliflower and celery remained unchanged. Winter-season fresh market snap beans acreage was approximately 50% less than spring-season for years 2001, 2002 and 2003 respectively. A similar trend was observed with broccoli, sweet corn, bell pepper, and tomatoes. Production acreage for carrots and head lettuce were significantly higher in the winter-season than in the spring-season (ERS, USDA, 2003).

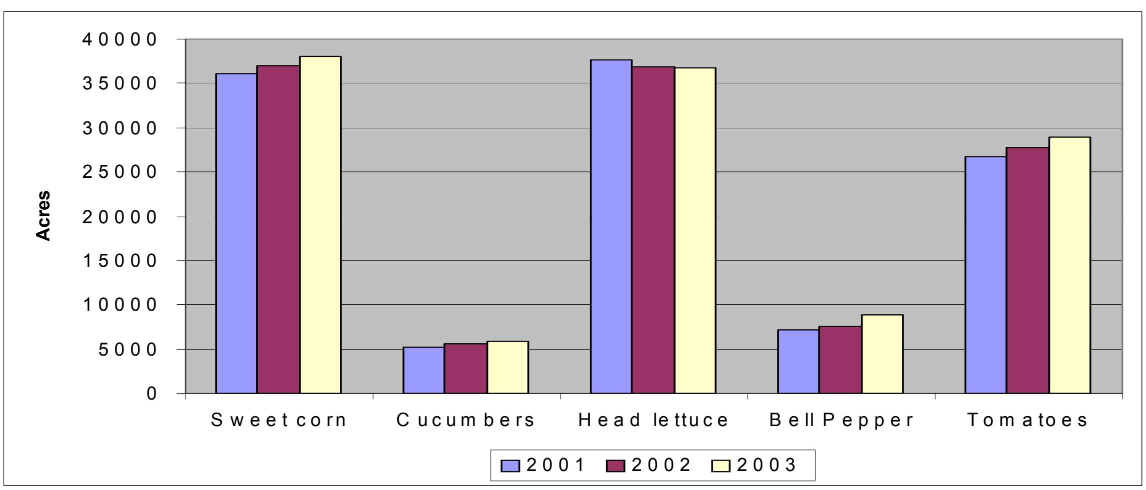
Figure 2: Spring-Season Fresh-Market Vegetable Area, 2001-2003

Source: NASS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April



Sweet corn, bell pepper and tomatoes reported increased acreage during 2003 spring-season fresh market production whereas cucumbers and head lettuce remained the same (Figure 3). For the three years in Figure 3, sweet corn and tomatoes maintained a slight but consistent increase while cucumbers, head lettuce and bell peppers showed no change.

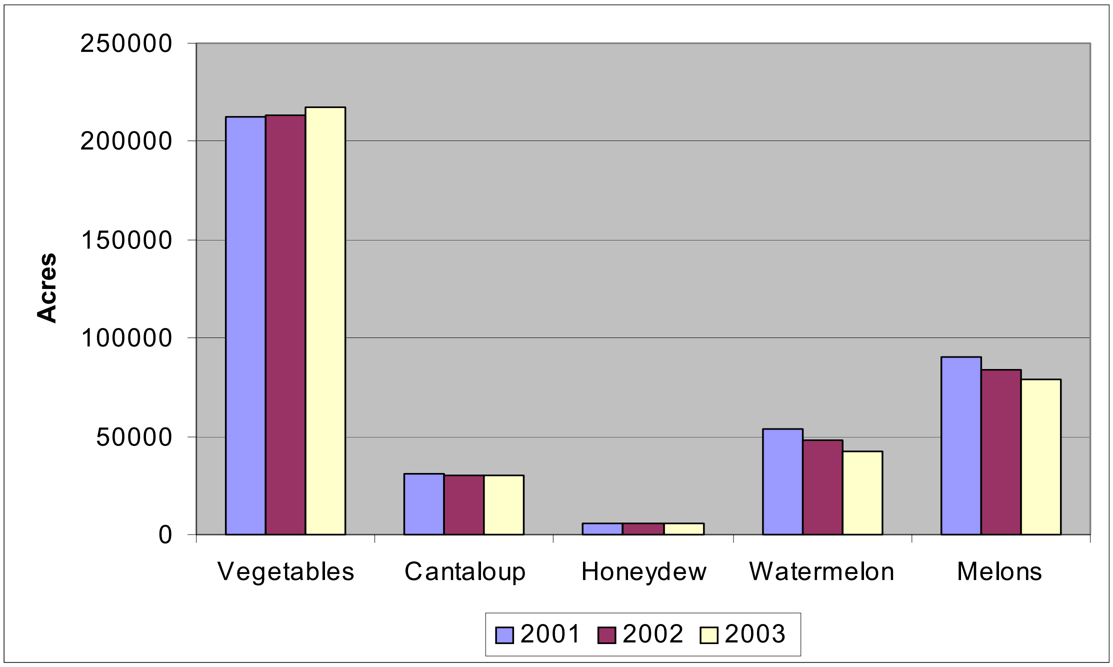
Figure 3: Spring-Season Fresh-Market Vegetable Area, 2001-2003



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April

Fresh vegetables include asparagus and onions. Figure 4 shows that there was no change in spring-season vegetables, cantaloupe and honeydew acreage in 2003. Watermelon and melon acreage decreased in the same period. Cantaloupe, honeydew and watermelon production were lower than 50,000 acres overall.

Figure 4: Spring-Season Fresh-Market Vegetable Area, 2001-2003



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April

REFERENCE

1. ERS, USDA (2003) Vegetables and Melons Outlook/VGS-295, February 25

2. ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296, April 17.

VEGETABLE WHOLESALE PRICE TREND

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Introduction

One of the major problems facing vegetable growers is price fluctuation. Vegetables are highly perishable with a short shelf life. Good pricing is an essential component for profit maximization. If the prices are good, the gap caused by the high cost of production is narrowed and profitability is improved. The reverse is true when depressing prices set into the equation.

In order to select pricing objective, it is important for the farmer to decide the target market. In the vegetable industry, most farmers or companies adopt the survival objective strategies due to (1) fierce competition, (2) increasing changes in consumer wants (3) overcapacity, (4) increasing regulations on input and chemical applications and (5) consumer awareness and health conscious attitude. Unfortunately however, the survival strategy is short-run incline. As long as the farmers can cover their variable and a portion of their fixed costs, there are still in business.

The primary objective of this research is to investigate wholesale price trend for vegetables. The specific objective is to analyze the wholesale price of selected vegetables in the Chicago Wholesale Market, originating from all over the United States, Costa Rica, Mexico, Canada and Honduras.

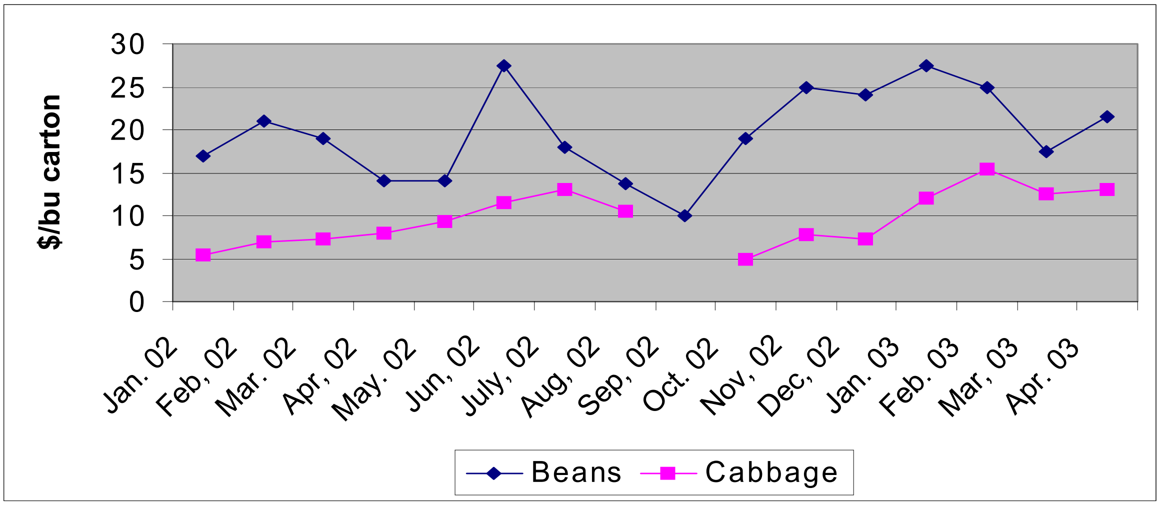
Material and Methods

Descriptive statistics such as graphs and/or time-series will be used to illustrate price trend for the specific objective. Secondary data will be collected from the Economic Research Service/USDA.

Results and Discussions

Wholesale prices for vegetables fluctuated from month to month. Price trend for snap beans in Chicago depicted how volatile prices are. The highest prices were obtained in June 2002. Thereafter, prices took a serious nosedive until September 2002 when an upward trend set in. Another peak was observed in January 2003. Cabbage prices were gradually on the rise in 2002 but the best price was obtained in February 2003. Figure 1 shows that the highest price for beans from Florida, Georgia and Michigan was $27.50 per bushel carton in June 2002 and January 2003 while the lowest price was recorded in September 2002 at $10 per bushel carton.

Figure 1: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

Prices for greens such kale and turnip started off on the wrong footing in the early part of 2002, i.e. $9 and $7.50 per carton of 24s respectively and both prices leveled off. Figure 2 shows that green kale and turnip prices peaked in March 2003 at $17 and $12 per carton respectively.

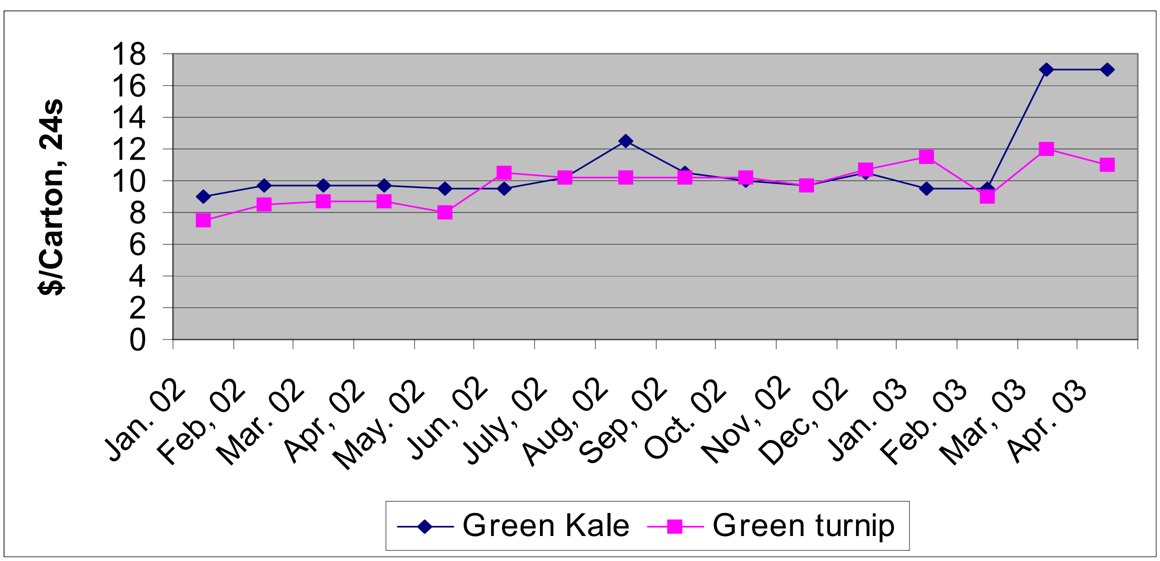
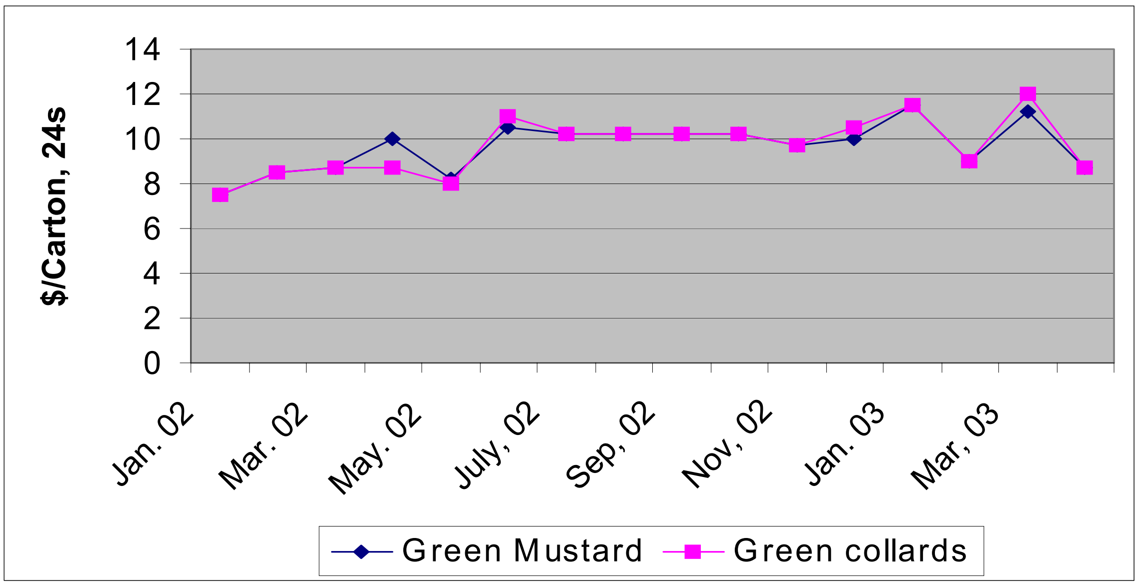


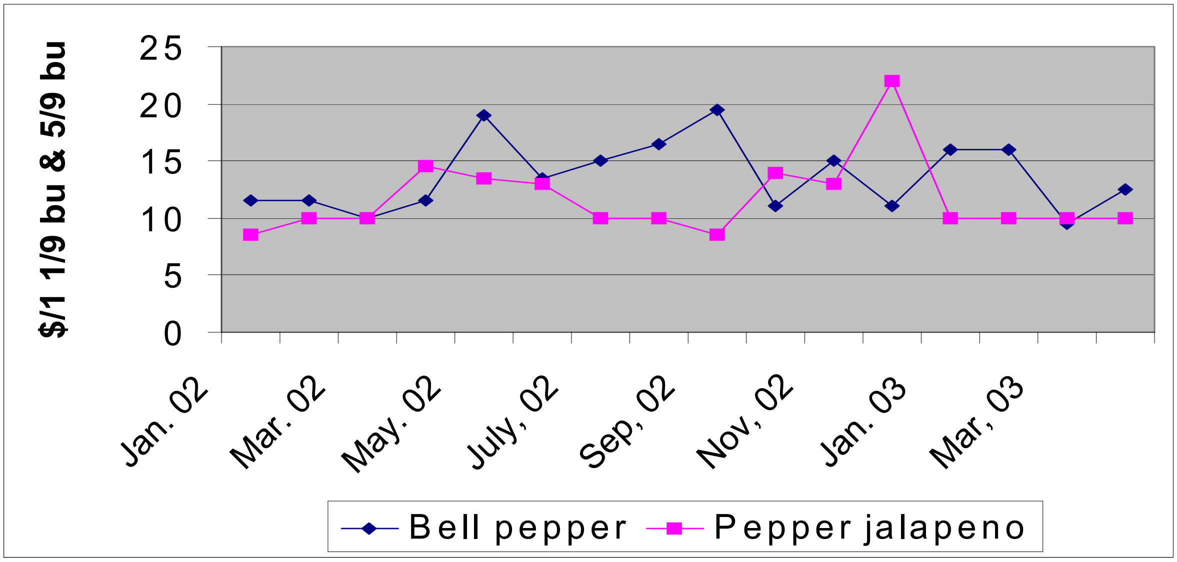
Figure 2: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

There was no significant change in the wholesale prices for mustard and collard greens obtained by Georgia and California growers in the Chicago wholesale market as shown in Figure 3. Price trend for these two vegetables were more or less the same from January 2002 commencing at $7.50 per carton of 24s to $12 and $11.50 per carton concomitantly in March 2003.

Figure 3: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

Figure 4 shows that bell pepper continues to command better prices per 1 1/9 or 5/9 bushel than jalapeno except in December 2002 when jalapeno price exponentially rose to $22 per 1/2 and 5/9 bushel crates compared with $11 for green pepper.

Bell pepper prices peaked in May and September 2002 before plummeting. Jalapeno prices were less fluctuating compared to bell pepper. These wholesale prices were obtained by Florida, Georgia and Michigan in the Chicago Market Point.

Figure 4: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03

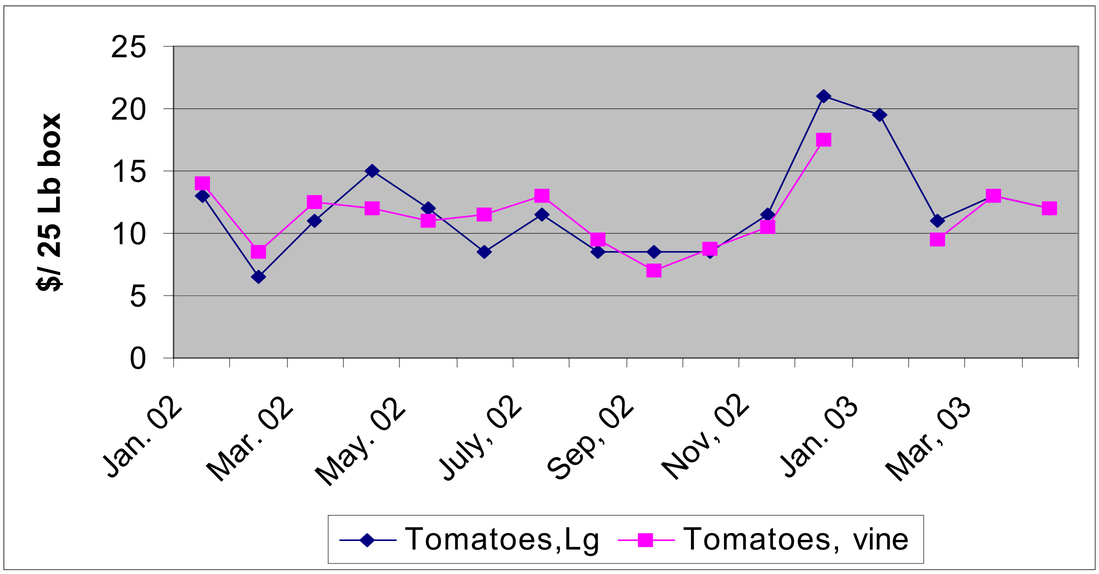
Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

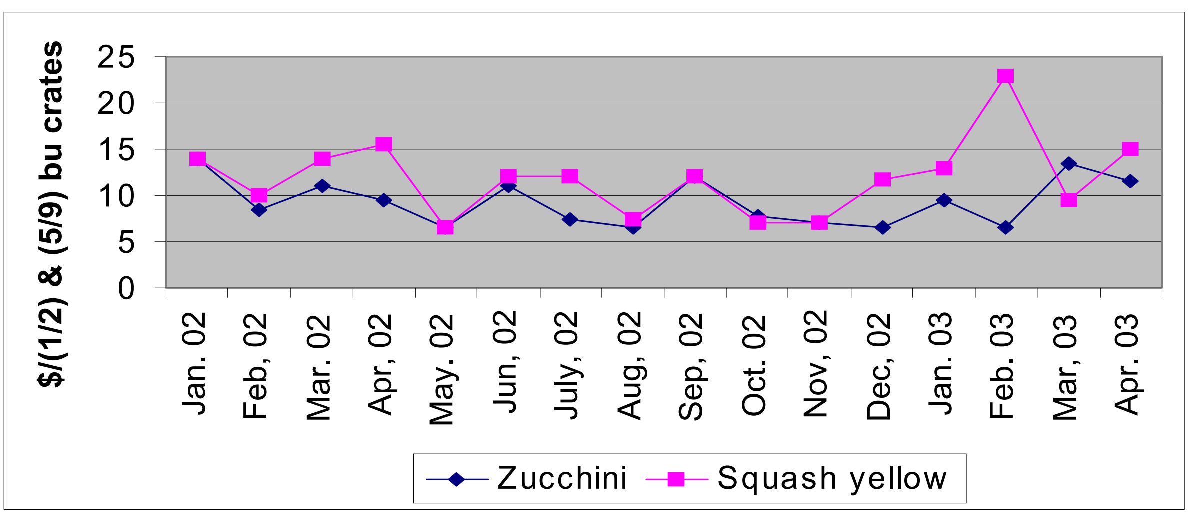
Figure 5 shows the zigzag wholesale price trend for zucchini and yellow straightneck medium squash. There was no significant difference in both crop prices until December 2002 when yellow squash price for 1/2 and 5/9 bushel crates skyrocketed and peaked at $23 in February 2003, almost twice as much as its average prices.

Figure 5: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03
Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

On the other hand, Figure 6 shows that mature green large tomatoes and vine ripe, large 6 x 6s tomatoes both commanded similar price trend. The peak price for both was recorded in December 2002 at $21 and $17.50 respectively. The least price was recorded in February 2002 at $6.50 and $8.50 per 25 Lb carton.

Figure 6: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03

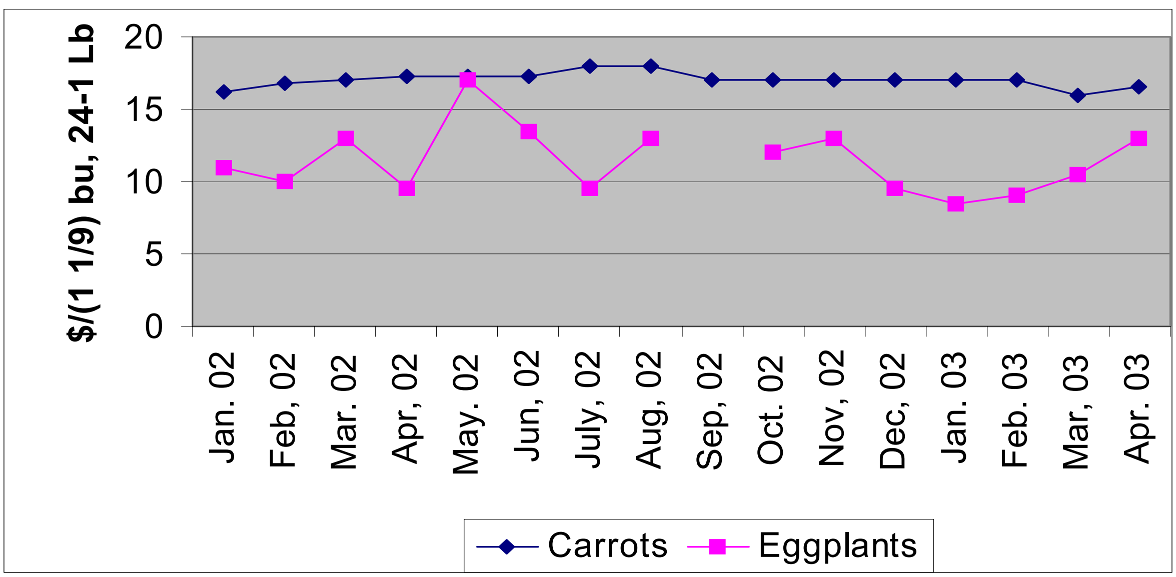




Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

Wholesale price for 24-1 Lb film bag carton of baby peeled carrots is the most consistent compared with other vegetables. It slightly fluctuates from $16 to $18 per carton year round, with April to June being the most favorite, i.e. $17.25 to $18 per carton. Eggplant prices on the other hand were volatile, with the peak recorded in May 2002 at $17 for medium size, 1 1/9 bushel carton. The minimum price was recorded in January and February 2003 at $8.50 and $9.00 per 1 1/9 bushel carton respectively (Figure 7).

Figure 7: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

Besides cherry tomatoes that have a more or less consistent price trend, green house, vine ripe medium and large tomato prices are as fluctuating as the plum-type tomatoes coming from California, Florida and Mexico. Three significant peaks were reported for plum-type tomatoes. Green house tomatoes obtained better prices from January to April 2002 before the downward trend set in. Another peak price was observed in the early part of 2003 as shown in Figure 8.

Figure 8: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03

Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

Figure 9 show that honeydews from California, Honduras and Costa Rica receive a less fluctuating prices compared with cantaloupe from California, Costa Rica and Mexico for 1/2 cartons of 15s and 2/3 cartons of 6s. Honeydew price is usually better in the early part of each year. Cantaloupe's peak prices were also recorded in the early part of 2002 and 2003 respectively.

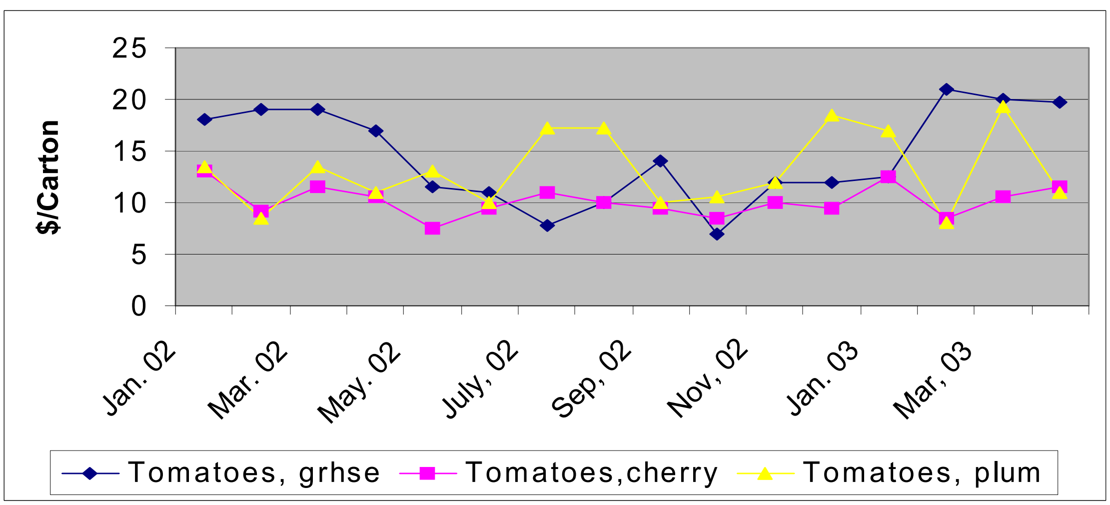
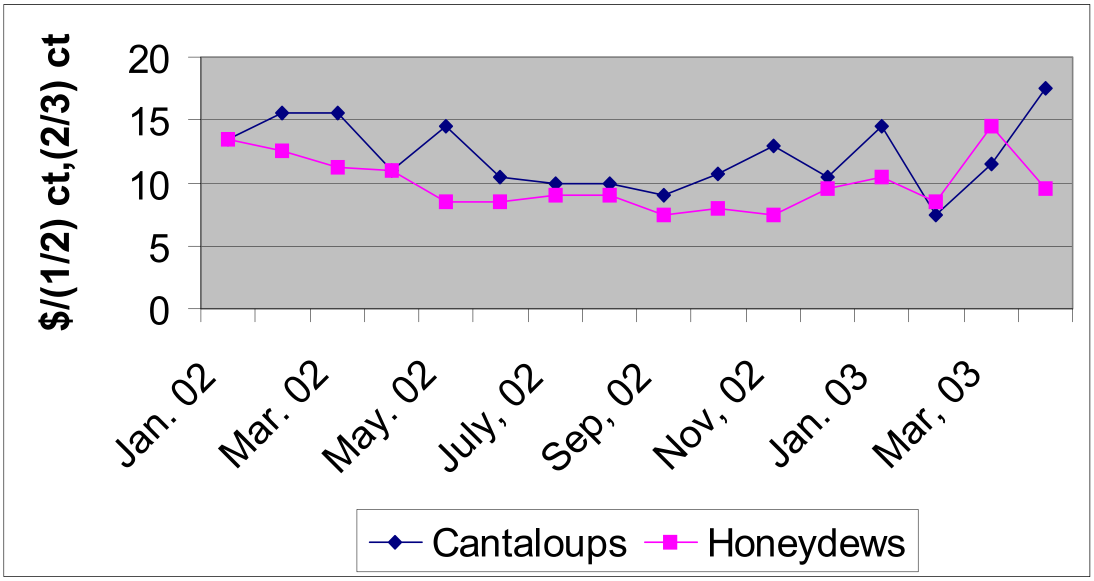


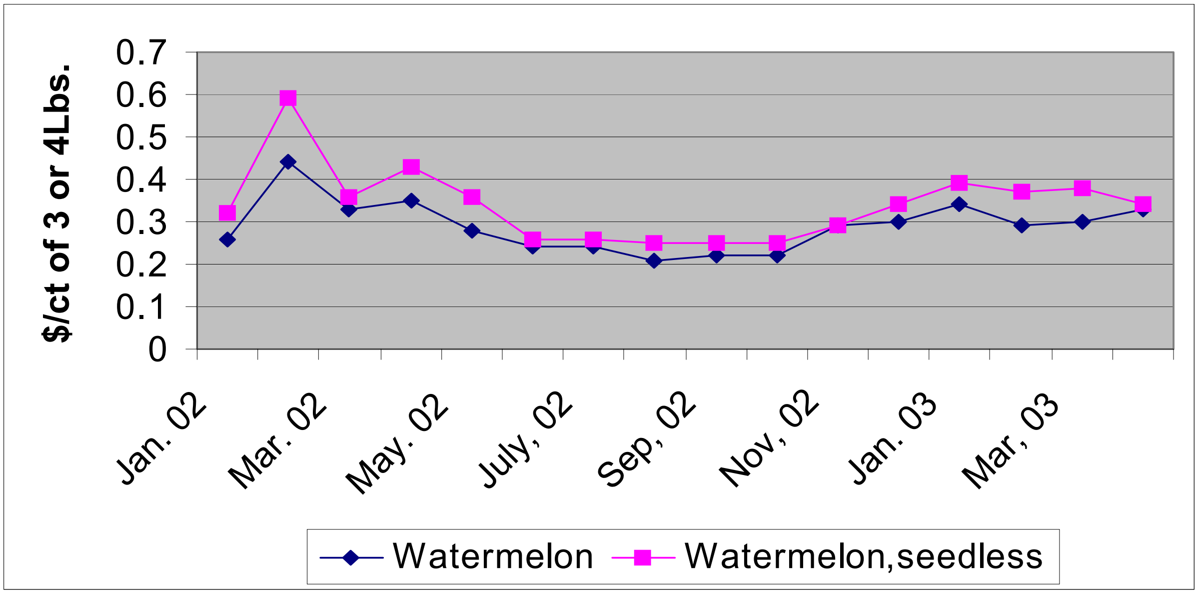
Figure 9: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

According to Figure 10, there is no significant price per pound differences for various seedless and red watermelon coming from California, Texas and Mexico in cartons of 3s, 4s or 5s. The only peak $0.44 and $0.59 per pound respectively was recorded in February 2002 and a downward trend set in thereafter. The minimum price of $0.25 per pound was reported in August, September and October 2002 for seedless and $0.21 per pound in August for seeded, red watermelon.

Figure 10: Wholesale Prices for fresh-market Vegetables in Chicago, 2002 - 03



Source: ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

Conclusion

Vegetable wholesale price trend is an important guide to farmers as well as financial institutions. It is a guide for production and marketing decision aid. Unfortunately, price trend is so volatile and fluctuating that predictability is impossible. Most of the time, growers have to utilize their gut feelings or simply "take the bull by the horn", so to speak and get on with their business. There may also be variations depending on the targeted market.

References:

1. ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296-April 17.

2. AMS, USDA (2003) Fruit & Vegetable Market News.

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Insect Control

INSECT PEST CONTROL TRIALS IN VEGETABLES IN 2001-2002

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Introduction

In 2001-2002, several insecticide efficacy trials were conducted to evaluate various chemicals for the control of insect pests of vegetable crops in Tift County, Georgia. The following results summarizes efficacy data for insect pests which occurred in significant numbers in two cabbage tests, three collard tests, an onion test, a pepper test and two squash tests. Insects cause millions of dollars in damage to Georgia vegetable crops each year and the use of effective insecticides is essential to the short term viability of the vegetable industry.

Materials and Methods

Evaluation of Insecticide Treatments in Cabbage 2002: Was transplanted into 2 rows per 6-ft beds on 27 March and maintained with standard cultural practices at the Lang Farm, Georgia Coastal Plain Experiment Station at Tifton. A total of 350 lbs of 10-10-10 was applied to Tift pebbly clay loam field plots and irrigation regularly with an overhead sprinkler system. Scouting was initiated on 22 April and continued weekly until harvest. Nine weekly applications of insecticide were made from 12April 31 May and 1 sample of 6 plants were scouted per plot approximately 48 h after weekly applications. Ten heads were harvested from approximately 10 ft of row on 17 June and heads were weighed and categorized as 0=not damaged, 1-slightly damage, 2=moderately damaged, 3=severely damaged. Damage ratings >1 were not marketable heads. Data was analyzed using GLM and LSD tests for separation of means (SAS Institute 1985).

Evaluation of Insecticide Treatments in Cabbage Fall 2002: Was transplanted into 2 rows per 6-ft beds on 7 August and maintained with standard cultural practices at the Lang Farm, Georgia Coastal Plain Experiment Station at Tifton. A total of 500 lbs of 10-10-10 was applied to Tift pebbly clay loam field plots and irrigation regularly with an overhead sprinkler system. Scouting was conducted weekly from 8 August to 3 October using one sample of 6 plants per plot. In addition, three leaves per plot were collected from 11 September to 3 October and total whitefly eggs, small nymphs (1^{st} and 2^{nd} instars) and large nymphs 3^{rd} and 4^{th} instars) were counted per 3.5 sq cm (2.1 cm diameter leaf disks) of lower leaf surface. One soil application of insecticide was made on 7 August. Foliar applications of *Bacillus thuriengensis* insecticide were made on 27 August, 10, 20 September and 4 October to reduce Lepidoteran pests. Ten heads were harvested from approximately 10 ft of row on November and heads were weighed and categorized as 0=not damaged, 1-slightly damage, 2=moderately damaged, 3=severely damaged by worms or contaminated by whitefly nymphs. Damage ratings >1 were not marketable heads. Data was analyzed using GLM and LSD tests for separation of means (SAS Institute 1985).

Evaluation of Insecticide Treatments in Collards Spring 2002: Collards were direct seeded into 2 rows per 6-ft beds on 20 March and maintained with standard cultural practices at the Lang Farm, Georgia Coastal Plain Experiment Station at Tifton. A total of 500 lbs of 10-10-10 was applied to Tift pebbly clay loam field plots and irrigation regularly with an overhead sprinkler system. Scouting was initiated on 22 April and continued weekly until harvest. Six weekly applications of insecticide were made from 12 April 31 May and 1 sample of 6 plants were scouted per plot after weekly applications. Ten plant tops were harvested from approximately 10 ft of row on 19 June and heads were weighed and categorized as 0=not damaged, 1-slightly damage, 2=moderately damaged, 3=severely damaged. Damage ratings >2 were not marketable heads. Data was analyzed using GLM and LSD tests for separation of means (SAS Institute 1985).

Evaluation of Insecticide Treatments in Collard Fall 2002 (a): Collards was transplanted into 2 rows per 6-ft beds on 7 August and maintained with standard cultural practices at the Lang Farm, Georgia Coastal Plain Experiment Station at Tifton. A total of 500 lbs of 10-10-10 was applied to Tift pebbly clay loam field plots and irrigation regularly using one sample of 6 plants per plot. In addition, three leaves per plot were collected from 29 August to 3 October and total whitefly eggs, small nymphs (1st and 2nd instars) and large nymphs (3rd and 4th instars) were counted per 3.5 sq cm (2.1 cm diameter leaf disks) of lower leaf surface. One soil application of insecticide was made on 7 August, 10, 20 September and 4 October to reduce Lepidoteran pests. Plant tops were harvested fro 5 ft of the center of the plot row on 28 October and plant tops were weighed and categorized as 0 = not damaged, 1 - slightly damage, 2 = moderately damaged, 3 = severely damaged by worms or contaminated by whitefly nymphs. Damage ratings >1 were not marketable collards. Data was analyzed using GLM and LSD tests for separation of means (SAS Institute 1985).

Evaluation of Insecticide Treatments in Collard Fall 2002 (b): Collards was transplanted into 2 rows per 6-ft beds on 7 August and maintained with standard cultural practices at the Lang Farm, Georgia Coastal Plain Experiment Station at Tifton. A total of 500 lbs of 10-10-10 was applied to Tift pebbly clay loam field plots and irrigation regularly with an overhead sprinkler system. Scouting was conducted weekly from 8 August to 3 October using six whole plant inspection samples per plot. Nine foliar applications were made weekly beginning on 28 August and ending on 23 October. Plant tops were harvested from 5 ft of of the center of the plot row on 28 October and plant tops were weighed and categorized as 0=not damaged, 1-slightly damage, 2=moderately damaged, 3=severely damaged by worms. Damage ratings >2 were not marketable collards. Data was analyzed using GLM and LSD tests for separation of means (SAS Institute 1985).

Evaluation of Insecticide Treatments in Onion 2002: Small plots of Granex 33 onions 40 ft in length were treated as follows in a randomized complete block design: TREATMENTS 1) untreated check, 2) calendar sprays of Warrior 3.8 oz/a and Atrapa 2 pt/a, 3) spray this mixture at 1 thrips/plant, 4) spray this mixture at 1 then 5 thrips per plant, 5) spray this mixture at 5 thrips per plant, 6) calendar sprays of Novaluron 0.19 lb ai/a, 7) calendar sprays of Novaluron 0.14 lb ai/a, 8) calendar sprays of Novaluron 0.09 lb ai/a. Thrips numbers, number of sprays, weight of marketable onion yield, and estimated return per acre were evaluated. Novaluron is a reduced risk benzoylphenyl urea that inhibits chitin formation in the exoskeleton of insects.

Even though thrips were low and no significant difference was observed in the overall yield, there was a significant increase in jumbo bulbs in the Novaluron treatments. This occurred even without a significant reduction in thrips over many dates. The two thresholds of 5 thrips or 1 then 5 thrips per plant significantly reduced insecticide costs.

Evaluation of Insecticide Treatments in Pepper 2002: Pepper was transplanted into 2 rows per 6-ft beds on 30 July 2002 and maintained with standard cultural practices at the Lang Farm, Georgia Coastal Plain Experiment Station at Tifton. A total of 350 lbs of 10-10-10 per acre was applied to Tift sandy clay loam field plots and irrigation regularly with an overhead sprinkler system. Scouting was initiated in Aug and continued weekly until October. Eight applications of insecticide were made from 9 Aug to 1 Oct and 1 sample of 6 plants were scouted per plot after weekly applications. Lepidoptera larvae and other insects were recorded per 6-plant sample. Pepper was harvested from 30 ft of row (20-60 plants per plot because of variable plant stand due to whitefly pressure and soil disease) on 26 September, 17 Oct and 1 Nov and fruit were categorized as marketable or unmarketable and all fruit were cut to inspect for pepper weevil larvae or pupae inside the pod. Data was analyzed using ANOVA and LSD tests for separation of means (SAS Institute 1985).

Evaluation of Insecticide Treatments in Squash 2002 (a): Yellow squash was planted into 2 rows per 6-ft beds on 31 May and maintained with standard cultural practices at the Lang Farm, Georgia Coastal Plain Experiment Station at Tifton. A total of 350 lbs of 10-10-10 was applied to Tift pebbly clay loam field plots and irrigation regularly with an overhead sprinkler system. Scouting was initiated on 10 June and continued weekly until harvest. Three applications of insecticide were made on 14, 21 June and 2 July and 1 sample of 6 plants were scouted per plot after applications. Squash was harvested from 10 ft of row in the center of the bed on 1, 9, and 17 July and fruit were categorized as marketable, pickleworm damaged or virus damaged and the average weight was measured. Data was analyzed using GLM and LSD tests for separation of means (SAS Institute 1985).

Evaluation of Insecticide Treatments in Squash 2002 (b): Yellow squash was transplanted into 2 rows per 6-ft beds on 15 July and maintained with standard cultural practices at the Lang Farm, Georgia Coastal Plain Experiment Station at Tifton. A total of 350 lbs of 10-10-10 was applied to Tift pebbly clay loam field plots followed by a sidedress of 125 lb of amonia nitrate and irrigation regularly with an overhead sprinkler system. Scouting was initiated on 29 July and continued weekly until harvest. Six applications of insecticide were made from 20 July to 23 August and 1 sample of 6 plants were scouted per plot approximately 48 h after weekly applications. Squash was harvested from 30 ft of row (approximately 30 plants) on 26 August and fruit were categorized as marketable, damaged by pickle worm or damaged by mosaic virus and the average weight was measured. Data was analyzed using GLM and LSD tests for separation of means (SAS Institute 1985).

Results and Discussion

Cabbage 2002: The best treatments in terms of reduced overall Lepidoptera larval numbers were the Novaluron treatments followed by Spintor and Avaunt treatments. These treatments also had the lowest damage to wrapper leaves and the heads. Unfortunately, the Dipel rotations did not provide as good a control level relative to Lepidoptera numbers. However, the first rotation, consecutively different chemistries, did provided better control in terms of reducing damage. In terms of lowest number of total diamond back moth larvae, the best treatments were again Novaluron treatments followed by Spintor and Avaunt treatments. The recent resistance to Spintor documented in Georgia was not clearly evident in this test, but there have been better levels of control with Spintor in previous trials at this same location. There was no significant difference in terms of total weight of heads harvested.

Cabbage Fall 2002: All of the soil insecticide treatments of Admire and Platinum reduced whitefly nymphs and increased the cabbage head weight compared to the untreated check. No treatments clearly reduced overall whitefly adult numbers even after migrations of adults reduced on 18 September. None of the soil treatments significantly controlled Lepidopteran larvae, mostly cabbage looper; *Trichoplusia ni* (Hübner) and diamondback moth; *Plutella xylostella* (L.), compared to the untreated check. This was the reason for the additional applications of Agree were made beginning on 27 August to reduce losses due to defoliation by these pests. As expected, there was no significant treatment differences in terms of Lepidopteran damage to cabbage heads. There was no significant difference in terms of total weight of heads harvested between the Admire and Platinum soil treatments, but all soil treatments produced significantly more cabbage weight than the untreated check .

Collards Spring 2002: The best treatments in terms of reduced overall Lepidoptera larval numbers ranked numerically from lowest number of larvae were the high rates of Spintor, Avaunt, Proclaim and Intrepid, but all treatments significantly reduced lepidopteran larvae compared to the untreated check. DBM control was best with Spintor and Proclaim, but Avaunt also controlled large DBM larvae very well. All treatments controlled ICW and CL compared to the check. Leaf damage was lowest with the Avaunt treatments followed by Spintor and Intrepid. Marketable weight was highest in the Avaunt treatments followed by the Proclaim and high rate of Spintor treatments.

Collard Fall 2002 (a): All of the soil insecticide treatments of Admire and Platinum reduced whitefly nymphs and increased the collard weight compared to at least one of the untreated checks. The 4 oz and 8 oz Platinum treatments and the 8 oz Admire treatments had the lowest numbers of whitefly nymphs and highest collard weights. There was some variability between the three untreated checks, where whitefly nymph counts were high, there was a proportional drop in plant weight. That is, a 31% increase in whitefly nymphs in the untreated vs. treated plots resulted in a 42% decrease in plant yield. Rates did not significantly affect whitefly control with either Platinum or Admire in this test.

Collard Fall 2002 (b): The main lepidopterous pest present was CL, but imported cabbageworm, *Pieris rapae* (L.), and diamondback moth, *Plutella xylostella* (L.), were included in the total Lepidoptera count. Whitefly adults were significantly reduced high rate of S-1812 on 26 September, but not over all. CL was significantly reduced by most treatments compared to the check with the exception of s-1812 @ 0.15 lb ai plus Dipel. The high rate of S-1812 did not result in increased control of CL over the 0.1 and 0.15 lb ai rates. A possible explanation is the increased mortality of Coccinellidae predators in this treatment (marginally significant treatment effect on 18 September). Combination treatments tended to provide greater efficacy at the 0.1 lb ai rate for S-1812, but not at the higher rate and neither were significantly improved over the individual treatments of S-1812. With Dipel, the combination with the 0.15 lb ai rate of S-1812 significantly lowered efficacy against CL on 3 October.

Onion 2002: Thrips control in Vidalia onions is not always justified since there are some years that thrips numbers do not reach economically damaging levels. The best solution for managing thrips in onions is to include thrips counts as part of a regular scouting program so that insecticides are applied only when required. This is especially important for thrips since the over use of insecticides can lead to chemical resistance and potentially higher numbers of thrips than if no treatments were made at all. Even though the over all numbers of thrips were moderately low in the Spring of 2002, the testing of threshold show how spray costs can be reduced.

Pepper 2002: The treatments that had significantly lower aphids that the untreated check on 29 August were Platinum + Fulfill, Actara, and Danitol + Orthene and on 16 September, S-1812 at the high rate. No treatment significantly reduced Lepidoptera larvae in this test and there was no significant difference in worm damaged fruit at the end of the test. Variability due to poor plant stand could have affected this result. Even so, there was significantly higher yields than the check in the Asana, 0.15 lb ai/a rate of S-1812 and Asana + S-1812 treatments. When a late season pepper weevil infestation was analyzed on a pepper weevil per total fruit basis, there was significant reduction of pepper weevil in the Platinum + Fulfill, Actara + Fulfill, and 0.15 lb ai/a rate of S-1812 treatments compared to the untreated check.

Squash 2002 (a): The best treatments in terms of squash bug control was the high rate of F0570 and there seemed to be a rate response. In terms of pickle worm control all products provided good efficacy, but there was slightly more damage in the lowest rate of F0570. All products control squash vine borer. The control of leaffooted bug was inconsistent with F0570, but clear with Avaunt. The best treatments in terms of overall yield tended to be the high rate of F0570, Avaunt, and Success but the treatment effect was not statistically significant.

Squash 2002 (b): The best treatments in terms of overall yield were the Fulfill + Additive Nufilm P SL followed by Success + Provado, Intrepid, and Avaunt treatments. These treatments also had some of the highest numbers of squash bug, suggesting that this insect pest is not economically important at the levels observed in this test. Lower aphid, whitefly, and pickle worm numbers were associated with greater yield, but no individual pest was clearly associated with the greatest amount of yield loss. A combination of different pest control provided the higher yields in this test. Various additives to Fulfill were significantly different in their effects on whitefly and squash bug control. Activator 90 tended to provide the best control of whiteflies. Additive LI700EC, Activator 90, Dyne-amic, and Kinetic improved control of squash bug.

Cabbage 2002:

Treatment (product/acre) week spray	Cabbage looper	Diamond back moth	Imported cabbage worm	Total Lep. larvae	Wrapper leaf damage[2]	Head damage	Wt. (lb) per 10 heads
1 Novaluron 0.83 EC (15 oz) weekly	0.54 bcd[1]	1.63 bc	0.13 ef	2.29 de	0.48 d	0.23 de	38.16 a
2 Novaluron 0.83 EC (12 oz) weekly	0.46 cd	1.54 bc	0.46 def	2.46 de	0.53 d	0.29 cde	46.08 a
3 Novaluron 0.83 EC (9 oz) weekly	0.21 d	1.08 c	0.29 def	1.63	0.53 d	0.2	45.13 a
4 Novaluron 0.83 EC (6 oz) weekly	1.17 bc	1.29 c	0.04 f	2.54 de	0.50 d	0.35 cde	41.63 a
5 Spintor 2SC (4.3 oz) weekly	0.71 bcd	1.58 bc	0.21 def	2.50 de	0.83 cd	0.60 c	25.63 a
6 Avaunt WDG (3.5 oz) weekly	1.08 bc	1.71 bc	0.63 cde	3.42 cd	0.78 cd	0.50 cde	36.23 a
7 Avaunt WDG (3.5 oz) 1,4,7 weeks Dipel DF (1 lb) 2,5,8 weeks Spintor 2SC (4.3 oz) 3,6,9 weeks	1.21 b	2.00 bc	1.13 bc	4.42 bc	0.95c	0.58 cd	38.33 a
8 Avaunt WDG (3.5 oz) 1,2,3 weeks Dipel DF (1 lb) 4,5,6 weeks Spintor 2SC (4.3 oz) 7,8,9 weeks	1.04 bc	1.92 bc	1.38 b	4.33 bc	2.07 b	1.60 b	44.54 a
9 Proclaim SG (4.8 oz) weekly	2.00 a	2.54 b	0.67 cd	5.21 b	2.05 b	1.58 b	36.38 a
10.Untreated Check	2.33 a	4.79 a	3.38 a	10.58 a	3.00 a	3.00 a	34.61 a

[1] Means within columns followed by the same letter are not significantly different (LSD, P<0.05).
[2] Damage rating is 0=none, 1=slight (few holes, possible still marketable), 2=moderate (several holes, not marketable), 3=severe (multiple holes and severe feeding damage, not marketable).

Cabbage Fall 2002:

Treatment (product/acre) week spray	Whitefly adults on 18 Sept.	Whitefly immatures 17 Sept.	Whitefly eggs over all dates	Whitefly small nymphs	Whitefly large nymphs	Head whitefly infestation	Wt. (lb) per head
1. Untreated	7.7 a	176 a	89 a	62 a	5.1 a	0.6 a	1.3 b
2. Admire 2SC 5 fl oz in furrow	5.4 a	113 ab	62 b	33 b	1.3 b	0.6 a	2.3 a
3. Platinum 2SC 5 fl oz in furrow	7.4 a	125 ab	50 b	26 b	0.8 b	0.4 a	2.7 a
4. Platinum 2SC 4 fl oz in furrow	6.8 a	59 b	42 b	23 b	0.8 b	0.5 a	2.5 a
5. Platinum 2SC 8 fl oz in furrow	5.2 a	84 b	45 b	26 b	1.9 b	0.4 a	2.5 a
6. Platinum 2SC 11 fl oz in furrow	6.3 a	126 ab	57 b	25 b	0.5 b	0.5 a	2.5 a
7. Admire 2SC 16 fl oz in furrow	5.2 a	86 b	50 b	26 b	0.7 b	0.4 a	2.6 a
8. Admire 2SC 8 fl oz in furrow	6.4 a	102 b	58 b	27 b	1.2 b	0.3 a	2.4 a

[1] Means within columns followed by the same letter are not significantly different (LSD, P<0.05).

[2] Damage rating is 0=none, 1=slight (few whitefly nymphs per leaf), 2=moderate (several nymphs per leaf), 3=severe (severe feeding damage, not marketable).

Collards Spring 2002:

Treatment (product/acre) week spray	Cabbage looper average	Diamond back moth small larvae	Diamond back moth large larvae	Diamond back moth total average	Imported cabbage worm average	Total Lep. larvae	Lea dam
1 Avaunt WDG (2.4 oz)	0.20 b	0.70 ab	0.00 c	0.70 bc	1.20 b	3.15 b	0.45
2 Avaunt WDG (3.5 oz)	0.05 b	0.50 bc	0.00 c	0.50 bc	1.15 b	2.10 b	0.38
3 Spintor 2SC (2.5 oz)	0.40 b	0.20 c	0.05 c	0.25 c	0.70 b	1.85 b	1.30
4 Spintor 2SC (4.3 oz)	0.70 b	0.10 c	0.00 c	0.10 c	0.60 b	1.95 b	1.00
5 Intrepid 80W (2.5 oz)	0.70 b	0.50 bc	0.40 b	0.90 b	1.35 b	3.30 b	1.30
6 Proclaim SG (4.8 oz)	0.70 b	0.15 c	0.00 c	0.15 c	1.25 b	2.75 b	1.60
7.Untreated Check	1.90 a	1.00 a	1.05 a	2.05 a	2.30 a	6.50 a	2.98

[1] Means within columns followed by the same letter are not significantly different (LSD, P<0.05).

[2] Damage rating is 0=none, 1=slight (one hole, still marketable), 2=moderate (several holes, marginally marketable), 3=severe (multiple holes and severe feeding damage, not marketable).

Collard Fall 2002 (a):

Treatment (product/acre) week spray	Whitefly eggs on 11 Sept.	Whitefly small nymphs on 11 Sept.	Whitefly nymphs overall on 11 Sept.	Whitefly nymphs overall on 19 Sept.	Whitefly nymphs season average	Whitefly season totals	Wt. (lb) per plant top
3. Untreated	82.8 a	19.4 a	19.4 a	102 a	49	113 a	1.9 ab
6. Untreated	73.0 ab	18.4 ab	18.5 ab	87 ab	36.8	85 ab	1.6 b
1. Untreated	43.6 cd	13.6 abc	13.6 abc	87 ab	41.2	91 ab	2.0 ab
4. Platinum 2SC 4 fl oz. in furrow	36.1 cd	3.6 c	3.6 c	63 bc	28.5	65 b	2.9 ab
5. Platinum 2SC 8 fl oz in furrow	23.4 d	2.1 c	2.1 c	60 bc	32.2	71 b	3.6 a
2. Platinum 2SC 4 fl oz in furrow	32.4 cd	5.9 bc	5.9 bc	51 c	28.8	83 ab	3.6 a
7. Admire 2SC 16 fl oz in furrow	52.1 bc	7.7 abc	7.7 abc	59 bc	28.8	70 b	2.5 ab
8. Admire 2SC 8 fl oz in furrow	31.2 cd	1.3 c	1.3 c	56 bc	28.2	74 b	3.3 a

[1] Means within columns followed by the same letter are not significantly different (LSD, $P<0.05$).

Collard Fall 2002 (b):

Treatment (product/acre) week spray	Whitefly adults on 26 Sept.	CL large larvae 3 Oct.	CL total 3 Oct.	CL total overall	Lep. larvae season average	Lady beetles average	Wt. (lb) per 5 ft
1. S-1812 35 WP 0.1 lb ai/a	46 ab [1]	0.75 bcd [2]	1.5 bc [2]	1.42 bc [1]	1.42	0.44	8.8
2. S-1812 35 WP 0.15 lb ai/a	38 abc	0.25 cd	0.50 c	1.50 bc	1.75	0.19	7.3
3. S-1812 35 WP 0.2 lb ai/a	25 c	1.75 bc	3.25 ab	2.00 abc	2.67	0.06	7.9
4. S-1812 35 WP 0.1 lb ai/a +Dipel 6.4WP 0.5 lb prod./a	29 bc	0.00 d	0.75 c	1.33 bc	1.58	0.19	9
5. S-1812 35 WP 0.15 lb ai/a +Dipel 6.4WP 0.5 lb prod./a	49 a	2.25 ab	3.25 ab	2.83 ab	2.83	0.81	9.5
6. S-1812 35 WP 0.1 lb ai/a +Asana XL 0.66 EC 0.02 lb ai/a	43 abc	0.00 d	1.5 bc	2.00 abc	2.25	0.38	8.4
7. S-1812 35 WP 0.15 lb ai/a +Asana XL 0.66 EC 0.02 lb ai/a	52 a	0.50 cd	0.50 c	1.08 c	1.5	0.25	9.6
8. Asana XL 0.66 EC 0.02 lb ai/a	38 abc	0.25 cd	0.50 c	2.17 abc	2.25	0.31	10.3
9. Danitol 2.4 EC 0.2 lb ai/a +Orthene 90SP 0.63 lb ai/a	47 a	0.00 d	1.25 bc	1.25 bc	1.58	0.31	8.8
10 Untreated check	45 ab	3.50 a	4.25 a	3.58 a	3.92	0.63	9.3

[1] Means within columns followed by the same letter are not significantly different (LSD, P<0.05).
[2] Means within columns followed by the same letter are not significantly different (LSD, P<0.1).

Onion 2002:

Treatment	Thrips per 5 plants March 12	Thrips per 5 plants April 2	Total number of sprays	Total wt (lb) onions/10 ft	Total number of jumbos
1. Untreated	12.3 a	31.3 a	0	27.6 a	6.4 b
2. Calendar	5.8 b	14.5 c	6	21.3 a	6.7 b
3. 1 thrips	9.0 ab	23.8 ab	6	24.1 a	7.1 b
4. 1 then 5 thrips	5.5 b	20.5 bc	2	28.9 a	6.4 b
5. 5 thrips	9.8 ab	19.3 bc	2	28.4 a	6.6 b
6. Novaluron 0.19	9.0 ab	29.5 a	6	32.9 a	14.1 ab
7. Novaluron 0.14	7.3 b	24.0 ab	6	29.9 a	17.9 a
8. Novaluron 0.09	7.8 b	24.3 ab	6	28.2 a	16.0 ab

Means followed by same letters not significantly different LSD, $P<0.05$ (3 reps used for jumbo counts, treatment effect $P<0.1$).

Pepper 2002:

Treatments	Aphids on 8/29	Aphids on 9/16	BAW on 9/27	Total Lep. larvae 9/27	Marketable wt/kg pepper	Pepper weevil per total fruit
1. Untreated Check	1.00 ab	3.42 ab	0.50 a	1.50 a	1.98 d	0.91 a
2. Actara 25 WG 3 oz wt Fulfill 50 WG 2.75 pz wt.	0.67 abc	1.50 bc	0.25 a	0.25 a	2.99 abcd	0.49 bc
3. Platinum 2 SC 8 fl oz Fulfill 50 WG 2.75 oz wt	0.33 c	2.83 abc	0.00 a	1.25 a	4.24 abcd	0.20 c
4. Fulfill 50 WG 2.75 oz wt	0.50 bc	1.83 abc	0.00 a	2.00 a	2.77 bcd	0.65 ab
5. Warrior W/Z 1CS 2.56 fl oz	1.17 a	3.42 a	0.00 a	0.50 a	3.48 abcd	0.74 ab
6. Warrior W/Z 1CS 3.84 fl oz	0.75 abc	1.42 bc	0.25 a	1.50 a	3.32 abcd	0.74 ab
7. Actara 25 WG 3 oz wt	0.42 c	3.83 a	0.00 a	0.75 a	3.09 abcd	0.74 ab
8. Asana XL 0.66 EC (0.02)	0.75 abc	3.08 ab	0.00 a	1.75 a	5.06 a	0.74 ab
9. S-1812 35 WP (0.10)	0.50bc	1.58bc	0.00a	1.25a	2.93abcd	0.60ab
10. S-1812 35 WP (0.15)	0.83 abc	2.17 abc	0.00 a	1.00 a	4.64 ab	0.50 bc
11. S-1812 35 WP (0.20)	0.67 abc	0.75 c	0.00 a	1.00 a	2.02 cd	0.64 ab
12. S-1812 35 WP (0.10) Orthene 97 SP (0.63)	0.67 abc	3.08 ab	0.25 a	1.25 a	1.61 d	0.82 ab
13. S-1812 35 WP (0.10) Asana XL 0.66EC (0.02)	0.83 abc	2.58 abc	0.25 a	1.25 a	2.63 abc	0.80 ab
14. S-1812 35WP (0.15) Orthene 97 SP (0.63)	0.50 bc	2.67 abc	0.00 a	1.25 a	2.89 abcd	0.59 ab
15. S-1812 35 WP (0.15) Asana XL 0.66EC (0.02)	0.50 abc	1.33 bc	0.25 a	0.25 a	2.47 bcd	0.79 ab
16. Danitol 2.4EC 0.2 lb ai/a Orthene 97 SP (0.63)	0.33 c	1.67 bc	0.00 a	0.75 a	1.43 d	0.63 ab

Means within columns followed by the same letter are not significantly using LSD Test (P>0.05)

Squash 2002 (a):

Treatment (rate lb ai per acre)	Squash bug	Leaf-footed bug	Pickle worm	Squash vine borer	Lady bird beetle	Number of clean fruit	Number of pickleworm damaged fruit	Pickle worms in fruit
1. F0570 0.8ECDF (0.016)	0.56 abc	0.445 a	0.13 a	0.00 b	1.44 ab	6.50 a	3.8 ab	0.83 b
2. F0570 0.8ECDF (0.020)	0.31b c	0.00 b	0.19 a	0.00 b	0.56 ab	7.58 a	3.17 b	0.42 b
3. F0570 0.8ECDF (0.024)	0.06 c	0.69 a	0.13 a	0.00 b	0.94 b	8.08 a	2.92 b	0.58 b
4. Avaunt 30 WDG (0.065)	0.94 a	0.00 b	0.12 a	0.06 b	1.56 ab	8.33 a	2.56 b	1.17 b
5. Success 2 SC (0.067)	0.81 ab	0.38 ab	0.13 a	0.07 b	1.06 ab	8.83 a	1.50 b	0.25 b
6. Untreated Check	0.81 ab	0.63 a	0.38 a	0.31 a	1.88 a	6.33 a	6.92 a	3.83 a

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

Squash 2002 (b):

Treatment - rate per acre	Squash bug over all dates	Squash bug 9/6/02	Melon aphids 9/6/02	Whitefly adults 9/6/02	Whitefly eggs 9/7/02	Whitefly nymphs 9/7/02	No. picklewor damaged fruit
1. Fulfill 50 WG 2.75 oz prod/a	0.31 bcde	0.00 c	0.75 c	11.67 b	31.25 bcd	21.92 bc	6.25 ab
2. Fulfill 50 WG 2.75 oz prod/a Additive LI700EC 0.25% v/v	0.06	0.00 c	0.42 c	8.25 c	38.92 bcd	35.08 abc	5.00 abcd
3. Fulfill 50 WG 2.75 oz prod/a Dyne-amic 0.5% v/v	0.13 de	0.00 c	0.33 c	4.92 def	27.67 bcd	29.42 bc	2.75 bcde
4. Fulfill 50 WG 2.75 oz prod/a Kinetic 0.125% v/v	0.25 cde	0.75 bc	1.00 c	8.92 c	35.33 bcd	38.83 abc	5.50 abc
5. Fulfill 50 WG 2.75 oz prod/a Activator 90 0.5% v/v	0.13 de	0.00 c	0.67 c	3.33 fg	6.67 d	12.83 c	1.50 cde
6. Fulfill 50 WG 2.75 oz prod/a Penetrator Plus 0.5% v/v	0.44 abcde	1.75 a	0.33 c	5.92 d	15.08 cd	14.50 bc	7.50 a
7. Fulfill 50 WG 2.75 oz prod/a Additive Nufilm P SL 1 pt/a	0.75 a	1.75 a	0.42 c	4.67 def	31.58 bcd	24.58 bc	2.75 bcde
8. F0570 0.8ECDF (0.016)	0.69 ab	1.50 ab	0.33 c	2.50 g	76.08 a	43.92 abc	4.50 abcd
9. F0570 0.8ECDF (0.024)	0.44 abcde	0.75 bc	0.33 c	5.50 de	10.17 d	18.42 bc	4.00 abcd
10. Avaunt 30 WDG (0.045)	0.13 de	0.00 c	2.00 b	13.50 b	46.67 abc	59.92 ab	0
11. Avaunt 30 WDG (0.065)	0.13 de	0.00 c	5.42 a	17.58 a	29.83 bcd	28.08 bc	1.25 de
12. Success 2SC (0.039) Provado 1.6 3.75 floz prod/a	0.38 abcde	1.25 ab	0.25 c	2.83 fg	16.08 bcd	7.67 c	0.25
13. Success 2SC (0.067)	0.13 de	0.00 c	0.42 c	3.75 efg	6.17 d	14.83 bc	1.25 de
14. Intrepid 80 W (0.125)	0.19 de	0.00 c	1.00 c	2.42 g	28.58 bcd	25.33 bc	1.50 cde
15. Proclaim 5% (0.0075)	0.50 abcd	1.75 a	1.00 c	4.50 defg	8.25 d	15.92 bc	3.75 abcd
16. Untreated Check	0.63 abc	1.25 ab	2.58 b	19.58 a	52.17 ab	79.33 a	2.50 bcde

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

Conclusion

Vegetable wholesale price trend is an important guide to farmers as well as financial institutions. It is a guide for production and marketing decision aid. Unfortunately, price trend is so volatile and fluctuating that predictability is impossible. Most of the time, growers have to utilized their gut feelings or simply "take the bull by the horn", so to speak, and get on with their business. There may also be variations depending on the targeted market.

References

1. ERS, USDA (2003) Vegetables and Melons Outlook/VGS-296/April 17.

2. AMS, USDA (2003) Fruit & Vegetable Market News.

CONTROL OF SILVERLEAF WHITEFLY IN SQUASH WITH FOLIAR NEONICOTINOID INSECTICIDES

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Introduction

The silverleaf whitefly (SLWF), *Bemisia argentifolii* or *Bemisia tabaci* strain B, is a key pest of many vegetable crops in South Georgia. Neonicotinoid insecticides play a key roll in management of this pest, with the greatest efficacy generally obtained with soil applications with the earliest developed products in this chemistry. Recently, newer neonicotinoid insecticides have shown greater promise for control of SLWF with foliar applications.

In the fall or 2002, a small plot efficacy trial was conducted at The University of Georgia Coastal Plains Experiment Station's Lang Farm to evaluate the efficacy of foliar applied insecticides, including four neonicotinoids, against the SLWF. Foliar applications of the insecticides were made to squash with established populations of whitefly. Aphids (melon aphid) became established in the test after treatments were applied, and were sampled for evaluation of residual activity on this pest.

Materials and Methods

Plots were established and treated on 3August, 2002. Plots were 2 rows wide (on a single 6 foot bed) and 12 feet long. Each treatment was replicated 3 times in a randomized complete block design. Applications were made with a CO_2 pressurized backpack sprayer (40 PSI) calibrated to deliver 30 gallons per acre with 3 hollow-cone nozzles per row (1 over-the-top, 2 on drops).

Treatments evaluated were Provado 1.6F at 0.0468 lb AI/ac, Centric 40WG at 0.0468 lb AI/ac, Assail 70WP at 0.05 lb AI/ac, Knack 0.83EC at 0.05 lb AI/ac, FMC 1785 50DF at 0.088 lb AI/ac, and a non-treated check. Knack is an insect growth regulator, and the other four insecticides are neonicotinoids. All insecticide treatments were tank mixed with DyneAmic at 8 oz/100 gal.

SLWF adults were counted on 5 randomly selected leaves in each plot at 2 and 4 days after treatment (Aug. 5 and 7). Plots were visually rated on amount of leaf 'silvering' on a 1 to 5 scale (1 = no silvering; 2 = light, 3 = moderate, 4 = heavy, 5 = very heavy) at 3 and 16 days after treatment (Aug. 6 and 19). Aphids were counted on a single plant (destructive sampling) in each plot at 6 days after treatment (Aug. 9). Data were analyzed with the PROC ANOVA procedure of PC-SAS. Where significant differences were detected ($P<0.05$) means were separated with LSD ($P=0.05$).

Results and Discussion

SLWF adult densities were decreased to the greatest extent by Assail, Centric and Provado. This resulted in reduced amounts of silvering in these treatments. The Assail and Centric appeared to provide control for a longer period, with only these two treatments showing moderate silvering on August 19. Knack had little impact on adult SLWF, as would be expected, because it is a growth regulator. Assail, Centric, Provado and FMC 1785 provided good control of aphids, which moved into the plots after treatment. The trends in the silvering data, and the aphid counts suggest that the residual activity for Provado was less than that of Assail and Centric.

Table 1. Silverleaf whitefly and aphid densities and amount of plant silvering in squash

Treatment	Number of SLWF adults per leaf		Leaf 'silvering' rating		Aphids per plant (8/09)
	37472	37474	37473	37486	
Check	19.6 ab	10.5 ab	2.2 a	4.3 a	121.0 a
Knack	24.1 a	14.5 a	2.3 a	3.7 abc	86.3 b
FMC 1785	11.4 bc	10.1 ab	2.0 ab	4.7 a	4.7 c
Provado	2.1 c	4.2 bc	1.7 b	4.2 ab	24.7 c
Assail	2.2 c	2.2 c	1.7 b	2.8 c	7.3 c
Centric	2.9 c	2.2 c	1.7 b	3.0 bc	3.0 c

[1]Where significant differences were detected ($P<0.05$) means were separated with LSD($P=0.05$)

EFFICACY OF SELECTED INSECTICIDES AGAINST SILVERLEAF WHITEFLY ON SNAP BEANS

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Introduction

The silverleaf whitefly (SLWF), *Bemisia argentifolii* or *Bemisia tabaci* strain B, has become a key pest of many vegetable crops in the South Georgia. Populations generally increase throughout the summer and present severe problems for fall vegetable production. In the fall of 2002, a small plot trial was conducted at The University of Georgia's Lang Farm in Tifton, Georgia, to evaluate the efficacy of selected insecticides against the silverleaf whitefly on snap beans.

Materials and Methods

Snap beans were direct seeded and plots established shortly after emergence. Plots were 2 rows wide (36 inch each) and 18 feet long. Each treatment was replicated 4 times in a randomized complete block design. Treatments were applied with a CO_2 pressurized backpack sprayer (40PSI) calibrated to deliver 30 gallons of spray per acre with three hollow-cone nozzles per row (1 over-the-top, 2 on drops).

Treatments evaluated were Knack 0.83EC at 8 and 10 oz/ac, Danitol 2.4EC at 0.15 lb AI/ac + Orthene 97 at 0.5 lb AI/ac, Capture 2EC at 0.08 lb AI/ac, Provado 1.6F at 0.0468 lb AI/ac, Actara 25WG at 0.0468 lb AI/ac, Assail 70WP at 0.05 lb AI/ac, FMC 1785 at 0.088 lb AI/ac, Courier 70WP at 8 oz/ac, and a non-treated check. All insecticides treatments were tank mixed with DyneAmic at 8 oz/100 gal of spray. The Danitol+Orthene and Capture treatments were applied on approximately a weekly schedule (8/22, 8/30, 9/05, 9/11, 9/20). All other treatments were applied on a two week schedule (8/22, 9/05, 9/20).

SLWF adults were periodically monitored by random selection of 3 to 5 leaves per plot (varied by date, but constant within a date) and visual counting of all whitefly adults on each leaf. Whitefly nymphs were also monitored periodically. Nymph densities were monitored with random collection of 3 leaves per plot. A single one-inch diameter leaf disk was removed from each leaf and examined under magnification in the lab. All eggs, small nymphs, and large nymphs were counted on each disk.

All plots were visually rated on September 12. Plots were rated on a relative1 to 5 scale, with a 1 representing 'clean green growth' throughout the plot and a 5 representing stunted, hardened growth with sooty mold evident.

A final efficacy rating was conducted by collecting 5 leaves from each plot and holding these leaves in pint size ice-cream containers to allow for adult emergence. Leaves were selected based on approximate age to attempt to collect older nymphs (those most likely to complete development). Containers were held long enough to allow for emergence and mortality of the adults. All adults which had successfully emerged were placed in a petri dish, examined under a dissecting scope and counted.

SLWF adult and nymph counts and plot ratings were analyzed with the PROC ANOVA procedure of PC-SAS. Where significant differences were detected ($P<0.05$), means were separated with DMRT ($P=0.05$). Adult emergence data was also analyzed with the PROC ANOVA procedure of PC-SAS and means were separated with LSD ($P=0.05$). Because of the large variability associated with the adult emergence data (particularly for treatments with higher means), a log transformation was conducted (however, analyses on both raw and transformed data are presented).

Results and Discussion

Both adult and nymph counts provided little separation of treatments in this test. For adults, the Danitol+Orthene (standard treatment) and Actara appeared to provide the best control early in the test when adult populations were highest (Table 1). The lack of significant adult control with Capture suggests potential increased pyrethroid resistance, as this product usually performs well as a stand-alone application while other pyrethroids require a tank mix (usually with an organophosphate) for SLWF control. Nymph counts were highly variable and provided even less significant separations with no consistent trends across dates (Table 2). Plot ratings also showed a great deal of variability, with the best ratings in the two treatments applied weekly (Danitol+Orthene and Capture) (Table 1).

Most of the products tested should have provided noticeable control of SLWF. The lack of separation with adult and immature counts may be largely attributable to high immigration and small plot size. Although adult counts dropped during the test, immigration was constant throughout the test. The rates and timing (weekly or once every two weeks) of application used in this test for most of these products may be adequate for lower pest pressure and/or less immigration and/or whole field treatments, but were obviously inadequate for the conditions of the test.

The best separation of treatments occurred with the adult emergence data (Table 3). This data would include any population effects (reduced number of nymphs per leaf) as well as effects on successful emergence. While some differences may have existed in the initial densities of nymphs collected, any differences were not obvious at the time of collection. The primary effect reflected in these data are attributed to unsuccessful development and emergence. Knack provided the greatest reduction of whitefly emergence, with greater than 98% reduction in adults as compared to the check. The only other treatment significantly different from the Check was Courier, which provided a little over 50% reduction in emerged adults.

Of additional interest in the adult emergence, it was noted that although banded-wing whitefly made up a small percentage of the overall whitefly population in the test, most of the adults emerging in the Knack treatment were banded-wing whitefly.

Table 1. Adult whitefly counts and visual plot ratings, snap bean efficacy trail, Lang Farm, 2002.

Treatment	Whitefly adults per leaf					Plot ratings 9/12
	37855	37859	37866	37869	37875	
Knack 8oz	91.6 ab	122.5 a	16.8 a	6.9 a	26.3 ab	3.0 a
2	107.5 ab	86.3 abc	17.9 a	13.8 a	25.4 ab	3.25 a
Dan+Orth	24.8 c	50.0 c	12.5 a	8.1 a	4.2 d	1.75 bc
Capture	66.9 bc	107.5 ab	24.7 a	13.6 a	9.9 cd	1.25 c
Provado	78.0 ab	80.0 bc	21.2 a	13.8 a	27.8 a	3.25 a
Actara	24.3 c	52.5 c	22.3 a	8.2 a	22.9 ab	2.75 ab
Assail	77.0 ab	96.3 ab	23.9 a	7.3 a	16.1 bc	3.5 a
FMC 1785	116.2 ab	107.5 ab	18.4 a	13.8 a	30.9 a	2.75 ab
Courier	119.6 a	98.8 ab	20.4 a	11.2 a	23.1 ab	2.75 ab
Check	89.3 ab	105.0 ab	17.4 a	20.0 a	23.8 ab	3.5 a

[1]Where significant differences were detected (P<0.05) means were separated with LSD(P=0.05)

Table 2. Nymph whitefly counts, snap bean efficacy trail, Lang Farm, 2002.

Treatment	Number of nymphs per leaf disk			
	37854	37866	37874	37880
Knack 8oz	1.1 c	44.4 b	83.7 ab	100.2 ab
2	3.9 bc	106.4 ab	45.6 ab	91.9 abc
Dan+Orth	7.3 abc	31.2 b	**95.2 a**	**56.2 c**
Capture	2.8 bc	128.8 ab	32.9 b	**71.1 abc**
Provado	17.7 a	123.0 ab	100.0 a	**78.8 abc**
Actara	5.3 bc	36.8 b	64.6 ab	**94.4 abc**
Assail	0.5 c	148.4 a	81.0 ab	**95.5 abc**
FMC 1785	13.7 ab	78.9 ab	73.1 ab	**61.2 bc**
Courier	2.3 bc	111.5 ab	68.0 ab	**105.3 a**
Check	5.8 bc	90.4 ab	67.3 ab	**76.3 abc**

[1]Where significant differences were detected (P<0.05) means were separated with LSD(P=0.05)

Table 3. Whitefly adult emergence data, snap bean efficacy trail, Lang Farm, 2002.

Treatment	Number of whitefly adults emerged from 5 leaves (raw data)	Number of whitefly adults emerged from 5 leaves (transformed data)
Capture	2778.0 a	2650.5 a
Assail	2084.3 ab	2007.8 ab
Provado	2026.3 abc	1730.2 ab
Check	1789.0 bc	1682.8 abc
FMC 1785	1714.8 bc	1614.7 abc
Danitol+Orthene	1127.0 cd	1109.7 abc
Actara	1083.3 cd	737.1 bc
Courier	731.8 de	594.4 c
Knack 8oz	42.0 e	38.0 d
Knack 10oz	24.5 e	13.6 d

[1]Where significant differences were detected (P<0.05) means were separated with LSD(P=0.05)

FOR SUPPRESSION OF MOSAIC VIRUSES IN SQUASH

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Introduction

Fall production of squash and pumpkin in South Georgia is greatly limited by problems with mosaic viruses, which are transmitted by aphids. Typically, plant viruses are managed through resistant varieties or vector management. Virus resistant squash varieties are available, but general are not resistant to all of the multiple mosaic viruses in South Georgia. Attempts to control virus problems through aphid management are made difficult because of the ease with which aphids transmit these diseases. Aphids can pick up the virus from an infected plant in seconds and can transmit the virus to a healthy plant also with only a few seconds of feeding.

Grower attempts to prevent aphids from vectoring viruses typically have included various combinations of Admire at planting, foliar insecticides, and spray oils. A small plot trial was conducted at the Coastal Plains Experiment Station's Lang Farm to evaluate the effects of selected treatments on the incidence of mosaic virus in squash. Treatments included soil applied systemic insecticide (Admire), foliar oil and insecticide applications, and various combinations of each. Although the primary purpose of this test was to evaluate the effects on occurrence of mosaic viruses transmitted by aphids, data was also collected on the influence on silverleaf systems caused by the silverleaf whitefly.

Materials and Methods

Plots were direct seeded on July 11, 2002 with straight neck early squash. Two rows of squash were planted on 6 foot beds. Plots were established prior to planting to allow for at-planting application of insecticide. Plots were 2 rows (1 bed) by 35 feet, with 5 foot allies down the row and a single bed (6 feet) between plots across the row. Plants were thinned to approximately 1 plant per foot after stand establishment.

Treatments evaluated were:

1 At planting application of Admire (16 oz/ac)
2 At planting application of Admire (16 oz/ac) followed by twice weekly foliar applications of spray oil (PCC-1223; 1% v/v)
3 At planting application of Admire (16 oz/ac) followed by once weekly application of spray oil (PCC-1223; 1% v/v) and once weekly application of spray oil (PCC-1223; 1% v/v) plus endosulfan (0.75 lb ai/ac)

4 Twice weekly foliar applications of spray oil (PCC-1223; 1% v/v)
5 Once weekly application of spray oil (PCC-1223; 1% v/v) and once weekly application of spray oil (PCC-1223; 1% v/v) plus endosulfan (0.75 lb ai/ac)
6 Non-treated check

At planting treatments with admire were applied in-furrow (immediately behind the planter shoe) in a total volume of 83 GPA. Foliar applications were made with a high volume, high pressure sprayer pulled behind a tractor and operated with the PTO. Foliar applications were made at 300 PSI in 100 GPA with hollow cone nozzles on 10 inch spacing across the row. Foliar applications were initiated at the cotyledon stage. The oil only foliar applications were applied to all foliar plots (oil or oil+endosulfan) on 7/15, 7/25, 8/01, 8/08, and 8/16. Oil (on oil only plots) or oil plus endosulfan treatments were applied on 7/18, 7/24, 7/29, 8/05, and 8/12.

Winged aphids were monitored periodically early in the test to verify presence in each plot. On the first sample, winged aphids were counted on 5 randomly selected plants in each plot. On subsequent dates, winged aphids and silverleaf whitefly adults were counted on five leaves in each plot (one leaf on five randomly selected plants).

Incidence of mosaic viruses were determined at harvest by visual examination of all fruit harvested from 20 feet of row in each plot and calculating the percentage of fruit with virus symptoms. In addition, visual examinations were conducted of all plants and all remaining fruit to determine the number of plants and fruit with obvious virus symptoms in each plot. All plots were also visually rated for severity of silverleaf on a 0 to 3 scale (0 = no silverleaf symptoms; 1 = light or spotty silvering; 2 = moderate uniform silvering; 3 = heavy silvering, little green plant material).

In addition to virus incidence, fruit were evaluated for bleaching associated with silverleaf whitefly. All fruit were separated by color, with three designations: orange (healthy normal fruit), yellow (slight to moderate bleaching of fruit associated with silverleaf whitefly), and white (heavily bleached fruit). All fruit of each color class were counted and weighed.

Data were analyzed with the PROC ANOVA procedure of PC-SAS. Where significant ($P<0.05$) differences were determined, means were separated with LSD ($P=0.05$).

Results and Discussion

Aphid densities were low but were evenly distributed with no significant differences among treatments (Table 1). Aphids were easily found on all sample dates and provided ample opportunity for virus transmission.

Occurrence of virus in all treatments was relatively low during and shortly after first harvest (20 Aug., 4 days after the last foliar application) (Table 2). No significant differences occurred among treatments in number of plants with virus symptoms on Aug. 19 and 23, nor in the number of fruit with virus symptoms on Aug. 23 (although for fruit the significance levels was P=0.058). General trends in these data do show slightly less virus symptoms in plants and fruit in all treatments that included foliar oil applications (as compared to Admire alone). The low number of fruit with virus in the check plot is partially attributed to low yields and overall poor quality of plants in these plots. Similar trends (but no significant differences) were seen in the number of fruit with virus symptoms in the first harvest (Aug. 20) (Table 3). By the second and third harvest, virus incidence had increased to over 30% in all plots except the check (data not presented).

Adult whitefly numbers were significantly reduced by all treatments, resulting in reduced amounts of leaf discoloration (silvering) (Table 2). The greatest reductions in silvering occurred in treatments which included Thiodan foliar applications once per week. Silvering was reduced to a lesser extent in the Admire plus foliar oil spray treatment, followed by Admire alone and oil alone.

Whiteflies had an impact on both quantity and quality of yields at first harvest (Tables 4 and 5). Although no significant differences occurred in total number of fruit, significant differences were detected in the total weight of fruit, the number and weight of marketable fruit (orange and yellow fruit), and the average weight of fruit. In general, as incidence of silvering decreased, total yield weight, marketable yields (number and weight), and average fruit size increased.

In comparing the check with the three treatments that received Admire at planting, there is a stair step decrease in silverleaf ratings from the check to Admire to Admire+oil to Admire+Thiodan treatments (Table 2). Across these same treatments, there are minor differences in total number of fruit, a near stair step increase in total yields, and a stair step increase in marketable fruit (numbers and weight) and average fruit weight (Tables 4 and 5). The oil alone treatment provided silverleaf ratings and marketable yields similar to Admire alone. The Thiodan treatments (without Admire) provided silverleaf ratings and yields intermediate to the Admire+oil and Admire+Thiodan treatments.

In comparison of the Admire+oil versus oil alone and Admire+Thiodan versus Thiodan alone, the general trends indicate a decrease in siverleaf ratings and an increase in total and marketable yields associated with the use of Admire.

Overall, mosaic virus incidence was low at first harvest with only minor differences among treatments, however, all treatments with foliar oil applications had slightly less virus. Admire alone, applied at planting, had the highest virus incidence. Admire at planting appeared to increase yields across all treatments through an impact on silverleaf whitefly, but silverleaf symptoms were decreased and marketable yields were increased with the addition of foliar treatments.

Table 1. Aphid and whitefly densities, mosaic virus suppression test in squash, Tifton, Georgia, 2002.

Treatment	Aphids			Silverleaf whitefly	
	7/24 per 5 plants	7/30 per 5 leaves	8/6 per 5 leaves	7/30 per leaf	8/6 per leaf
Check	2.50 a	2.75 a	3.25 a	62.00 a	32.15 a
Admire	2.75 a	2.00 a	3.75 a	18.60 b	3.35 b
Admire/oil	4.25 a	2.25 a	2.50 a	9.10 b	1.80 b
Admire/thiodan	5.25 a	0.50 a	2.25 a	4.50 b	0.55 b
Oil	3.00 a	1.25 a	2.50 a	14.20 b	2.95 b
Thiodan	3.00 a	1.00 a	1.00 a	4.10 b	0.35 b

[1]Where significant differences were detected (P<0.05) means were separated with LSD(P=0.05)

Table 2. Silverleaf ratings and virus incidence, mosaic virus suppression test, Tifton, Georgia, 2002.

	Rating for silverleaf		No. plants with virus		No. of fruit with virus 8/23 (P=0.058)
	37473	37486	37486	37490	
Check	2.5 a	3.00 a	4.75 a	4.00 a	0.50 a
Admire	0.75 bc	1.88 b	3.50 a	6.50 a	4.75 a
Admire/oil	0.50 c	1.13 c	0.00 a	0.50 a	0.75 a
Admire/thiodan	0.00 c	0.00 d	0.75 a	1.75 a	1.75 a
Oil	1.50 b	2.25 b	2.25 a	2.75 a	1.00 a
Thiodan	0.00 c	0.38 d	1.25 a	1.00 a	2.00 a

[1]Where significant differences were detected (P<0.05) means were separated with LSD(P=0.05)

Table 3. Yield data (first harvest) and virus infection, mosaic virus suppression test, Tifton, Georgia, 2002.

	Mean weight of fruit (kg/fruit) (8/20)	Number of fruit per plot with virus (8/20)	Percent of fruit with virus (8/20)
Check	0.195 c	2.00 a	7.45 a
Admire	0.221 c	2.75 a	7.76 a
Admire/oil	0.243 ab	0.50 a	1.47 a
Admire/thiodan	0.276 a	0.50 a	1.56 a
Oil	0.233 abc	0.25 a	1.00 a
Thiodan	0.247 ab	1.25 a	4.17 a

[1]Where significant differences were detected ($P<0.05$) means were separated with LSD($P=0.05$)

Table 4. Yield data (number of fruit, first harvest) by color classification, mosaic virus suppression test, Tifton, Georgia, 2002.

	Number of fruit per plot (8/20)			
	Orange	Yellow	White/green	Total
Check	0.00 b	0.00 b	24.50 a	24.50 a
Admire	3.50 b	6.25 a	23.25 a	33.00 a
Admire/oil	12.00 a	8.50 a	10.25 b	30.75 a
Admire/thiodan	17.75 a	9.00 a	5.50 b	32.25 a
Oil	3.25 b	6.75 a	14.75 ab	24.75 a
Thiodan	14.75 a	6.75 a	7.25 b	28.75 a

[1]Where significant differences were detected ($P<0.05$) means were separated with LSD($P=0.05$)

Table 5. Yield data (weight, first harvest) by color classification, mosaic virus suppression test, Tifton, Georgia, 2002.

	Weight (kg) of fruit per plot (8/20)			
	Orange	**Yellow**	**White/green**	**Total**
Check	0.00 b	0.00 c	4.68 a	4.68 c
Admire	1.03 b	1.80 ab	4.40 a	7.23 ab
Admire/oil	3.53 a	1.95 ab	1.93 b	7.40 ab
Admire/thiodan	5.23 a	2.53 a	1.15 b	8.90 a
Oil	0.95 b	1.83 ab	2.93 ab	5.70 bc
Thiodan	4.55 a	1.30 b	1.18 b	7.03 b

[1]**Where significant differences were detected (P<0.05) means were separated with LSD(P=0.05)**

EFFICACY OF SELECTED INSECTICIDES AGAINST MELONWORM

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Introduction

The melonworm, *Diaphania hyalinata* (Linnaeus), acts primarily as a defoliator of cucurbit crops, but will also feed directly on fruit when populations are high or foliage is consumed.

A small plot efficacy trial was conducted at The University of Georgia Coastal Plains Experiment Station's Lang Farm to evaluate the efficacy of selected insecticides against the melonworm, *Diaphania hyalinata*.

Materials and Methods

Plots were established in a planting of pumpkins with a heavy infestation of melonworm. Plants had been extensively defoliated at the time of treatment. Plots were established and treated on 4 September, 2002. Plots were 1 row (on a 6 foot bed) wide and 35 feet long. Each treatment was replicated 3 times in a randomized complete block design.

Treatments evaluated were Pounce 3.2 EC at 0.2 lb AI/ac, Lannate LV 2.4EC at 0.45 lb AI/ac, SpinTor 2 SC at 0.0625 lb AI/ac, Proclaim 5 SG at 0.0075 lb AI/ac, Avaunt 30 WDG at 0.045 lb AI/ac, and a non-treated check. Treatments were applied with a tractor mounted, compressed air pressurized sprayer (60 PSI) calibrated to deliver 60 gallons per acre with 3 TX18 hollow cone nozzles per row (1 over-the-top, 2 on drops).

A single destructive sampling was conducted on Sept. 6, 2002 (2 days after treatment). All plant material was removed (leaf-by-leaf) from one meter of row in each plot. The plant material was visually examined and all melonworm larvae were classified as small (early instars) or large (later instars) and counted. Larval counts were statistically analyzed using the PROC ANOVA procedure of PC-SAS. Where significant differences were detected ($P<0.05$), means were separated with LSD ($P=0.05$).

Results and Discussion

All treatments provided significant reductions in the number of melonworm larvae, as compared to the check (Table 1). Differences among treatments occurred primarily in control of large larvae. Avaunt, Proclaim and SpinTor provided the greatest levels of

control. Lannate and Pounce appeared to be slightly less efficacious, with Lannate having significantly more large larvae than Avaunt, Proclaim and SpinTor.

Table 1. Mean number of melonworm larvae per meter of row, Lang Farm, 2002.

Treatment	Number of larvae per meter of row		
	Total	Small	Large
Check	221.4 a	127.7 a	93.7 a
Lannate	64.7 b	27.0 b	37.7 b
Pounce	33.3 bc	10.3 b	23.0 bc
Avaunt	14.3 bc	5.0 b	9.3 c
Proclaim	10.4 c	5.7 b	4.7 c
SpinTor	6.3 c	2.3 b	4.0 c

Means not followed by the same letter are significantly different (LSD, P=0.05).

INSECTICIDE RESISTANCE IN DIAMONDBACK MOTH LARVAE IN IRWIN COUNTY GEORGIA - 2002

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Introduction

The diamondback moth, *Plutella xylostella* (Linnaeus), is a pest of cruciferous crops. This pest has a high potential for development of insecticide resistance when repeatedly exposed to any class of insecticides. A small plot efficacy trial was conducted in a commercial field of collards in Irwin County, Georgia, to evaluate the efficacy of selected insecticides against larvae of the diamondback moth (DBM), and evaluate potential resistance to these insecticides. The field had been treated with multiple insecticides including dimethoate, methomyl, permethrin, Dipel, and SpinTor. Heavy DBM pest pressure existed in the field despite previous treatments, suggesting potential resistance to registered insecticides. Treatments tested included representative insecticides from all registered classes (organophosphates, carbamates, etc.) except for *Bacillus thuringiensis*. Two additional products (Proclaim and Avaunt) were included as they have previously shown good efficacy against this pest but were not registered for use on collards.

Materials and Methods

Plots were established on October 3, 2002. Plots were 3 rows wide (36 in. centers) and 20 feet long. Each treatment was replicated 4 times in a randomized complete block design. Insecticide treatments were applied on October 4 with a CO_2 pressurized backpack sprayer (40 PSI) calibrated to deliver 30 gallons per acre, with 3 hollow cone nozzles per row (1 over-the-top, 2 on drops).

Treatments were Dibrom 8EC at 0.94 lb AI/ac, Thiodan 3EC at 1.0 lb AI/ac, Lannate 2.4EC at 0.9 lb AI/ac, Fury 1.5EC at 0.05 lb AI/ac, SpinTor 2F at 0.094 lb AI/ac, Confirm 2F at 0.12 lb AI/ac, Proclaim 5G at 0.01 lb AI/ac, Avaunt 30WG at 0.065 lb AI/ac, and a non-treated check. All treatments were tank mixed with DyneAmic at 0.45% by volume.

DBM larval densities were monitored at 1 and 3 days after treatment (DAT). In each plot, all larvae were counted on 5 leaves on each sample date. Leaves were selected from the middle row of each plot and selected based on location and age to attempt to insure selection of infested leaves that received good insecticide coverage. Only 3 replications were sampled at 1 DAT and all 4 replications were sampled at 3 DAT. In addition to larval

sampling, at 3 DAT, 10 larvae were collected from each Check and each Confirm plot and held on foliage to assess potential additional mortality in the Confirm treatment (Confirm's mode of action generally stops feeding rapidly in susceptible insects, but mortality can take several days).

DBM counts were analyzed with the PROC ANOVA procedure of PC-SAS. Where significant differences were detected (P<0.05), means were separated with Duncan's Multiple Range Test (DMRT) (P=0.05).

<u>Results</u> <u>and</u> <u>Discussion</u>

SpinTor, Fury (pyrethroid), and Confirm did not significantly reduce DBM densities. For Confirm, an additional 17.5% of larvae collected at 3 DAT (and held for 3 days) died, which still represents poor control. Lannate (carbamate), Dibrom (organophosphate), and Thiodan (organo-chlorine) provided significantly reduced DBM densities as compared to the check, but provided only 53 to 62 percent reductions in populations. Avaunt and Proclaim provided the best control with > 98% reductions in populations by 3 days after treatment.

Confirm is the single product in this test which generally does not provide much control of DBM. Fair to poor performance of other products in this test likely represent increased tolerance or resistance to those chemistries within the DBM population. While DBM has shown resistance to older chemistries in the past, the poor performance of SpinTor is alarming, as even lower rates should have provided excellent control. (Note: resistance testing with a dose selected to provide 100% mortality of susceptible individuals provided less than 10% mortality).

While the DBM population in this study showed relatively high levels of resistance to registered insecticides, past experience with this pest has demonstrated that with removal of the selection pressure, DBM will revert to susceptible over a relatively short period (months). These results emphasis the need to rotate insecticide chemistries in control programs to manage insecticide resistance.

(Note: these data provided the basis for a Section 18 request for registration of Avaunt and Proclaim on collards.)

Table 1. Number of diamondback moth larvae per leaf, collards trial, Irwin County, 2002.

Treatment	Mean number of larvae per leaf	
	1 DAT	3 DAT
Check	22.3 a	21.4 a
Fury	18.1 a	21.2 a
SpinTor	17.6 a	19.5 a
Confirm	19.5 a	19.2 a
Dibrom	11.6 b	10.1 b
Lannate	12.3 b	9.5 b
Thiodan	11.7 b	8.2 b
Avaunt	2.1 c	0.3 c
Proclaim	0.7 c	0.2 c

Means within columns followed by the same letter are not significantly different (DMRT, P=0.05)

EFFICACY OF SELECTED INSECTICIDES AGAINST APHIDS ON RUTABAGAS

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Introduction

A small plot efficacy trial was conducted in a commercial planting of rutabaga in Echols County, Georgia, to evaluate the efficacy of selected insecticides against aphids. Two species of aphids were present in the test. The majority of population was turnip aphids, *Lipaphis erysimi* (Kaltenbach), with the green peach aphid, *Myzus persicae* (Sulzer), estimated at 10 to 20 percent of the population. Insecticides tested included representatives of each insecticide chemistry commonly used for control of aphids and currently registered for use on greens (organophosphates [dibrom, malathion], pyrethroids [Fury], organochlorine [endosulfan] and neonicitinoids [Provado, Assail]).

Materials and Methods

Plots were established on December 6, 2002. Plots were a single row wide and 18 feet long (some individual plots were made slightly longer because of skippy stands). All plots were arranged down a single row. Each treatment was replicated 4 times in a randomized complete block design. A single application of each insecticide treatment was applied on December 6 with a CO_2 pressurized backpack sprayer (40 PSI) calibrated to deliver 30 gallons per acre with three hollow cone nozzles per row (one over-the-top, 2 on drops).

Treatments evaluated were Assail 70WP at 0.035 and 0.054 lb AI/ac, Malathion 5EC at 0.94 lb AI/ac, Dibrom 7.5EC at 0.94 lb AI/ac, Thiodan 3EC at 0.75 lb AI/ac, Provado 1.6F at 0.0468 lb AI/ac, Fury 1.5EC at 0.04 lb AI/ac, and a non-treated control. All treatments included a tank mix with DyneAmic at 0.5% by volume.

Aphid densities were monitored through visual inspection of leaves. On each sample date, aphids were counted on three leaves per plot. On leaves with low densities, individual aphids were counted (less than 25) or were estimated to the nearest 5 or 10 (less than 100). On leaves with high densities of aphids, aphid numbers were estimated to the nearest 25.

Because of the extreme variability in aphid densities, particularly in plots with higher densities (it was not uncommon to have counts range from 100 to over 500 in a single plot with high densities, and occasionally range from 20 or 30 to several hundred in a single plot), a Log (Y+1) transformation was performed on the data prior to analyses. Transformed data were then analyzed with the PROC ANOVA procedure of PC-SAS.

Where significant differences were detected (P<0.05), means were separated with LSD (P=0.05).

Although the weather varied during the test, of potential importance is that the weather was cold and overcast for several days at the time of application. Rain was minimal during the test and the field was irrigated (overhead center pivot) on December 19 (half the plots irrigated prior to counts).

Results and Discussion

Pest pressure in this test was high, but extremely variable. At one day after treatment, Provado had the lowest aphid densities but was not significantly different from Fury and Thiodan. Thereafter, Provado consistently provided the best control, followed by Assail at the high rate, Fury and Thiodan.

In general, the two organophosphates (Dibrom, Malathion) did not provide adequate control of aphids in this test. Provado provided the greatest level of control, followed closely by Assail and Fury. Thiodan provided slightly less control in the first week after treatment, but aphid densities in the Thiodan treatment continued to decline throughout the test resulting in good control on the last two sample dates. A rate effect was seen with Assail, with the higher rate showing better control after the first sample date.

Table 1. Mean number of aphids per leaf (transformed data), Echols County, 2002.

Treatment	Mean number of aphids per leaf				
	37961	37965	37970	37973	37977
Check	71.24 a	75.33 a	47.49 a	48.38 a	51.37 a
Dibrom	64.24 ab	56.04 ab	28.54 a	42.26 ab	26.25 ab
Malathion	41.76 abc	20.82 cd	24.77 ab	59.87 a	23.25 ab
Thiodan	31.07 bcd	24.25 bc	11.51 bc	6.68 cd	4.58 c
Fury	28.68 cd	9.36 de	2.19 e	6.99 cd	3.74 c
Assail 0.035	54.74 abc	13.93 cd	6.48 cd	17.94 bc	13.66 b
Assail 0.054	38.33 abc	4.0 e	2.73 de	3.80 d	3.63 c
Provado	14.05 d	0.27 f	0.00 f	0.19 e	0.67 d

Numbers within columns not followed by the same letter are significantly different (LSD; P=0.05).

Composting

PASSIVE COMPOSTING FAILS FOOD SAFETY TEST

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Introduction

Growers in Georgia are becoming increasingly aware of the benefits of compost. Compost amendments reduce the bulk density of soil, improve soil tilth, and facilitate more vigorous root growth. Compost improves soil aeration and drainage of heavy soils, and increases the water-holding capacity and aggregation of sandy soils. And especially beneficial to many soils in south Georgia, compost increases the cation exchange capacity of sandy soils, thereby, reducing leaching and helping hold nutrients in the root zone. Compost is also a source of many essential plant nutrients. Although the nutrient content of compost is relatively low compared to inorganic fertilizer, compost is widely recognized as a "slow release" source of nutrients that are less likely to leach from the soil or cause salt injury to plants or roots.

Because of the many potential benefits to soils and crops, interest in using compost is increasing among fruit and vegetable growers. Due to limited availability in some areas and the high cost of transport, some growers are considering making their own compost by on-farm composting. What makes this especially attractive to growers is the fact that many of them generate, or have access to, most of the feedstocks (peanut hulls, gin trash, old hay, cull vegetables, grass and brush trimmings, poultry litter, etc.) commonly used in south Georgia for making compost.

Compost produced on the farm or purchased from an off-farm commercial composter can be equally beneficial, as long as it is of a quality suitable for its intended use. Because of the dramatic increases in reported foodborne illnesses during the past ten years, food safety and producing safe food have become critical issues. When compost is used to grow produce, food safety is a major consideration. To be considered safe, non-processed or minimally processed produce must be free of virulent human pathogens. Because it is virtually impossible to thoroughly remove microbes from produce, the key to safe produce is preventing contamination. Pathogens such as *E. coli*, *Salmonella*, and *Campylobacter* which are routinely transmitted by an oral-fecal route are of primary concern. Poultry litter and other waste materials associated with animal bedding or confinement contain substantial amounts of fecal material. Whenever these materials are used as a feedstock in the composting process, the end-product can be a source of human pathogens if it is not properly composted. For compost to be considered suitable for use in produce production, it is recommended that temperatures above 130^0 F be maintained for a continuous duration of time during the composting process. Although the recommended time will vary based on

the actual temperatures achieved, 10 to 15 consecutive days of sustained temperatures above 130^0 F are considered adequate for sanitizing compost.

Large-scale, properly managed on-farm composting has a proven track record of consistently producing high quality compost that went through an adequate high-heat phase during the composting process. This type of composting is categorized as “active” or “managed” composting because of the active involvement of a manager in providing inputs that facilitate and enhance the microbial activity that produces high temperatures. Because of the intensive management, time, labor, and machinery required, managed composting systems require a substantial investment. In an effort to economize and avoid having to invest many thousands of dollars, less intensive “passive” processes are being considered by some growers. The process is referred to as passive because there is little participation of a compost manager in the process. Passive composting is characterized by low inputs - very little costs and very little management. This process is based on the premise that composting is a natural process and can occur with little or no manipulation by humans.

Fundamentally, composting is simply the microbial decomposition of organic matter and this decomposition does routinely occur without inputs from humans. In fact, natural composting was occurring before mankind came on the scene. Our ancestors probably had little interest in composting until they changed from hunters to gatherers and noticed that crops grew better near rotting piles of vegetation and manure.

There is no question that passive composting results in compost, of some form or fashion. The concern is whether or not that compost meets the desired quality standards. From the standpoint of food safety, the composting process must destroy any human pathogens associated with the organic materials being composted. The “kill factor” in the composting process is sustained temperatures above 130^0 F . This research was conducted to determine if the specific passive composting process used in this study produced temperatures above 130^0 for at least 15 consecutive days.

Materials and Methods

Feedstocks consisted of 45% ground yard waste (sieved through a 2 inch screen), 15% broiler litter, 15% cull vegetables, 10% cotton gin trash, 5% peanut hay, 5% clay, and 5% mature compost (% on volume basis). On July 8, 2002, feedstocks were mechanically mixed and combined into a composting pile using a front-end loader. The pile was constructed on a well-packed clay soil. The C:N ratio of the feedstocks, 36:1, was within the recommended range of 20:1- 40:1. The resulting conical compost pile was 8 feet high with a circumference of 56 feet and contained approximately 31 cubic yards of organic material.

To record temperatures at selected locations within the pile, TMC20-HA temperature sensors (Onset Computer Corporation, Bourne, MA) were installed at three locations in the pile. The sensors were placed in the center of the pile at the following distances above the base/soil surface: location # 1 - 28 inches above, location #2 - 55 inches above, and location #3 - 83 **inches above the soil surface. Beginning on July 13, hourly temperatures were recorded** using a H0BO H8 data logger (Onset Computer Corporation, Bourne, MA) and downloaded weekly. The compost pile was not disturbed from July 8 through December 1. During this 21-week period of time, the test site received 25.4 inches of rainfall.

Although the composting process used in the study was passive, at the beginning there were significant management inputs. The feedstocks were selected and proportioned to assure that the carbon to nitrogen ratio of the organic material would support a high-temperature composting process. To further enhance the composting process, the yard waste was ground to increase surface area, sufficient water was added to bring the moisture content of the combined ingredients to 50%, and all ingredients were mixed thoroughly. In addition, the pile was made large enough to ensure the “critical mass” necessary for generating high composting temperatures. Once the pile was made, there was no additional active management of the process - it was left entirely in mother nature’s hands for 147 days.

Results

Maximum Temperatures - For each location the maximum recorded temperature (Fahrenheit) and the date of its first occurrence were as follows: (a) location 1 - 153^0 (August 3), (b) location 2 - 141^0 (August 24) and (c) location 3 - 116^0 (August 29) .

Sustained Temperatures Above 130^0 - Throughout the duration of the experiment location 1 never reached 130^0. The highest sustained temperature at location 1 was 116^0 which lasted for 27 days (August 29 - September 24). When temperature measurements began on July 13, locations 2 and 3 had already risen to 137^0 F, and 143^0 F, respectively. At location 2, temperatures above 130^0 were sustained for 119 consecutive days (July 13 - November 8). Temperatures above 130^0 were sustained at location 3 for 48 days (July 13 - August 29).

Temperatures at Termination - At termination of this experiment on December 1, temperatures were 104^0, 124^0, and 82^0 for locations 1, 2, and 3, respectively.

Discussion

Sufficient heat was generated at locations 2 and 3 to kill human pathogens. However, the temperatures at location 1 were consistently sublethal. It was not within the scope of this study to determine the presence or absence of pathogens in the feedstocks. However, if the feedstocks used in this study were contaminated with human pathogens, compost taken from the area of the pile represented by location 1 would be a potential food safety hazard. Furthermore, even though temperatures were high enough to kill pathogens in locations 2 and 3, compost from those areas would be suspect because of possible cross contamination from location 1 after subsidence of the high temperatures. In addition, there is no way to determine the precise boundaries where lethal temperatures occurred so that only compost exposed to temperatures above 130^0 F could be selected for use.

Why did the temperatures at location 1 remain relatively low throughout the experiment? Observations and analysis of the compost at the termination of the experiment indicated that, compared to location 2, very little decomposition occurred at location 1. Lack of decomposition and low composting temperatures resulted from inadequate microbial activity which was probably due to excessive moisture and inadequate porosity near the bottom of the pile. From the standpoint of food safety, this suggests a serious limitation of passive composting. In contrast, during active composting, moisture and porosity are managed to enhance microbial activity and ensure sustained temperatures exceeding 130^0 F.

Conclusion

The passive composting process used in this study did not produce sustained temperatures above 130^0 F throughout the compost pile. Although some of the compost was subjected to sustained temperatures exceeding 130^0 F, a large portion of the compost was much cooler during the composting process. Subsequently, in this experiment, passive composting failed to achieve the recommended temperatures throughout the compost pile. Additional studies are planned to further investigate temperatures and temperature variability during passive composting.

Post Harvest

CALCIUM METALOSATE MAINTAINS CANTALOUPE WEIGHT AND FIRMNESS WHILE SLOWING RIPENING IN POSTHARVEST COLD STORAGE

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Introduction

Cantaloupes are an important crop in Georgia with over 7,000 acres and a value of almost $20 million (Doherty et al., 2002). The primary variety grown in Georgia is 'Athena', which is an eastern shipping type that is large, has sutures, and little netting. This variety and others in this class are noted for good shelf life when picked mature or nearly mature. Post-harvest shelf life for cantaloupe under refrigerated (35-40 deg. F) storage is only about 10-14 days. Being able to extend this shelf life or maintaining better fruit quality during handling and shipping would be advantageous. It has been known for sometime that calcium is an important constituent of cell walls and helps maintain cell wall integrity.

Recent work has shown that exogenous applications of calcium metalosate can extend shelf life and maintain fruit quality of honeydew melons (Lester and Grusak, 1999). The application of this material to netted cantaloupes however did not work as well, which the authors believe is due to the netting interfering with calcium uptake. Cantaloupes grown in Georgia do not have as much netting as western types, which may help improve the performance of this treatment.

In post-harvest handling of tomatoes, the fruit is often dipped in warm water for cleaning. Water temperatures above that of the fruit prevent infusion of the water into the fruit, which is undesirable. By contrast, reducing the solution temperature may improve movement of the solution into the cantaloupes.

This study was undertaken to investigate the effects of calcium metalosate treatment on post-harvest performance of cantaloupe.

Materials and Methods

Cantaloupe were harvested on 18 June 2002 at an on-farm location in Wheeler County, GA. and were treated by holding them in a solution made of 10.1 ounces of

calcium metalosate mixed in 192.7 ounces of water. To this was added crushed ice to maintain temperatures near freezing. Treated cantaloupes were held in this solution for 20 minutes at which time they were removed, dried, and, along with untreated cantaloupes, transported to the Vidalia Laboratory in Tifton, GA. Upon arrival at the laboratory all the cantaloupes were weighed and placed in refrigerated storage at 40-45 deg. F.

Every 2-4 days, the cantaloupes were removed from the cooler and reweighed. In addition, each cantaloupe was visually evaluated for firmness and ripeness. Cantaloupe firmness was rated on a 1-6 scale with 1-firm (marketable) and 5-soft (unmarketable). Ripeness was also visually evaluated on a 1-6 scale with 1-green (unripe) and 5-ripe. Cantaloupes removed from storage and disposed of during the study were given a rating of 6 for both ripeness and firmness. Fruit were evaluated for 28 days in this study.

Results and Discussion

Average fruit weight remained higher over time for treated cantaloupes compared to untreated cantaloupes (Figure 1). Cantaloupe ripeness increased with untreated fruit during the latter part of the study, although the difference was not dramatic (Figure 2). Finally, fruit remained firmer with the treatment compared to the untreated cantaloupes over the course of the experiment (Figure 3).

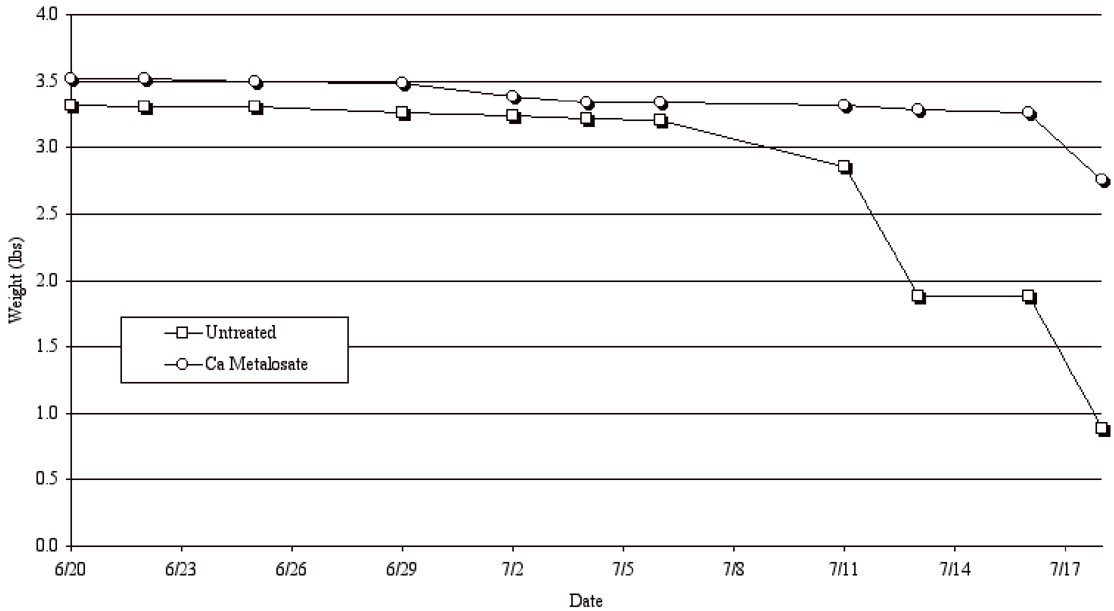
These results are very encouraging particularly in reference to Lester and Grusak's (1999) highly variable results with netted cantaloupes. The minimal netting in 'Athena' coupled with a cold solution dip appears to improve treatment effect.

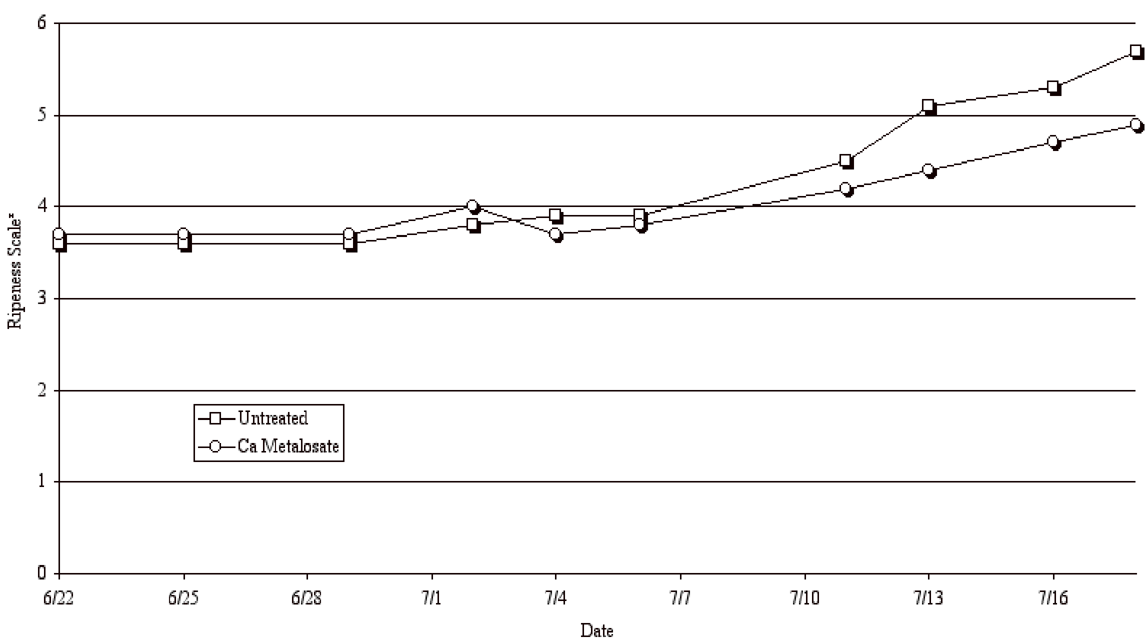
The cold solution treatment could be tested further with heavily netted cantaloupe to see if indeed this has a positive effect by increasing infusion. In addition, it should be noted that we did not test cold water alone as a check, which would have increased the validity of this study. Further work is planned particularly with field applications, which would be more convenient for growers.

Literature Cited

Doherty, B.A., N. Dykes, J.C. McKissick. 2002. 2001 Georgia farm gate value report. Univ. of Ga. Rep. AR-02-02.

Lester, G.E. and M.A. Grusak. 1999. Postharvest application of calcium and magnesium to honeydew and netted muskmelons: effects on tissue ion concentration, quality, and senescence. J. Amer. Soc. Hort. Sci. 124:545-552.





*Ripeness Scale: 1-5, 1-green, 5-ripe, 6-destroyed.

Food Safety

PASSING THE THIRD-PARTY GAPS FOOD SAFETY AUDIT

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Introduction

Since the Georgia GAPs Food Safety Certification began in mid-January of 2002, many produce growers and packers assumed that part of the "inspection process" was to have the auditor or county agent develop a food safety program for their farm or packing operation. That is not the intention of this program. It is the grower's or packer's responsibility to develop and implement an on-farm food safety program specific to their operation. However, the County Agent may point out areas where improvements need to be made and offer suggestions for improving the safety of the operation. The auditor's primary role is simply to verify by inspection that a sound, well-functioning food safety program is being followed. Unfortunately, most produce growers or packers do not have the training, expertise or time to undertake such a daunting task. Thus they have three choices: 1) pay a food safety consultant $10,000-$15,000 to provide this program, 2) "team up" with their county agent to prepare and implement a food safety program, or 3) take on this task themselves prior to the auditing process.

Materials & Methods

In response to this need for proper training, faculty in the Department of Food Science and Technology and the Department of Horticulture have developed and conducted district and state-wide programs to teach county agents and produce groups the mechanics of putting together a GAPs Food Safety Plan. This program has been particularly effective by utilizing hands-on sessions to identify areas of potential contamination and to develop Standard Operating Procedures (SOPs) to monitor and document control and prevention of contamination from these areas in the farming or packing operation. A 135-page, three-ring notebook with supporting material and sample forms was furnished in the one-day training seminars.

Results & Discussion

To date, eight programs as well as several invited lectures on GAPs have been presented around the state, involving more than 600 produce growers and packers, county agents, UGA Extension and research faculty, Georgia Department of Agriculture inspectors, Environmental Health specialists, and commercial third-party auditors. Produce buyers for Kroger and Publix have approved this program as a model guide for developing an on-farm food safety plan. The training program also scored an average of 4.49 out of 5.0

possible points for excellence, content, delivery and applicability by participants.

As an alternative to using expensive food safety consultants, Georgia producers have saved hundreds of thousands of dollars in creating their own food safety plans that have passed Georgia GAP Food Safety Certification audits as well as other third-party independent audits. The Georgia Fruit & Vegetable Growers Association featured this training program at their 2003 State Convention in Savannah so that more growers and packers could take advantage of this program. Two more one-day seminars have been scheduled for Summer 2003 in Bainbridge and Blue Ridge, Georgia.

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Disease Control

EVALUATION OF BED WIDTH IN PLASTICULTURE ON EFFICACY OF TELONE INLINE™ FOR YIELD INCREASE, NEMATODE, DISEASE AND WEED CONTROL IN BELL PEPPER, UGA-CPES BLACK SHANK FARM, TIFTON GEORGIA - SPRING 2002

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Introduction

Effectiveness of drip-applied chemicals, such as emulsifiable Telone products (eg InLine) and metam sodium, in plasticulture is dependent on adequate distribution of the chemical in the entire bed. Dye studies have indicated that injection times of up to 8 hours are required to ensure uniform wetting of a 30 in. bed. An alternative approach is to grow vegetables on narrower beds, as this can be expected to give a better distribution and bed coverage of the chemicals. However, no information is available on these aspects, and it needs to be verified whether an equally productive crop can be grown on narrower beds. The following test was done to compare effectiveness of different rates of InLine for nematode control in 20 in. versus 30 in. beds.

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. The area had a history of soybeans, tobacco, and assorted vegetables. The area was prepared using all current University of Georgia Extension Service recommendations. The plot design was a randomized complete block consisting of single bed plots replicated five times. Each plot was 30 feet long and beds were either 20 or 30 in. in width.

On 26 February a root gall evaluation was done on vetch, the cover crop that was planted to sustain nematodes through the winter in the plot area. The early index was done to determine the base root-knot nematode level.

On 11 March, the first chisel injection treatments, methyl bromide 98%, and Telone C35, were applied to the test plot area. At the time of injection, all the plots were shaped to pre-determined sizes and covered with 3 mil black polyethylene with drip tape in the center of the bed approximately 1 in. deep. On 15 March the remaining drip tape injection treatments were started and injections were finished on 18, 19, and 20 March.

Bell Pepper seedlings, cv. Crusader, a variety susceptible to M. incognita, were produced in nutrient tray system to the 4-leaf stage. A single pepper plant was transplanted using a mechanical type transplanter which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 28 March. Plants were spaced 12 in. apart.

As per the recommendation of the University Of Georgia Extension service, all plots received 500 lbs. of fertilizer (10-10-10) incorporated prior to planting. Additional fertilizer was added in the form of liquid fertilizer (Miracle-Gro 20-20-20) injected through the irrigation tubing during the growing season. All plots were sprayed on a 4 to 7 day interval with Manex with Zinc (2.4 qt/A) plus Kocide LF (0.5 gal/A) and Bravo (2 pts/A) for control of foliar diseases, and Ambush (10 oz./A) alternating with Pounce 3.2 (6 oz./A), Asana XL (6 oz./A) and Avaunt (3 oz./A) for insect control.

Stand counts were made to record live plants on 8 and 17 April. Vigor ratings were done on different dates starting at 20 days after planting (17 April, 2 May, 21 May, and 4 June). The plots were rated on a 1 to 10 scale, 10 representing live and healthy plants and 1 representing dead plants.

Nematode soil samples were collected at plant, at flowering and at final harvest. They consisted of twelve cores of soil, 2.5-cm-diam. × 25-cm-deep, both from the center and edge of each plot. Nematodes were extracted from a 150-cm^3 soil sub-sample using a centrifugal sugar flotation technique, except at planting when they were extracted in Baermann pans (to capture only active nematodes). Populations of slowly moving nematodes, such as sting, stubby root and ring nematodes, may therefore be underestimated at planting. Root gall evaluations were done on 14 May on three plants per plot, and again following final harvest on 12 July on the remaining plants using a 1 to 5 scale, 1 = 0%, 2 = 1% to 25%, 3 = 26% to 50%, 4 = 51% to 75%, 5 = 76% to 100%.

Soil fungal assays were done using a subsample from the samples taken for nematode assessments. Aliquots of soil were removed from each subsample and air dried for 24 hours. Five grams of soil were added to 100 ml of 0.3% water agar and mixed thoroughly. Immediately afterward, 1 ml of soil/agar was removed and mixed with 20 ml of 0.3% water agar. One ml of the first preparation was dispensed and spread evenly onto a petri plate containing an oomycete-selective medium (pimaricin-ampcillin-rifampicin-PCNB) for isolation of *Pythium* and *Phytophthora* spp. One ml of the second preparation was dispensed and spread onto a petri plate containing a *Fusarium*-selective medium (peptone-PCNB).

Treatment efficacy was also evaluated by placing propagules (fungus-infested wheat seed and/or toothpicks) of *Fusarium solani*, *Pythium irregulare*, *Rhizoctonia solani*, and *Cyperus esculentum* (yellow nutsedge) into nylon mesh bags (sachets) and

burying them in plots prior to application of treatments. Sachets were removed at transplanting and survival of the fungal propagules was evaluated on semi-selective media, whereas nutsedge germination was evaluated on wet tissue paper.

Nutsedge infestation in the field was also recorded by counting the number of plants poking through the plastic (at plant and at flowering) and by estimating the percentage nutsedge cover per plot at harvest.

Incidence of Tomato Spotted Wilt Virus (TSWV) was estimated by counting the number of plants that showed symptoms in each plot.

Shoot and root weights were recorded on 14 May (three plants per plot). All peppers were hand-harvested and each harvest was separated into marketable and cull, counted, and weighed. There were a total of six harvests, they were as follows; 31 May, 5, 11, 19, and 25 June and a final on 3 July.

All data collected was analyzed with an analysis of variance ($\underline{P}$ = 0.05) and means were separated using Duncan's Multiple range test.

Conclusion

Root gall evaluations on vetch prior to fumigation indicated low root-knot nematode pressure and resulted in low at-plant and at-flowering soil populations (Tables 3, 4). Early plant vigor was better for chiseled C35 as compared to dripped C35 (InLine) (Table 1). By harvest, root-knot nematode galling was somewhat greater in 20 in. beds as compared to 30 in. beds, and for dripped C35 as compared to chiseled C35 (Table 1). Soil populations of both root-knot and sting nematodes, irrespective of application rate, were similarly high in 20 in. beds as compared to non-treated beds (Tables 4, 5). In the 30 in. beds, the 35 gal/acre rate, chiseled or dripped, had similarly low sting and root-knot soil populations than the methyl bromide standard (Table 5). High nutsedge incidence was observed in 20 in. beds, even compared to the non-treated plots (Table 6). Tomato spotted wilt virus was slightly less in 20 in. compared to 30 in. beds.

Greatest pepper yields were recorded in 30 in. beds that were non-treated, chisel-injected with methyl bromide and C35, and drip-fumigated with InLine at a rate of 35 gal/acre (Table 2).

Viability of Pythium and Fusarium propagules in sachets that were buried near the bed shoulder was greater for the lower application rates. Fusarium viability was lowest in the narrow beds, but no effect of bed width was noted for any of the other pathogens/pests (Table 7). Nutsedge viability in sachets was reduced only by the chiseled fumigants, methyl bromide and especially C-35. Pythium soil

populations at planting were greater on the bed shoulder than on the bed centers (Table 7). All chemical treatments resulted in significant reductions of Pythium in the bed centers, but no reduction was noted for the lower InLine rates at the bed shoulders. Also Fusarium soil populations at planting were higher at the bed shoulders, especially following drip-fumigation. Again, application rate was most important in reducing fungal populations.

Overall, reducing the bed width did not improve nematode, fungal and nutsedge control. On the contrary, nematode and fungal soil populations, as well as nutsedge incidence, were greater in the 20 in. beds as compared to 30 in. beds.

Acknowledgments

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Table 1. Early growth, plant vigor, plant weight at flowering, and root gall index of pepper at flowering and harvest, spring 2002, Black Shank Farm Tifton, GA.

Treatment	Bed width	Rate / acre	Plant death (%)	Plant vigor (0-10)	Shoot weight (lbs)	Root weight (g)	Gall index (1-5)	
			At 20 days	At 20 days	At 47 days	At 47 days	At 47 days	At 106 days
InLine drip	20’’	35 gal	1 c	5.0 cd	79 bcd	11.6 ab	1.3	1.6 bc
InLine drip	20’’	26 gal	1 c	5.4 bcd	79 bcd	13.3 ab	1.3	1.8 ab
InLine drip	20’’	13 gal	0	5.8 abc	83 bcd	13.7 ab	1.1	2.3 a
InLine drip	30’’	35 gal	12 b	4.7 cd	75 cd	10.7 ab	1.2	1.3 bc
InLine drip	30’’	26 gal	29 a	3.8 d	66 d	10.0 b	1.3	1.4 bc
InLine chisel	30’’	35 gal	0	7.4 a	113 abc	17.7 a	1.2	1.1 c
Methyl bromide	30’’	200lbs	2 c	6.9 ab	130 a	17.5 a	1.2	1.1 c
Non-treated	30’’		0	7.1 ab	119 ab	15.7 ab	1.5	1.8 ab

[1]Plant death was largely due to plastic burn.
[2]Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according
to Duncan’s multiple range test. No letters indicate non-significant difference.

Table 2. Marketable fruit yield at different stages and total cull yield of pepper, spring 2002, Black Shank Farm Tifton, GA

Treatment	Bed width	Rate / acre	Yield 1	Yield 1-2	Yield 1-3	Yield 1-4	Yield 1-5
InLine drip	20’’	35 gal	10.8	18.0 ab	23.0 bc	27.5 bc	30.7 b
InLine drip	20’’	26 gal	7.7	18.7 ab	25.4 b	30.3 bc	33.9 b
InLine drip	20’’	13 gal	10.8	17.2 ab	22.0 bc	27.8 bc	30.3 b
InLine drip	30’’	35 gal	8.7	15.7 bc	24.0 b	29.7 bc	36.6 ab
InLine drip	30’’	26 gal	8.2	17.2 ab	21.6 bc	26.1 bc	30.1 b
InLine chisel	30’’	35 gal	9.7	11.5 c	17.2 c	22.6 c	30.0 b
Methyl bromide	30’’	200lbs	14.0	21.9 a	35.5 a	38.6 a	43.5 a
Non-treated	30’’		9.9	20.2 ab	27.2 ab	33.9 ab	38.9 ab

Yield 1 = first pick, yield 1-2 = first and second pick, ..., yield 1-6 = total of 6 picks. Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan’s multiple range test. No letters indicate non-significant difference.

Table 3. Nematode soil populations at planting of pepper, spring 2002, Black Shank Farm Tifton, GA.

			Nematodes per 150-cm^3 soil						
Treatment	Bed width	Rate / acre	M.i.[a]		B.l.		P.m.		Mc.
			Ce.[b]	Sh.	Ce.	Sh.	Ce.	Sh.	Ce.
InLine drip	20’’	35 gal	0	0	0	0	0	0.4	0
InLine drip	20’’	26 gal	0	0	0	0	0.2	1	0
InLine drip	20’’	13 gal	0.2	0	0	0	1	1.2	0
InLine drip	30’’	35 gal	0	0	0	0	0	0	0
InLine drip	30’’	26 gal	0	0	0	0	0	0	0
InLine chisel	30’’	35 gal	0	0	0	0	0	0	0
Methyl bromide	30’’	200lbs	0	0	0	0	0	0	0
Non-treated	30’’		0.6	0	0	0	0.4	2	0

[a] M.i. = Meloidogyne incognita (southern root-knot nematode), B. l. = Belonolaimus longicaudatus (sting nematode), P.m. = Paratrichodorus minor (stubby root nematode), Mc. spp.= Mesocriconema spp. (ring nematodes), N.par = non-parasitic (free-living) nematodes

[b] Ce. = center of bed, Sh. = shoulder of bed.

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan’s multiple range test. No letters indicate non-significant difference.

Table 4. Nematode soil populations at flowering of pepper, spring 2002, Black Shank Farm Tifton, GA.

			Nematodes per 150-cm^3 soil						
			M.i.[a]		B.l.		P.m.		Mc
Treatment	Bed width	Rate / acre	Ce.[b]	Sh.	Ce.	Sh.	Ce.	Sh.	Ce.
InLine drip	20''	35 gal	0	0	0	1.2	3 ab	9	0.4
InLine drip	20''	26 gal	0.3	0	0.4	1.2	12 ab	8	0
InLine drip	20''	13 gal	2	0.6	0.4	2.4	10 ab	9.4	3.6
InLine drip	30''	35 gal	0	0	0.1	0.2	1.6 b	6	0.2
InLine drip	30''	26 gal	0	0	0.1	0	2.2 b	10	0.2
InLine chisel	30''	35 gal	0	0.2	0	0.7	5.4 ab	6.2	0
Methyl bromide	30''	200lbs	0	0	0.2	0.8	5.4 ab	8.6	0
Non-treated	30''		0.2	0	1.8	0	0	8.6	0.2

[a] M.i. = Meloidogyne incognita (southern root-knot nematode),B. l. = Belonolaimus longicaudatus (sting nematode), P.m. = Paratrichodorus minor (stubby root nematode), Mc. spp.= Mesocriconema spp. (ring nematodes), N.par = non-parasitic (free-living) nematodes

[b] Ce. = center of bed, Sh. = shoulder of bed.

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant difference.

Table 5. Nematode soil populations after final harvest of pepper, spring 2002, Black Shank Farm Tifton, GA.

			Nematodes per 150-cm^3 soil					
Treatment	Bed width	Rate / acre	M.i.[a]		B.l.		P.m.	
			Ce.[b]	Sh.	Ce.	Sh.	Ce.	Sh.
InLine drip	20''	35 gal	308 ab	137 a	146 a	78 a	11	16
InLine drip	20''	26 gal	228 ab	122 a	177 a	61 ab	7	13
InLine drip	20''	13 gal	758 a	184 a	125 a	63 ab	2	9
InLine drip	30''	35 gal	20 b	83 ab	21 b	13 bc	2	3
InLine drip	30''	26 gal	321 ab	44 b	75 ab	32 abc	4	6
InLine chisel	30''	35 gal	11 b	4 b	7 b	7 c	3	8
Methyl bromide	30''	200lbs	44 b	11 b	16 b	15 bc	6	3
Non-treated	30''		446 ab	64 ab	81 ab	26 bc	10	3

[a] M.i. = Meloidogyne incognita (southern root-knot nematode), B. l. = Belonolaimus longicaudatus (sting nematode), P.m. = Paratrichodorus minor (stubby root nematode), Mc. spp.= Mesocriconema spp. (ring nematodes), N.par = non-parasitic (free-living) nematodes

[b] Ce. = center of bed, Sh. = shoulder of bed.

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant difference.

Table 6. Incidence of tomato spotted wilt virus (TSWV) and nutsedge with pepper, spring 2002, Black Shank Farm Tifton, GA.

Treatment	Bed width	Rate / acre	TSWV (no of infected plants)	Nutsedge at planting (no of plants)	Nutsedge at flowering (no o plants)
InLine drip	20’’	35 gal	2.6 b	2.4 b	11.0 abc
InLine drip	20’’	26 gal	3.4 b	4.2 ab	15.8 ab
InLine drip	20’’	13 gal	3.2 b	10.4 a	21.2 a
InLine drip	30’’	35 gal	4.6 ab	0	1.2 c
InLine drip	30’’	26 gal	5.4 ab	1 b	4.8 bc
InLine chisel	30’’	35 gal	7.4 a	0	0
Methyl bromide	30’’	200lbs	6.0 ab	0	0
Non-treated	30’’		3.2 b	0.5 b	5.2 bc

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan’s multiple range test. No letters indicate non-significant difference.

Table 7. Population densities of *Pythium* spp. and *Fusarium* spp., and viability of *Pythium irregulare*, *Fusarium solani*, *Rhizoctonia solani*, and yellow nutsedge in soil 3 weeks after treatment with alternatives to methyl bromide, spring 2002, Black Shank Farm Tifton, GA.

Treatment	Bed width	Rate / acre	Fungal soil populations [a]				Pathoger	
			Fusarium		Pythium		P.i.	F.
			Ce.[c]	Sh.	Ce.	Sh.		
InLine drip	20’’	35 gal	624 c	2496 c	0	1 c	2 bc	0
InLine drip	20’’	26 gal	576 c	3472 b	1 b	10 bc	4 ab	0
InLine drip	20’’	13 gal	1904 b	5552 a	3 b	14 b	6 a	10
InLine drip	30’’	35 gal	192 c	2512 c	0	1 c	1 c	2

InLine drip	30''	26 gal	192 c	1824 c	0	10 bc	2 bc	4ab	8b	86a
InLine chisel	30''	35 gal	144 c	752 d	0	0	0	0	0	0
Methyl bromide	30''	200lbs	1536 b	592 d	2 b	2 bc	1 c	18ab	8b	44b
Non-treated	30''		4304 a	4672 a	0.0833	40 a	2 bc	32a	12ab	86a

[a] Total populations of *Fusarium* spp. and *Pythium* spp. expressed as the number of colony forming units per gram of soil.
[b] Percentage of pathogen-infested grains or yellow nutsedge nutlets that were viable after removal from treated soil prior to transplanting of peppers. P.i.=*Pythium irregulare*, F.s.=*Fusarium solani*, R.s.=*Rhizoctonia solani* (AG-4), and C.e.=Cyperus esculentum (yellow nutsedge); sachets were buried near the bed shoulder.
[c] Ce. = Center of bed, Sh. = shoulder of bed.
Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant difference.

EVALUATION OF TELONE INLINE™ ON TOMATO AND SQUASH TRANSPLANTS TO DETERMINE PLANTING TIME FOLLOWING INJECTION UGA-CPES BLACK SHANK FARM, TIFTON GEORGIA - FALL 2002

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Introduction

Traditionally, soil fumigants for pest control are applied with tractors via shank injection. However, where drip systems are installed fumigation through drip lines via irrigation water is a more convenient option. Drip fumigation increases a growers flexibility, reduces the potential for worker exposure and allows growers to continue using the same drip lines and plastic mulch for successive crops.

Inline is an emulsifiable version of Telone C35 soil fungicide and nematicide, containing the active ingredient 1,3-D, plus 35% chloropicrin. Phytotoxicity of 1,3-D requires a waiting period between fumigation and planting of 1 week for each 10 gallons/acre, and in practice a 14-day interval is recommended. However, few data are available on what soil levels of 1,3-D actually cause phytotoxicity. The objective of this study was to evaluate growth of two common vegetables, squash and tomato, in plastic mulch beds as affected by different levels of drip-applied 1,3-D (Inline). This study was a follow-up to a previous test in the spring of 2002.

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. The area had a history of soybeans, tobacco, and assorted vegetables. The area was prepared using all current University of Georgia Extension Service recommendations. The plot design was a randomized complete block consisting of single 30 feet long bed plots replicated five times.

On 16 September all test plots were covered with 3 mil black polyethylene with drip tape in the center of the bed approximately 1in deep. On 18 September the Inline treatments were injected at different rates as follows; 40 Gal, 30 Gal, 20 Gal, 10 Gal, and 4 Gal/acre.

Yellow Straight neck Squash and BHN-44 tomato seedlings, both susceptible to *M. incognita* (root-knot nematode), were produced in nutrient tray system to the 4-leaf stage. Single beds were split in two 15-ft sections and each vegetable crop was randomly asigned to a section. Twelve plants of each cultivar were transplanted using a mechanical type transplanter which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 19 September. Plant spacing was 12 in. On that same day, prior to planting, 1,3-D gas readings were recorded using a Sensidyne Gastec Detector™ system.

As per the recommendation of the University Of Georgia Extension service, all plots received 500 lbs. of fertilizer (10-10-10) incorporated prior to planting. Additional fertilizer was added in the form of liquid fertilizer (Miracle-Gro 20-20-20) injected through the irrigation tubing during the growing season. All plots were sprayed on a 4 to 7 day interval with Manex with Zinc (2.4 qt/A) plus Kocide LF (0.5 gal/A) and Bravo (2 pts/A) for control of foliar diseases, and Ambush (10 oz./A) alternating with Pounce 3.2 (6 oz./A), Asana XL (6 oz./A) and Avaunt (3 oz./A) for insect control.

Stand counts were made to record live plants on 23 and 30 September, and on 2, 7 and 14 October. Three vigor ratings were done on 2, 7, and 14 October. The plots were rated on a 1 to 10 scale, 10 representing live and healthy plants and 1 representing dead plants. On 14 October all remaining plants were pulled to record shoot and root weights. All data collected was analyzed with an analysis of variance ($\underline{P}$ = 0.05) and means were separated using Duncan's Multiple range test.

Conclusion

Vegetables were visibly affected by residual 1,3-D in the soil and showed symptoms such as leaf chlorosis and shriveling (squash), black spots on leaves and stem (tomato) and lodging of the stem (both crops). Application rates of Inline showed better correlation with different plant growth parameters than1,3-D levels in the soil (the opposite was noted in spring). Plant stand and vigor were negatively correlated with Inline rate. Phytotoxicity response was more severe with squash during the first week, but was more prolonged with tomato. Squash mortality was high during the first week after planting, but did not increase afterwards. Tomato mortality was low during the first week, but plant vigor was poor and high mortality took place in the following weeks.

Similar to the spring test, little or no plant damage was observed for low 1,3-D levels (<10 ppm) but severe phytotoxicity was noted at the higher levels. In general, 1,3-D soil gas levels were lower in fall than in spring and differences between rates were less pronounced. This was probably due to higher temperatures in fall, and increased volatilization of the chemical into the air. Phytotoxicity response was also more rapid in fall than in spring, but was more prolonged in spring. The results indicate that if 1,3-D has not been allowed to dissipate sufficiently, plants can be severely injured or killed.

Acknowledgments

The authors wish to thank Dow Agrosciences for financial support. Also, Tonya Jo Cravens, Unessee Hargett, Don Hickey, Lewis Mullis, and Chris Williamson for technical support.

Table 1. Growth of tomato with different application rates of Inline (1,3-D (65%) + chloropicrin (35%)), Blackshank farm, fall 2002.

Inline rate (gal/acre)	1,3-D in soil at planting (ppm)	Stand count (%)	Wilt count (%)	Vigor rating (1-10)

		4days	8days	14days	26days	4days	8days	14days	26days	26days	26days
40	30	99	92	75	65 bc	22.9 ab	9.9 abc	4.6 cd	4.4 b	0.50 b	0.90 c
30	31	100	90	57	50 c	25.3 a	22.6 a	3.0 d	3.2 b	0.28 b	0.51 c
20	37	100	94	59	54 c	33.1 a	18.4 ab	3.4 d	3.8 b	0.32 b	0.53 c
10	29	100	97	85	85 ab	6.1 bc	4.4 bc	6.0 bc	6.6 a	0.80 ab	1.90 bc
4	25	100	100	98	97 a	1.4 c	0.0	7.4 ab	8.0 a	1.32 a	5.09 a
0	0	100	100	100	95 a	0	0.0	8.8 a	8.2 a	1.07 a	4.02 ab

[1]Inline was applied 1-3 days before planting

[2]Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant difference.

Table 2. Growth of squash with different application rates of Inline (1,3-D (65%) + chloropicrin (35%)), Blackshank farm, fall 2002.

Inline rate (gal/acre)	1,3-D in soil at planting (ppm)	Stand count (%)				Wilt count (%)		Vigor rating (1-10)		Root weight (g)	Shoot weight (lbs)
		1days	8days	14days	26days	4days	8days	14days	26days	26days	26days
40	30	92 ab	68 b	68 ab	67 ab	46 a	10	5.8 bc	5.2 bc	0.80 b	0.02 b
30	31	96 a	77 b	59 b	54 b	42 a	12	4.2 c	3.8 c	0.81 b	0.03 ab
20	37	85 b	72 b	57 b	55 b	55 a	13	5.0 c	4.2 bc	0.51 b	0.02 b
10	29	96 a	81 ab	73 ab	70 ab	31 ab	15	5.6 bc	5.6 abc	0.95 ab	0.03 ab
4	25	99 a	99 a	89 a	89 a	4 c	3	8.0 ab	8.2 a	1.73 a	0.08 a
0	0	100 a	99 a	91 a	77 ab	12 bc	0	8.4 a	7.0 ab	0.94 ab	0.05 ab

[1]Inline was applied 1-3 days before planting

[2]Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

EVALUATION OF TELONE INLINE™ ON TOMATO, PEPPER AND CUCUMBER TRANSPLANTS

TO DETERMINE PLANTING TIME FOLLOWING INJECTION UGA-CPES BLACK SHANK FARM, TIFTON GEORGIA - SPRING 2002

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Introduction

Traditionally, soil fumigants for pest control are applied with tractors via shank injection. However, where drip systems are installed fumigation through drip lines via irrigation water is a more convenient option. Drip fumigation increases a growers flexibility, reduces the potential for worker exposure and allows growers to continue using the same drip lines and plastic mulch for successive crops.

InLine is an emulsifiable version of Telone C35 soil fungicide and nematicide, containing the active ingredient 1,3-D, plus 35% chloropicrin. Phytotoxicity of 1,3-D requires a waiting period between fumigation and planting of 1 week for each 10 gallons/acre, and in practice a 14-day interval is recommended. However, few data are available on what soil levels of 1,3-D actually cause phytotoxicity. The objective of this study was to evaluate growth of three common vegetables, cucumber, pepper and tomato, in plastic mulch beds as affected by different levels of drip-applied 1,3-D (Inline).

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. The area had a history of soybeans, tobacco, and assorted vegetables. The area was prepared using all current University of Georgia Extension Service recommendations. The plot design was a randomized complete block consisting of 30 feet long single bed plots replicated five times.

On 1 April all test plots were covered with 3 mil black polyethylene with drip tape in the center of the bed approximately 1in deep. On 1 and 2 April the Inline treatments were injected at different rates. The treatments were as follows; 40 Gal, 30 Gal, 20 Gal, 10 Gal, 4 Gal, and 2 Gal/acre. Non-treated plots served as controls.

Crusader Bell pepper, BH-444 Tomato, and Thunder Cucumber

transplants, all susceptible to M. incognita, were produced in nutrient tray system to the 4-leaf stage. Each bed was split in three 10-ft sections and each vegetable crop was randomly asigned to a single section. Seven plants of each cultivar were transplanted using a mechanical type transplanter which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 5 April. Plant spacing was 12 in. On 4 April, prior to planting, 1,3-D gas readings were recorded using a Sensidyne Gastec Detector™ system, and again on 5 April following planting.

As per the recommendation of the University Of Georgia Extension service, all plots received 500 lbs. of fertilizer (10-10-10) incorporated prior to planting. Additional fertilizer was added in the form of liquid fertilizer (Miracle-Gro 20-20-20) injected through the irrigation tubing during the growing season. All plots were sprayed on a 4 to 7 day interval with Manex with Zinc (2.4 qt/A) plus Kocide LF (0.5 gal/A) and Bravo (2 pts/A) for control of foliar diseases, and Ambush (10 oz./A) alternating with Pounce 3.2 (6 oz./A), Asana XL (6 oz./A) and Avaunt (3 oz./A) for insect control.

Stand counts were made to record live plants on 8, 15, 17, and 26 April. Three vigor ratings were done on 10, 17 April and a final on 1 May. The plots were rated on a 1 to 10 scale, 10 representing live and healthy plants and 1 representing dead plants.

Height measurements were done from the soil level to the tip of the longest leaf on 25 April. Shoot and root weights were recorded on 22 May. All data collected was analyzed with an analysis of variance (P = 0.05) and means were separated using Duncan's Multiple range test.

Conclusion

Vegetables were visibly affected by residual 1,3-D in the soil and showed symptoms such as leaf chlorosis (cucumber and pepper), leaf bronzing (tomato) and stem browning (all crops). Tomato and pepper did not start dying till two weeks after planting, but plant vigor was poor and up to 40 % of plants were dead at 4 weeks (Tables 1, 2). Cucumber started dying immediately after planting and continued to do so afterwards. Mortality was as high as 70 % (Table 3). Little or no plant damage was observed for low 1,3-D levels (<10 ppm) but severe phytotoxicity was noted at the higher levels.

1,3-D levels in the soil were negatively and linearly correlated with different plant growth parameters, in particular plant vigor. Poorer correlation was found with application rates of InLine than with 1,3-D soil gas levels. The tested vegetables were ranked for their sensitivity to 1,3-D as follows: cucumber > tomato > pepper. The results indicate that 1,3-D gas levels in the soil are a good indicator

of risk and extent of phytotoxicity that can be expected after fumigation with Telone products. If 1,3-D has not been allowed to dissipate sufficiently, plants can be severely injured or killed.

Acknowledgments

The authors wish to thank Dow Agrosciences for financial support. Also, Tonya Jo Cravens, Unessee Hargett, Don Hickey and Lewis Mullis for technical support.

Table 1. Growth of pepper with different application rates of InLine (1,3-D (65%) + chloropicrin (35%)), Blackshank farm, spring 2002.

Inline rate (gal/acre)	1,3-D in soil at planting (ppm)	Stand count (%)				Vigor rating (1-10)			Height (cm)	Root weight (g)	Shoot weight (lbs)
		1week	2weeks	3weeks	7weeks	1weeks	2weeks	4 weeks	3weeks	7weeks	7weeks
40	112	100	80	63	63	5.8 bc	2.7 b	3.2 cd	10.2 b	41.1 bc	1.14 ab
30	74	100	100	100	93	6.9 ab	5.8 a	5.8 abc	13.3 ab	79.5 ab	1.18 ab
20	61	100	80	63	60	4.4 c	3.0 b	2.8 d	11.6 ab	26.2 c	0.56 b
10	39	100	94	77	80	5.6 bc	4.8 ab	5.2 bcd	13.2 ab	57.3 abc	1.02 ab
4	12	100	80	86	83	7.1 ab	5.5 a	6.4 ab	14.2 ab	79.2 ab	1.20 ab
2	6	100	97	94	94	7.8 a	6.6 a	7.4 ab	14.8 a	98.4 a	1.74 a
0	0	100	100	94	91	7.9 a	6.8 a	8.4 a	14.0 ab	79.3 ab	1.70 a

[1]InLine was applied 2-4 days before planting

[2]Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

Table 2. Growth of tomato with different application rates of InLine (1,3-D (65%) + chloropicrin (35%)), Blackshank farm, spring 2002.

Inline rate (gal/acre)	1,3-D in soil at planting (ppm)	Stand count (%)				Vigor rating (1-10)			Height (cm)	Root weight (g)	Shoot weight (lbs)
		1week	2weeks	3weeks	7weeks	1weeks	2weeks	4 weeks	3weeks	7weeks	7weeks
40	112	100	89 b	77	77	5.1 bc	4.8 bc	4.4 bc	16.4 bc	204	8.8
30	74	100	97 ab	97	97	5.1 bc	5.1 bc	5.2 abc	16.4 bc	215	9.4
20	61	100	97 ab	83	83	4.3 c	3.8 c	4.0 c	14.0 c	154	6.3
10	39	100	97 ab	86	86	4.4 c	4.7 bc	5.0 abc	15.6 bc	161	6.6
4	12	100	97 ab	91	91	6.9 ab	7.2 ab	6.8 abc	18.6 abc	220	9.9
2	6	100	100 a	100	100	7.8 a	7.2 ab	7.2 ab	20.4 ab	247	10.4
0	0	100	100 a	91	91	8.5 a	8.9 a	7.6 a	22.2 a	234	12.8

[1]InLine was applied 2-4 days before planting

[2]Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

Table 3. **Growth of cucumber with different application rates of InLine (1,3-D (65%) + chloropicrin (35%)), Blackshank farm, spring 2002.**

Inline rate (gal/acre)	1,3-D in soil at planting (ppm)	Stand count (%)				Vigor rating (1-10)			Root weight (g)	Shoot weight (lbs)
		1week	2weeks	3weeks	7weeks	1weeks	2weeks	4 weeks	7weeks	7weeks
40	112	71	43	31 b	26 b	2.6 d	2.8 bc	2.4 ab	9.9 b	1.36
30	74	86	69	40 ab	31 ab	3.6 bcd	4.2 abc	2.8 ab	12.0 ab	1.66
20	61	77	63	46 ab	37 ab	2.9 cd	2.4 c	2.4 ab	10.3 b	1.22
10	39	83	51	37 ab	23 b	3.2 bcd	2.7 bc	1.8 b	10.0 b	1.06
4	12	89	86	71 a	69 a	5.6 abc	6.1 a	5.6 a	28.7 a	3.04
2	6	100	86	63 ab	43 ab	5.8 ab	5.4 abc	4.6 ab	16.3 ab	1.78
0	0	100	89	74 a	60 ab	6.6 a	5.8 ab	4.8 ab	22.3 ab	2.14

[1]InLine was applied 2-4 days before planting

[2]Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

EVALUATION OF DRIP-FUMIGATION COMBINED WITH VYDATE™ APPLICATIONS AND POTENTIAL OF BIO-FUMIGATION ON SQUASH FOR NEMATODE CONTROL AND YIELD INCREASE, UGA-CPES BLACK SHANK FARM, TIFTON GEORGIA - FALL 2002

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Introduction

Oxamyl (Vydate) is an oxime carbamate used to control nematodes, mites and insects. A systemic pesticide, it is suggested for use as a pre-plant, at-plant and post-plant treatment. Oxamyl is used in a variety of formulations and is currently one of the only available post-plant nematicides registered for vegetables in the southeastern US. Oxamyl is not acceptable to farmers as a stand-alone treatment for nematode control. In vegetable plasticulture, it has been used in methyl bromide alternative programs as a post-plant application following pre-plant applications of 1,3-D and metam sodium. Greater and better quality crop yields following oxamyl and other carbamates have frequently been reported, but to this date the mechanism is not known.

On the other hand, consumer demand for reduced chemical pesticide use is increasing and several bio-pesticides have recently come to the fore. Many cruciferous plants contain nematicidal compounds (allyl isothiocyanates) that are related to methyl isothiocyanate (MITC), which is the active ingredient of the soil fumigant metam sodium. An experimental granular biopesticide (UCC-A1641) was developed from crushed mustard seed and has shown some promise for control of plant-parasitic nematodes.

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. The area had a history of soybeans, tobacco, and assorted vegetables. The area was prepared using all current University of Georgia Extension Service recommendations. The plot design was a randomized complete block consisting of single bed plots replicated five times. Each plot was 30 feet long.

On 19 August, 2002, the chisel injection treatment, methyl bromide 98%,

and the granular nematicide (Uniroyal Chemical) treatments were applied and all test plots were covered with 3 mil black polyethylene with drip tape in the center of the bed approximately 1in. deep. The following day, 20 August, the Telone C35 EC (Inline), and Vapam (metam sodium), and the combinations of Telone Inline + Vapam, were applied to the test plot area. Vydate (oxamyl, DuPont Chemicals) was applied in chemical combination at planting, and two and four weeks post-plant through the drip tape at a rate of 2 qts/acre per application.

The injector used in this study, we refer to as the chisel injector, was specially built for these applications. It has chisel shanks for injecting chemicals 8-10 inches deep and is equipped with a combination rototiller for applying chemicals such as metam sodium in combination with injectable soil fumigant products.

Yellow straight neck squash seedlings, cv. Prelude II, a variety susceptible to M. incognita, were produced in nutrient tray system to the 4-leaf stage. A single squash plant was transplanted using a mechanical type transplanter which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 10 September.

As per the recommendation of the University Of Georgia Extension service, all plots received 500 lbs. of fertilizer (10-10-10) incorporated prior to planting. Additional fertilizer was added in the form of liquid fertilizer (Miracle-Gro 20-20-20) injected through the irrigation tubing during the growing season. All plots were sprayed on a 4 to 7 day interval with Manex with Zinc (2.4 qt/A) plus Kocide LF (0.5 gal/A) and Bravo (2 pts/A) for control of foliar diseases, and Ambush (10 oz./A) alternating with Pounce 3.2 (6 oz./A), Asana XL (6 oz./A) and Avaunt (3 oz./A) for insect control.

Two stand counts were made to record live plants on 16 September (one week after planting) and on 15 October (at final harvest). A vigor rating was done on 23 September on a 1 to 10 scale, 10 representing live and healthy plants and 1 representing dead plants.

Eight cores of soil, 2.5-cm-diam.× 25-cm-deep, were collected from the center of each plot on 17 October 2002. Nematodes were extracted from a 150-cm^3 soil sub-sample using a centrifugal sugar flotation technique, except at planting when they were extracted in Baermann pans (to capture only active nematodes). Populations of slowly moving nematodes, such as sting, stubby root and ring nematodes, may therefore be underestimated at planting. Root gall evaluations were done on 8 October on three plants per plot, and again following final harvest on 15 October on the remaining plants using a 0 to 10 scale, whereby, 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of

which some are grown together, 4 = numerous small and some big galls, 5 = 25 % of roots severely galled, 6 = 50 % of roots severely galled, 7 =75 % of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, 10 = plant and roots dead.

Shoot and root weights were recorded on 8 October (three plants per plot). All squash were hand-harvested from the center 20-ft area of the bed. Each harvest was separated into marketable and cull, counted, and weighed. There were a total of three harvests, they were on 7, 10, and 14 October.

All data collected was analyzed with an analysis of variance ($\underline{P}$ = 0.05) and means were separated using Duncan's Multiple range test.

Conclusion

Root-knot nematode pressure was very high and caused severe stunting in 60% of non-treated plots. Pre-plant fumigants gave fair to good nematode control. Vydate following methyl bromide caused a small reduction in root galling compared to methyl bromide only, and a slight increase in yield. Metam sodium + oxamyl and InLine + oxamyl gave good nematode control up to harvest, better than the metam sodium + InLine combination.

The granular bio-pesticide failed to provide control of root-knot nematode at both tested rates.

Squash yields were very low due to severe wilting of the crop after flowering had set in. Wilt was caused by melon worm and airborne fungal pathogens. Poty and papaya ringspot viruses added on to the disease pressure. Lowest yields were recorded for non-treated plots and for the lowest bio-pesticide rate.

Acknowledgments

The authors wish to thank DuPont, Dow Agrosciences, and Uniroyal-Crompton Corporation, for financial support. Also, Tonya Jo Cravens, Unessee Hargett, Don Hickey, Lewis Mullis, and Chris Williamson for technical support.

Table 1. Early plant vigor, and plant weight, gall index and stand count at different growth stages of squash, fall 2002, Blackshank farm, Tifton, GA.

Treatment	Rate / acre	At 2 weeks		At 4 weeks		At 5 weeks (final harvest)	
		Plant vigor (0-10)	Gall Index (0-10)	Shoot wgt (lbs)	Root wgt (g)	Stand count	Gall Index (0-10)
Methyl bromide	200 lbs	7.8	0.3b	3.6a	25.0	12ab	0.2b
Methyl bromide + Vydate[a]	200 lbs + 2 qts	7.4	0.0	2.8ab	19.1	0.08333333	0.1b
Metam sodium +Vydate[a]	37.5 gal + 2qts	5.9	0.7b	1.9ab	18.1	0.125	0.9b
InLine + Vydate[a]	13 gal + 2qts	7.2	0.1b	2.8ab	19.7	15a	0.3b
Metam sodium + InLine	37.5 gal + 13 gal	5.4	1.9ab	1.9ab	25.3	11abc	1.6ab
UCC-A1641	12 lbs/1000 sq feet	5.6	5.5a	1.5b	23.7	3d	2.6ab
UCC-A1641	18 lbs/ 1000 sq feet	5.8	5.5a	1.6ab	25.7	6cd	5.0a
Non-treated		4.9	5.7a	1.6b	23.8	7bcd	5.0a

[a] Vydate was applied at 0, 2 and 4 weeks after planting

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

Table 2. Marketable yield of squash after one, two and three harvests and total culled fruits over three harvests during fall 2002, Blackshank farm, Tifton, GA.

Treatment	Rate / acre	One harvest		Two harvests		Three harvests		Total culls	
		Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)
Methyl bromide	200 lbs	10	3.1	15ab	4.7ab	0.375	6.9a	5	0.8
Methyl bromide + Vydate[a]	200 lbs + 2 qts	11	3.5	0.20833	5.5a	0.45833	7.3a	2	0.4
Metam sodium +Vydate[a]	37.5 gal + 2qts	9	2.1	15ab	3.6abc	0.29167	4.7ab	2	0.2
InLine + Vydate[a]	13 gal + 2qts	8	3.0	12abc	4.2abc	17ab	5.6a	3	0.4
Metam sodium + InLine	37.5 gal + 13 gal	3	1.0	6bc	1.8bc	13abc	3.9ab	2	0.5
UCC-A1641	12 lbs/1000 sq feet	4	1.1	5bc	1.3bc	7bc	1.5b	1	0.1
UCC-A1641	18 lbs/ 1000 sq feet	8	2.3	10abc	2.8abc	16ab	4.5ab	3	0.6
Non-treated		2	1.0	4c	1.8bc	5bc	1.8b	1	0.1

[a] Vydate was applied at 0, 2 and 4 weeks after planting

There were a total of three harvests, they were on 7, 10, and 14 October.

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate non-significant difference.

Table 3. Nematode soil populations before fumigation, at planting and at harvest of squash during fall 2002, Black Shank Farm Tifton, GA.

Treatment	Rate / acre	Nematodes per 150-cm^3 soil							
		Pre-fumigation			At planting			A	
		M.i [a]	P.m. [a]	N.par. [a]	M.i	P.m.	N.par.	M.i	P
Methyl bromide	200 lbs	1126	7	1844	0	0	345b	3ab	1
Methyl bromide + Vydate [b]	200 lbs + 2 qts	358	6	2037	0	0	316b	0	
Metam sodium +Vydate [b]	37.5 gal + 2qts	508	6	2094	7c	0	178b	1ab	
InLine + Vydate [b]	13 gal + 2qts	1076	7	1844	0	0	466b	4ab	2
Metam sodium + InLine	37.5 gal + 13 gal	1404	7	1960	0	0	394b	13ab	4
UCC-A1641	12 lbs/1000 sq feet	1060	7	1896	46ab	1	805ab	112a	2
UCC-A1641	18 lbs/ 1000 sq feet	1168	7	1450	14abc	2	1083a	80ab	4
Non-treated	N/A	1028	7	1446	188a	1	1095a	61ab	2

[a] M.i. = Meloidogyne incognita (southern root-knot nematode), P.m. = Paratrichodorus minor (stubby root nematode), N.par = non-parasitic (free-living) nematodes
[b] Vydate was applied at 0, 2 and 4 weeks after planting
Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

EVALUATION OF VYDATE™ IN COMBINATION WITH DRIP FUMIGATION ON EGGPLANT FOR YIELD INCREASE, NEMATODE CONTROL, AND INSECT SUPPRESSION, UGA-CPES BLACK SHANK FARM, TIFTON GEORGIA - SPRING 2002

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Introduction

Oxamyl (Vydate, Dupont Chemicals) is an oxime carbamate used to control nematodes, mites and insects. A systemic pesticide, it is suggested for use as a pre-plant, at-plant and post-plant treatment. Oxamyl is used in a variety of formulations and is currently one of the only available post-plant nematicides registered for vegetables in the southeastern US. Although Vydate will not be acceptable to farmers as a stand-alone treatment for nematode control, it may have potential as a post-plant application following pre-plant soil fumigation. Several researchers also reported improved fruit quality of tomato and pepper following Vydate application. Tests were set up to evaluate the effect of Vydate on nematode (and insect) damage and fruit yield of eggplant in combination with the drip-applied soil fumigants 1,3-dichloropropene (InLine) and metam sodium.

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. The area had a history of soybeans, tobacco, and assorted vegetables. The area was prepared using all current University of Georgia Extension Service recommendations. The plot design was a randomized complete block consisting of single bed plots replicated five times. Each plot was 30 feet long.

On 26 February a root gall evaluation was done on vetch, the cover crop that was planted to sustain nematodes through the winter in the plot area.

On 18 March, 2002, all test plots were covered with 3 mil black polyethylene with drip tape in the center of the bed approximately 1in. deep. On 19 March, Telone C35 EC (Inline, Dow Agro-Science) and metam sodium (Vapam) treatments were injected through the drip tape into designated plots (Table 1). Vydate (DuPont Chemicals) was applied at planting, and two and four weeks post plant through the drip tape at a rate of 2 qts/A per application.

Eggplant seedlings, cv. Purple Haze, susceptible to M. incognita, were produced in nutrient tray system to the 4-leaf stage. A single eggplant was transplanted using a mechanical type transplanter which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 15 April.

As per the recommendation of the University Of Georgia Extension service, all plots received 500 lbs. of fertilizer (10-10-10) incorporated prior to planting. Additional fertilizer was added in the form of liquid fertilizer (Miracle-Gro 20-20-20) injected through the irrigation tubing during the growing season. All eggplant plots were sprayed

on a 4 to 7 day interval with Manex with Zinc (2.4 qt/A) plus Kocide LF (0.5 gal/A) and Bravo (2 pts/A) for control of foliar diseases. No insecticides were sprayed to allow insect evaluations.

Two stand counts were made to record live plants on 18 and 22 April. A vigor rating was done on 30 April, rated on a 1 to 10 scale, 10 representing live and healthy plants and 1 representing dead plants.

Twelve cores of soil, 2.5-cm-diam × 25-cm-deep, were collected from the center of each plot before fumigation (18 March), at planting (15 April) and at harvest (28 June). Nematodes were extracted from a 150-cm^3 soil sub-sample using a centrifugal sugar flotation technique, except at planting when they were extracted in Baermann pans (to capture only active nematodes). Populations of slowly moving nematodes, such as sting, stubby root and ring nematodes, may therefore be underestimated at planting.

On 4 June (at flowering stage) an early root gall evaluation was done on three plants per plot using a 0 to 10 scale, whereby, 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some big galls, 5 = 25 % of roots severely galled, 6 = 50 % of roots severely galled, 7 =75 % of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, 10 = plant and roots dead. Again following final harvest on 22 July ten plants per plot were evaluated for root galls using that same scale.

Shoot and root weights were recorded at flowering stage of eggplant (4 June) on three plants per plot. All eggplants were hand-harvested from the 20-ft center area of each bed. Each harvest was separated into marketable and cull fruits, counted, and weighed. There were a total of three harvests, they were on 13, 20, and 26 June.

All data collected was analyzed with an analysis of variance ($\underline{P}$ = 0.05) and means were separated using Duncan's Multiple range test.

Discussion

Root galling on vetch was limited and the winter cover resulted in low pre-fumigation and at-plant nematode soil populations (Table 1). Phytotoxicity problems with InLine (1,3-D + Pic) resulted in high plant mortality in plots where InLine was dripped and the chemical affected plant vigor negatively (Table 2). Gall indices at flowering and harvest of eggplant were low for all treatments, including the non-treated control, confirming the low nematode pressure in this test (Table 2). All treatments reduced nematode galling compared to the control, but root-knot nematode soil populations were similarly high in plots where only Vydate or metam sodium was applied (Table 3).

Foliar insect damage to eggplant was significantly reduced following oxamyl applications (Fig. 1). The most common insects were eggplant flea beetles (*Epitrix fuscula*

(Crotch)) and leaf-footed bugs (*Leptoglossus* spp.). When oxamyl was applied, populations of both insects were consistently lower at 5 or less individuals per 10 m bed length (*P*<0.01).

Greatest total marketable yield was recorded with the metam sodium and Vydate combinations (Table 4). InLine gave poorer yields, except when combined with metam sodium and Vydate (Table 4). Vydate in combination with fumigation, either metam sodium or InLine or both, gave consistently higher yields than fumigation without Vydate.

Acknowledgments

The authors wish to thank Dow Agrosciences, and DuPont Chemical for financial support, Also, Tonya Jo Cravens, Unessee Hargett, Don Hickey, Lewis Mullis, and Chris Williamson for technical support.

Table 1. Nematode soil populations before fumigation, at planting (three weeks after fumigation), and at harvest of eggplant, spring 2002, Black Shank Farm Tifton, GA

		Nematodes per 150-cm3 soil								
		Pre-fumigation			At Planting			At final Harvest		
		18 March			15 April			28 June		
Treatment	Rate / acre	M.i.[a]	P.m.	N.par	M.i.	P.m.	N.par	M.i.	P.m.	N.par
Vydate	2 qts/A	1	31 a	209	0	17	156	1324 ab	28	123 cd
Metam sodium	75 gal/A	9	3 c	107	0	0	0	3031 bc	42	151 a-d
InLine	26 gal/A	4	1 c	121	0	0	7	112 c	19	113 cd
Metam sodium + Vydate	75 gal/A 2 qts/A	6	7 c	76	0	0	1	5 d	27	162 abc
InLine + Vydate	26 gal/A 2 qts/A	7	5 c	69	0	1	11	7 d	84	103 d
Metam sodium + InLine	37.5 gal/A 13 gal/A	11	3 c	103	0	0	3	5 d	19	137 bcd
Metam sodium + InLine + Vydate	37.5 gal/A 13 gal/A 2 qts/A	5	6 c	93	0	0	1	7 d	33	213 ab
Non-Treated	N/A	2	20 ab	198	2	14	109	3008 a	41	269 a

[a] M.i. = Meloidogyne incognita (southern root-knot nematode), P.m. = Paratrichodorus minor (stubby root nematode), N.par = non-parasitic (free-living) nematodes

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

All pre-plant treatments were drip-applied on 19 March, 2002. Eggplants were transplanted on 15 April, 2002.

Table 2. Plant stand and vigor during early growth stage, plant weight at flowering stage, and gall index of eggplant at flowering and harvest stage, spring 2002, Black Shank Farm Tifton, GA

Treatment	Rate / acre	Plant Mortality (%) 3 days	Plant Mortality (%) 7 days	Vigor Rating[a] 15 days	Shoot Weight(g) 50 days	Root Weight(g) 50 days	Early Root gall index [b] 50 days	Final Root Gall Index 90 days
Vydate	2 qts/A	12 ab	19 abc	6.8 ab	369	40.9	0.1 b	1.0 b
Metam sodium	75 gal/A	4 bc	9 abc	7.0 ab	393	44.6	0.3 b	1.1 b
InLine	26 gal/A	5 bc	13 abc	4.8 c	308	29.1	0.0 b	0.3 b
Metam sodium + Vydate	75 gal/A 2 qts/A	5 bc	6 bc	6.8 ab	466	43.9	0.1 b	0.1 b
InLine + Vydate	26 gal/A 2 qts/A	0.29167	26 a	5.4 bc	381	44.7	0.0 b	0.1 b
Metam sodium + InLine	37.5 gal/A 13 gal/A	10 bc	22 ab	6.2 bc	324	42.4	0.1 b	0.4 b
Metam sodium + InLine + Vydate	37.5 gal/A 13 gal/A 2 qts/A	5 bc	16 abc	7.2 ab	432	43.1	0.0 b	0.1 b
Non-Treated	N/A	1 c	3 c	8.6 a	378	50.8	1.4 a	2.7 a

[a] Vigor was done a 1-10 scale with 10= live and healthy plants and 1=dead plants.

[b] Root Gall Index 0-10 scale whereby, 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some big galls, 5 = 25 % of roots severely galled, 6 = 50 % of roots severely galled, 7 =75 % of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, 10

= plant and roots dead. Pre-fumigation treatments were drip-applied on 19 March, 2002. Eggplants were transplanted on 15 April, 2002.

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

Table 3. Marketable fruit yield of eggplant, spring 2002, Black Shank Farm Tifton, GA

Treatment	Rate / acre 3	Number and weight (lbs) of marketable eggplant plot (20 lin. ft. row)					
		Harvest 1[a]		Harvest 1 + 2		Harvest 1 + 2 +	
		Number	Weight	Number	Weight	Number	Weight
Vydate	2 qts/A	6	7.1	21	22.3 ab	43 abc	40.3 bc
Metam sodium	75 gal/A	6	8.6	20	21.9 ab	45 abc	44.6 bc
InLine	26 gal/A	7	8.1	14	15.8 b	31 c	33.8 c
Metam sodium + Vydate	75 gal/A 2 qts/A	7	8.7	24	28.4 a	58 a	63.3 a
InLine + Vydate	26 gal/A 2 qts/A	6	7.9	15	15.8 b	36 c	37.4 bc
Metam sodium + InLine	37.5 gal/A 13 gal/A	10	11	14	15.0 b	37 bc	36.8 bc
Metam sodium + InLine + Vydate	37.5 gal/A 13 gal/A 2 qts/A	13	10.5	24	21.7 ab	55 ab	51.7 ab
Non-Treated	N/A	12	12.9	22	23.2 ab	44 abc	44.1 bc

[a] There were a total of three harvests, they were on 13, 20, and 26 June.

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

Table 4. Culled fruit yield of eggplant, spring 2002, Black Shank Farm Tifton, GA

Treatment	Rate / acre	Number and weight (lbs) of cull eggplant plot (20 lin. ft. row) Harvest 1[a]		Harvest 1 + 2		Harvest 1 + 2 + 3	
		Number	Weight	Number	Weight	Number	Weight
Vydate	2 qts/A	1	1.2	3 b	3.3 b	5 b	4.7 b
Metam sodium	75 gal/A	2	2.1	4 b	4.3 b	8 ab	7.2 ab
InLine	26 gal/A	1	1.9	2 b	3.0 b	4 b	5.5 b
Metam sodium + Vydate	75 gal/A 2 qts/A	1	1.1	3 b	3.3 b	5 b	5.3 b
InLine + Vydate	26 gal/A 2 qts/A	2	2	4 b	4.5 b	5 b	5.5 b
Metam sodium + InLine	37.5 gal/A 13 gal/A	1	0.9	3 b	3.2 b	5 b	4.8 b
Metam sodium + InLine + Vydate	37.5 gal/A 13 gal/A 2 qts/A	2	2.3	4 b	4.4 b	6 b	5.9 b

Non-Treated	**N/A**	**3**	**3.1**	**0.33333333**	**8.0 a**

[a] There were a total of three harvests, they were on 13, 20, and 26 June. Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

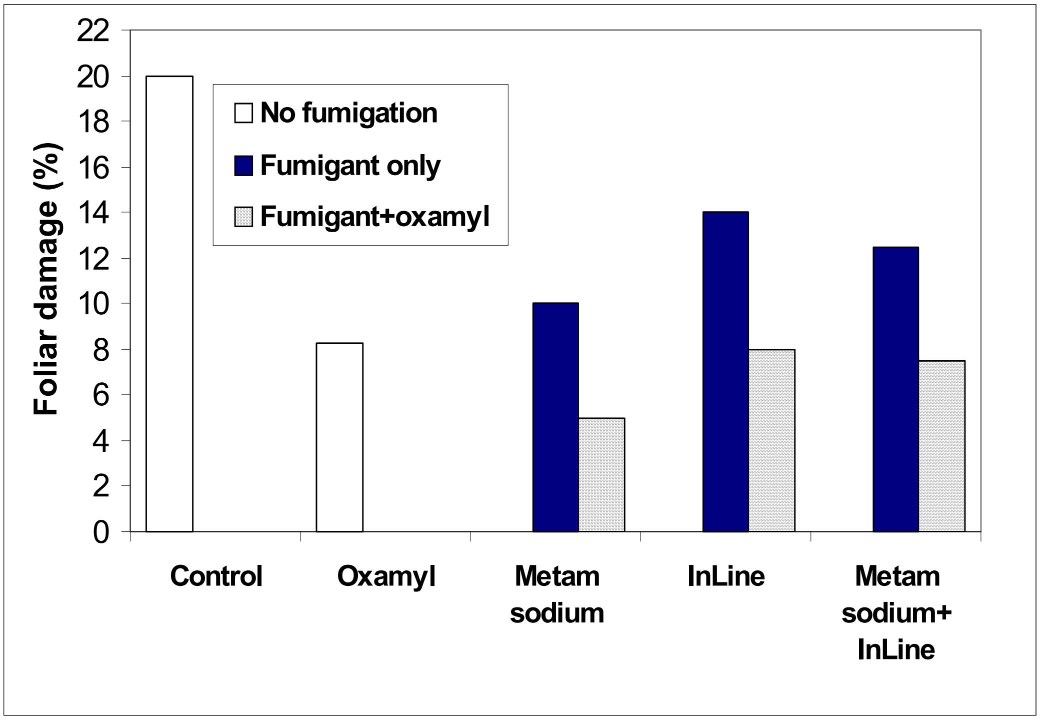

Fig. 1 Effect of soil fumigation with metam sodium and/or InLine, and oxamyl drip applications on foliar insect damage on eggplant, spring 2002, Tifton, GA.

MOVEMENT AND BIOLOGICAL ACTIVITY OF DRIP-APPLIED TELONE INLINE IN RAISED BEDS IN THE SOUTHEASTERN USA, SUMMER 2002

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Introduction

InLine®, an emulsified formulation of Telone C35 (60.8% 1, 3-dichloropropene (1, 3-D) plus 33.3% chloropicrin (Pic)) is one of the more

promising short-term alternatives to methyl bromide for application through the drip irrigation system. A major problem, however, for successfully applying pre-plant soil pesticides through the drip system is that the soils used for plastic mulch vegetable production in the Southeastern US are difficult to wet completely with drip irrigation systems. These deep sandy soils, having around 90% or more sand, drain rapidly and have limited lateral water movement. Recent research has focused on optimizing the distribution of drip-applied water in an effort to improve delivery of emulsified soil fumigants through these drip systems. Although emulsified 1, 3-D moves largely with the water in which it is applied, it has been shown to diffuse beyond the area wetted by drip-applied water.

The studies reported here were conducted to gain a better understanding of movement of water-soluble 1, 3-D in raised sandy beds and evaluate its activity outside of the wetted area. We also wanted to examine the effect of application rate and concentration, of pre- and post-fumigation irrigation events, of drip tape configuration and of plastic mulch type on movement and activity of 1, 3-D. Tests were done at three different locations, Tifton (GA), Quincy (FL) and Bradenton (FL). Biological activity of InLine was measured in terms of nutsdege control (all three locations) and root-knot nematode control (Tifton only).

Materials and Methods

Trials were conducted at the University of Georgia's Coastal Plain Experiment Station, Tifton, GA (July 15, 2002), at the University of Florida's Gulf Coast Research and Education Center, Bradenton, FL (July 31, 2002), and at the University of Florida's North Florida Research and Education Center, Quincy, FL (October 8, 2002). Soil types were Fuquay loamy sand (88% sand, 9% silt, 3% clay) at Tifton, EauGallie fine sand at Bradenton (97% sand, 2% silt, <1% clay), and Dothan loamy fine sand (88.5% sand, 4% silt, 7.5% clay) at Quincy. All soils had less than 2% organic matter.

Plots were located in fields with dense populations of nutsedge (*Cyperus* spp.), which served as a biological indicator of the distribution of effective concentrations of 1, 3-D. Raised beds were formed using a commercial tractor-drawn bed-former. Drip tape was installed together with the black polyethylene film mulch. Drip tape was put 1 in. below the surface in Tifton, and on the surface in Bradenton and Quincy. Beds were covered with mulch about 2 weeks prior to application at Tifton and Quincy. At Bradenton, the beds were formed about 3 months prior to application. Heavy summer rains and resulting flooding of the test site prohibited application at two weeks as planned. Beds were 30 ft long at Tifton and 20 ft long at Bradenton and Quincy. Width of the bed tops was 30 in at Tifton and Bradenton and 36 in at Quincy. Bed height was ca. 8 in at all locations.

Spacing between bed centers was 6 ft at Tifton and Quincy and 5 ft at Bradenton. The drip tape used for single tube treatments at Quincy and Tifton was Chapin (12-in. emitter spacing between emitters and a flow rate of 1.14 l/hr at 0.069 MPa). At Bradenton, the drip tape was T-Tape (12 -in. emitter spacing, delivering 1.03 l/hr at 0.069 MPa). Plastic mulch was low density polyethylene (LDPE, thickness 50 mm).

Emulsified Telone C35 (InLine®, 1,3-D plus 33% Pic) was injected into plots through the drip irrigation system. This was done with a battery-operated Even-Flo® water pump which pumped pre-mixed solutions from a 15 gal water tank. Flow was calibrated to deliver the 15 gal in appropriate irrigation times. At all three sites, 35 gal per treated acre was applied in concentrations of 1000 and 1500 ppm (parts per million) of 1, 3-D. In Bradenton and Quincy, rates of 26 gal and 35 gal per treated acre were applied at a concentration of 1500 ppm of 1, 3-D. In Quincy, both rates (at a concentration of 1500 ppm) were applied using single and double drip tape configurations. In Tifton and Bradenton, the effect of pre-fumigation soil moisture ('wet' and 'dry' plots) and of subsequent irrigation was also investigated. To achieve 'wet' and 'dry' plots at Tifton, the wet plots were irrigated through the drip system from 1200 to 2030 hrs the day prior to application. Soil moisture immediately prior to application was determined at 7.8 and 10.3% in the dry and wet plots, respectively. At Bradenton, high soil moisture precluded similar pre-application irrigation. The field used was historically wetter at one end, so the field was divided into wet and dry ends, and plots assigned accordingly. Soil moisture immediately prior to application was 11.4 and 11.9% in the dry and wet plots, respectively. The effect of post-fumigation water (subsequent irrigation) was investigated by operating the drip system for 3.5 hr at one and two days after an initial application of 35 gal of fumigant at 1500 ppm. Blue marking dye (Signal®) was injected into all plots concurrent with the chemical injection (1 pint of dye/10 gal of water delivered to the plots) so that the extent of water movement could be determined. Following each treatment, the drip system in each plot was allowed to run an additional 15-30 min, depending on length of runs, to purge remaining chemical from drip tubes. All plots were replicated four times in a randomized complete block design. Treatments and application parameters are given in Table 1.

Gas concentrations of 1, 3-D in soil were measured using Gastec® detection tubes capable of detecting 2-450 ppm of 1, 3-D. Concentrations were measured on four consecutive days following application. Each day measurements were taken in the bed center, midway between the bed center and bed shoulder, and at the bed shoulder. Measurements were taken from a ½ in diameter, 6 in deep hole cored into the bed at each location. A Sensidyne® Gas Detection Pump (Model AP-1S) was used to draw 50-200 ml of air from each hole through the detection tube. The amount of air drawn through the tube was based on sensitivity of the tube

and levels present in the soil. At Quincy, Gastec readings were taken at two locations in relation to the drip emitters to determine the effect of proximity to drip emitters on Gastec readings. One set of samples was drawn from the bed center, bed shoulder and midway between these two at a location level with the drip emitters. A similar set of samples was drawn at locations halfway between two emitters.

At 7-8 days after application, plastic mulch was removed from one half of the plots and the location of drip tube emitters were marked with surveyor's flags. Width of nutsedge control was measured in a two-inch band centered on an emitter and in a similar band located between emitters. A trench was then excavated across the bed at the level of the emitter and at a level midway between emitters and the width of the dye pattern was measured. In Tifton, nutsedge viability was also evaluated in the greenhouse by following the germination pattern of nutsedge tubers for 30 days. Nutsedge tubers were therefore collected two days after removing the plastic from the bed center, mid-way between the bed center and bed shoulder, and at the bed shoulder. Four soil cores (gulf cup cutter cores) were collected from each location. After washing the soil from the tubers, tubers from each plot and for each location were counted, planted into designated pots and the germination patterns were followed for 30 days, counting the number of shoots at 7, 14, 21 and 28 days after planting. At 28 days, pots were screened again and the number of tubers counted.

In addition to nutsedge control, biological activity of InLine in Tifton was also assessed by its effect on soil nematodes. Nematode soil populations were determined before fumigation and after removing the mulch from 10 soil cores (1 in-diam. x 10 in-deep) from each plot. Soil cores were mixed, and nematodes were extracted from a 100- cm^3 sub-sample with a modified Baermann method. Before application, each bed was sampled by collecting cores covering the entire bed. After removing the mulch, separate samples were taken from the bed center, mid-way between the bed center and bed shoulder, and at the bed shoulder.

Conclusion

1,3-D soil gas levels decreased with time and with distance from the drip injection point (Fig. 1). High concentrations of 1,3-D were measured at the center and midway between center and shoulder, but concentrations were low at the bed shoulders (Figs. 1, 2). Width of nutsedge control was significantly greater than width of water movement (Fig. 3). Plant-parasitic nematodes were controlled over the entire bed width (Table 2), but nutsedge re-emerged at the bed shoulders

regardless of treatment. Higher application rates and concentrations of InLine resulted in higher concentrations of 1,3-D in soil air. Irrigations subsequent to application reduced soil air concentrations of 1,3-D and increased water movement, as did the use of two instead of one drip tube. The latter also improved the width of nutsedge control, although some nutsedge was observed in the bed centers. At Bradenton, the VIF plastic mulch resulted in significantly higher 1,3-D levels over the entire bed width and nutsedge control in these beds extended up to the bed shoulder. The data show that the pesticidal activity of InLine extends beyond the waterfront and indicate a significant degree of fumigant activity of emulsifiable Telone products. However, unlike plant-parasitic nematodes, nutsedge could not be controlled over the entire bed width, regardless of rate, concentration and volume of water applied.

Acknowledgments

The authors wish to thank Dow Agrosciences for financial support. Also, Tonya Jo Cravens, Unessee Hargett, Don Hickey, Lewis Mullis, and Chris Williamson for technical support.

Table 1. Treatments and application variables for InLine (1,3-D plus 33% Pic) drip fumigation trials at Tifton, GA, Bradenton, FL and Quincy, FL, 2002.

Location/ Treat no.	**Rate (G/acre)**	**Concentration (ppm)**	**Soil moisture**[a]	**Drip tubes**	Subsequent irrigation? [b]	Injection time	Irrigation water (l/m^2)
Tifton, GA							

1	35	1500	Dry	1	No	4 h 12 m	17.2
2	35	1500	Wet	1	No	4 h 12 m	17.2
3	35	1000	Dry	1	No	6 h 18 m	25.7
4	35	1000	Wet	1	No	6 h 18 m	25.7
5	35	1500	Dry	1	Yes	4 h 12 m	42.8
6	35	1500	Wet	1	Yes	4 h 12 m	42.8
7	0	---	Dry	1	---	---	---
8	0	---	Wet	1	---	---	---
Bradenton, FL							
1	26	1500	Dry	1	No	3 h 29 m	12.8
2	26	1500	Wet	1	No	3 h 29 m	12.8
3	35	1500	Dry	1	No	4 h 40 m	17.2
4	35	1500	Wet	1	No	4 h 40 m	17.2
5	35	1000	Dry	1	No	7 h	25.7
6	35	1000	Wet	1	No	7 h	25.7
7	35	1500	Dry	1	Yes	4 h 40 m	42.8
8	35	1500	Wet	1	Yes	4 h 40 m	42.8
9	0	---	Dry	---	---	---	---
10	0	---	Wet	---	---	---	---
Quincy, FL							
1	26	1500	Dry	1	No	3 h 8 m	12.8
2	35	1500	Dry	1	No	4 h 12 m	17.2
3	35	1000	Dry	1	No	6 h 18 m	25.7
4	26	1500	Dry	2	No	3 h 8 m	12.8
5	35	1500	Dry	2	No	4 h 12 m	17.2
6	0	---	Dry	---	---	---	---

[a]Tifton soil: dry=7.8% moisture; wet=10.3% moisture
Bradenton soil: dry= 11.4% moisture; wet=11.9% moisture
[b]Subsequent irrigation was applied for 3.5 h at one and two days after application

Table 2. Effect of InLine on nematode soil populations at different locations in the bed and for different soil moisture levels.

Factor	Plant-parasitic nematodes [a]				Free-living nematodes		
	M. i.	P. m.	B. l.	M.c spp.	Bacteri-vores	Fungi-vores	Omni-vores
Treatment							
1500ppm	0	0	0	0	7b	0	0

1000ppm	0	0	0	0	6b	0	0
1500ppm+water	0	0	0	0	5b	0	0
Non-treated	29	2	8	18	151a	15	18
Location [b]							
Center	0	0	0	0	1b	0	0
Between	0	0	0	0	1b	0	0
Shoulder	0	0	0	0	15a	0	0
Moisture [b]							
Dry	0	0	0	0	3b	0	0
Wet	0	0	0	0	9a	0	0

[a] M.i. = Meloidogyne incognita (southern root-knot nematode), P.m. = Paratrichodorus minor (stubby root nematode), B. l. = Belonolaimus longicaudatus (sting nematode), Mc. spp.= Mesocriconema spp. (ring nematodes), N.par = non-parasitic (free-living) nematodes

[b] Means are calculated excluding the non-treated control

Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test.

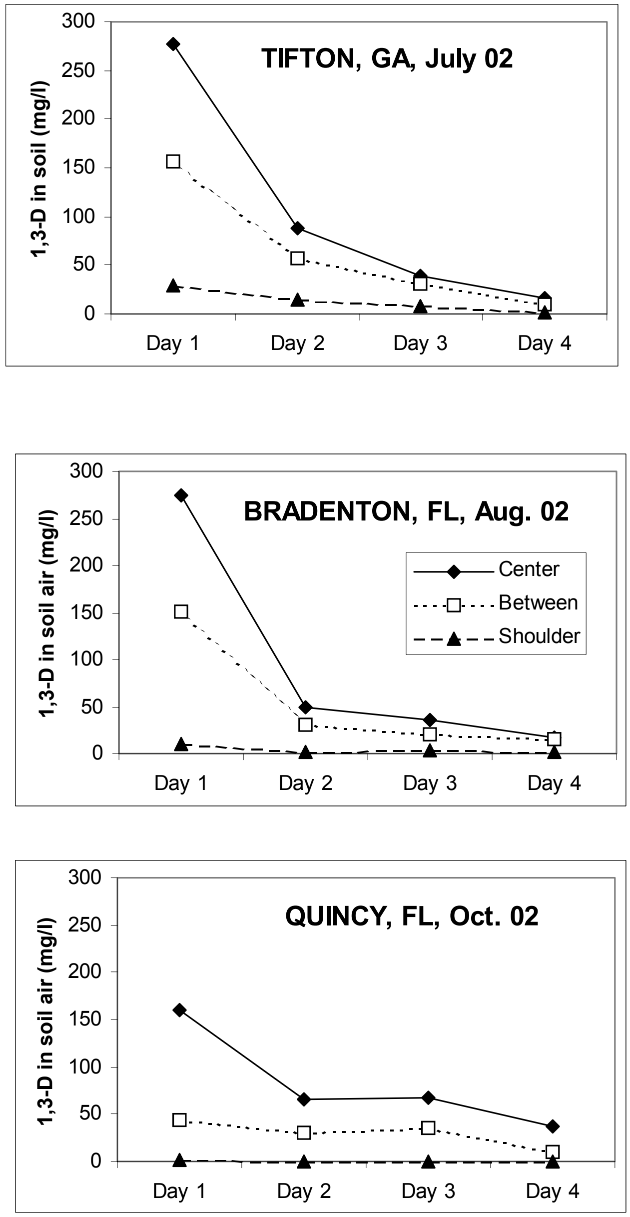

Fig. 1 Time-concentration curves for 1,3-D in soil air at different positions in the bed in Tifton, GA, Bradenton, FL and Quincy, FL, July-October 2002.

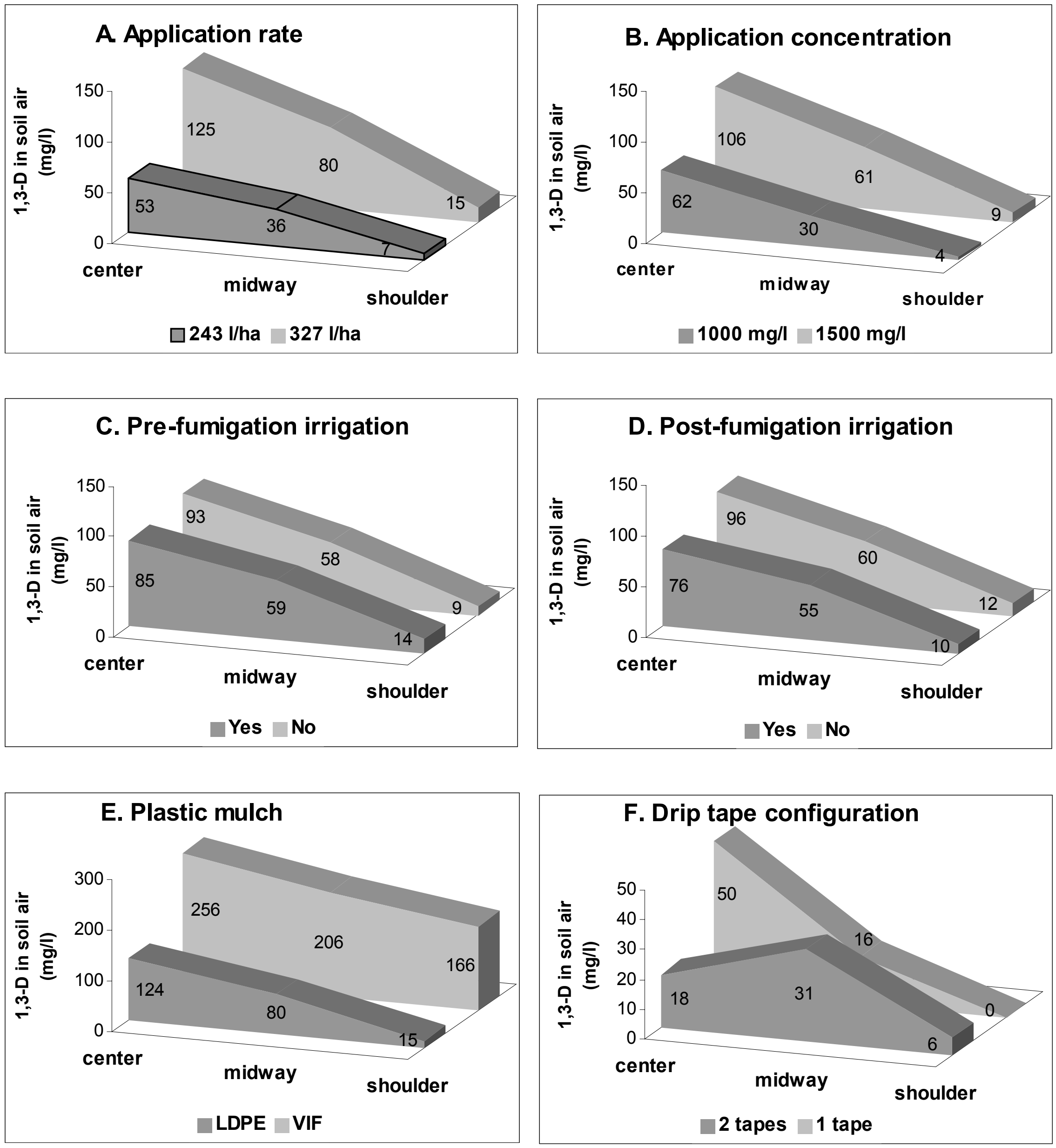

Fig. 2 Effect of InLine application rate and concentration, pre- and post-fumigation irrigation, plastic mulch type, and number of drip tapes on soil air concentrations of 1,3-D at different positions in raised beds. Values are averaged over different sites, except for plastic mulch type (only Bradenton) and number of drip tapes (only Quincy).

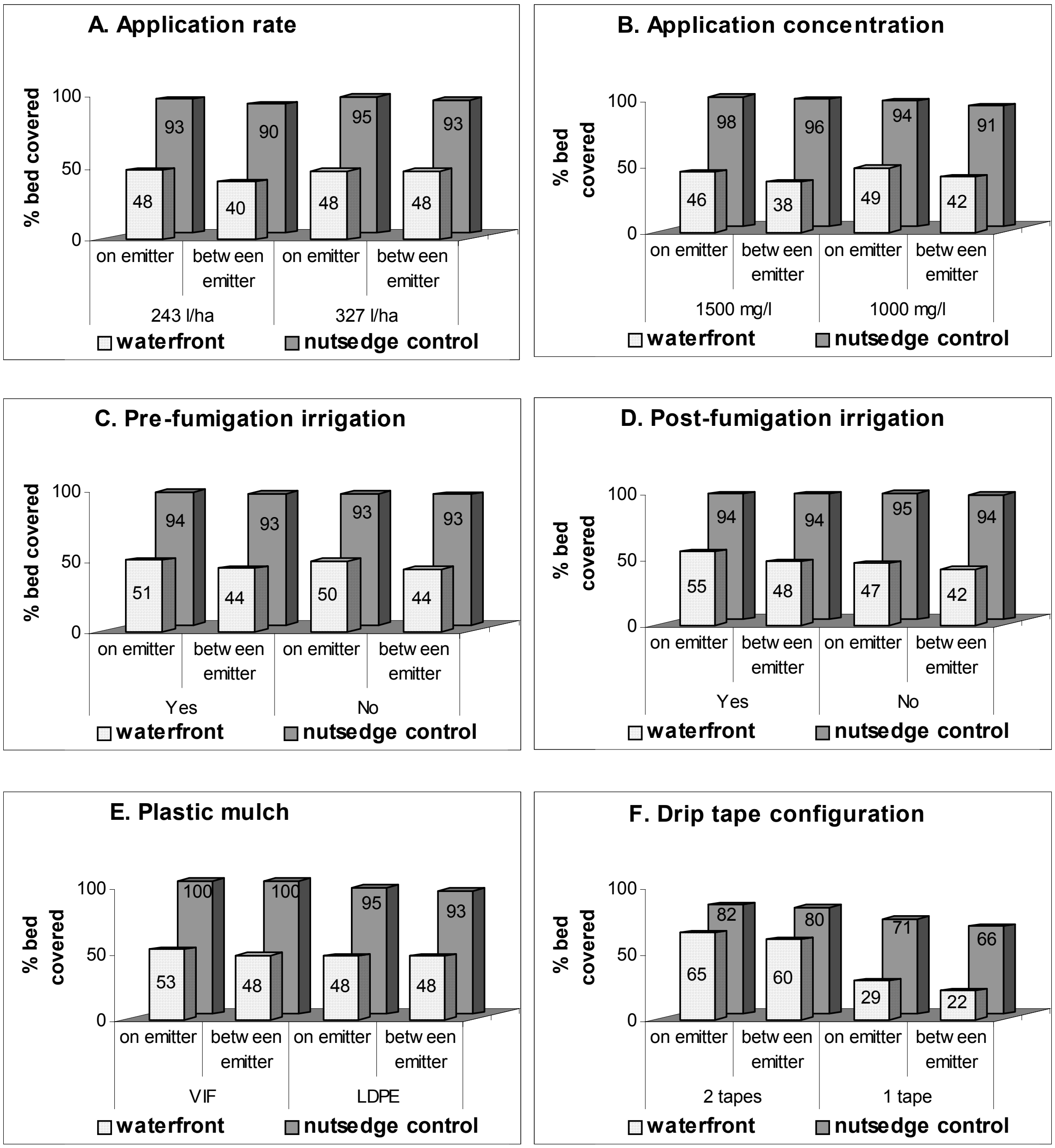

Fig. 3 Effect of application rate and concentration of InLine, pre- and post-fumigation irrigation, plastic mulch type, and number of drip tapes on width of water movement and nutsedge control at different positions in raised beds. Values are averaged over different sites, except for plastic mulch type (only Bradenton) and number of drip tapes (only Quincy).

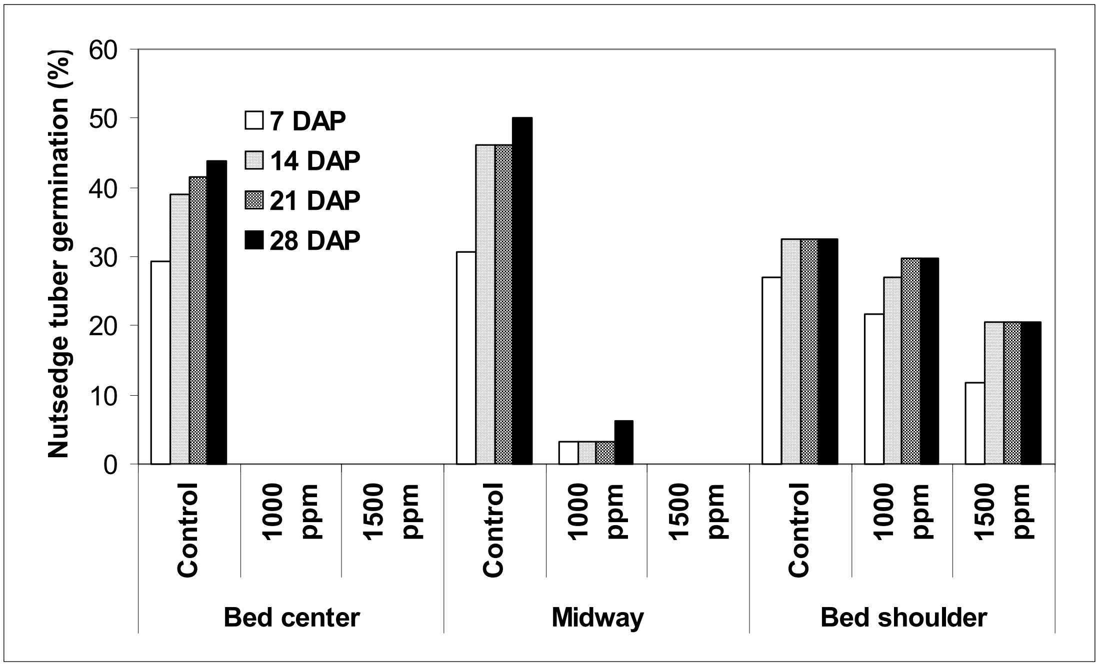

Fig. 4 Effect of Telone InLine application concentration and bed location on tuber germination patterns of *Cyperus rotundus* (purple nutsdege) at 7, 14, 21 and 28 days after planting (DAP) at Tifton, GA, July 2002.

EVALUATION OF DRIP-APPLIED FUMIGANTS ON CANTALOUPE, FOLLOWING A CROP OF EGGPLANT, FOR YIELD INCREASE AND NEMATODE CONTROL, UGA-CPES BLACK SHANK FARM, TIFTON GEORGIA - 2002

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Introduction

Polyethylene film mulch beds in the Southeastern US are commonly used for two up to four crops before they are destroyed. Soilborne pests and diseases often become problematic on the second and third crops and practically can only be controlled by applying water-soluble pre-plant pesticides, such as metam sodium or emulsifiable versions of 1,3-dichloropropene (1,3-D) through the drip tape. The use of micro-irrigation systems to deliver a water emulsifiable pesticide or plant health product is relatively new, but is promising, as more accurate targeting and uniform distribution of the fumigant in the bed can be expected. The objective of this study was to evaluate the efficacy of different drip-applied fumigants for nematode control on a second crop.

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. The area had a history of soybeans, tobacco, and assorted vegetables. The area was prepared using all current University of Georgia Extension Service recommendations. The plot design was a randomized complete block consisting of single bed plots replicated five times. Each plot was 25 feet long.

On 11 March, 2002, all test plots were covered with 3 mil black polyethylene with drip tape in the center of the bed approximately 1in. deep. Eggplant seedlings, cv. Black Beauty, a variety susceptible to _M. incognita_, were produced in nutrient tray system to the 4-leaf stage. A single eggplant was transplanted using a mechanical type transplanter which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 13 March, 2002. The crop of eggplant was allowed to reach full maturity. The first crop was then destroyed and plant debris removed. On 1 July, Vapam (metam sodium) was injected through the drip tape in designated plots. Telone EC treatments were applied over the next three days.

'Athena' Cantaloupe, a variety susceptible to M. incognita, seedlings were produced in nutrient tray system to the 4-leaf stage. A single cantaloupe plant was transplanted using a mechanical type transplanter which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 29 July. Plant spacing was 24 in.

As per the recommendation of the University Of Georgia Extension service, all plots received 500 lbs. of fertilizer (10-10-10) incorporated prior to planting. Additional fertilizer was added in the form of liquid fertilizer (Miracle-Gro 20-20-20) injected through the irrigation tubing during the growing season. All plots were sprayed on a 4 to 7 day interval with Manex with Zinc (2.4 qt/A) plus Kocide LF (0.5 gal/A) and Bravo (2 pts/A) for control of foliar diseases, and Ambush (10 oz./A) alternating with Pounce 3.2 (6 oz./A), Asana XL (6 oz./A) and Avaunt (3 oz./A) for insect control.

A stand count was made to record live plants on 12 August. A vigor rating was done on 20 August, rated on a 1 to 10 scale, 10 representing live and healthy plants and 1 representing dead plants.

Eight cores of soil, 2.5-cm-diam.× 25-cm-deep, were collected from the center of each plot at final harvest of the first crop (eggplant), and at flowering stage (on 28 August) and final harvest (on 20 October) of the second crop (cantaloupe). Nematodes were extracted from a 150-cm^3 soil sub-sample using a centrifugal sugar flotation technique, except at planting when they were extracted in Baermann pans (to capture only active nematodes). Populations of slowly moving nematodes, such as sting, stubby root and ring nematodes, may therefore be underestimated at planting. On 28 August, an early root gall index was performed on three plants per plot, using a 0 to 10 scale whereby, 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some big galls, 5 = 25 % of roots severely galled, 6 = 50 % of roots severely galled, 7 =75 % of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, 10 = plant and roots dead. Again following final harvest on 28 October a root gall evaluation was done on the remaining plants using that same scale.

Shoot and root weights were recorded on 8 October (three plants per plot). All cantaloupes were hand-harvested from the center 20-ft bed area. Each harvest was separated into marketable and cull, counted, and weighed. There were a total of two harvests, on 10 and 16 October. All data collected was analyzed with an analysis of variance ($\underline{P}$ = 0.05) and means were separated using Duncan's Multiple range test.

Conclusion

The previous (first crop) eggplant left a high legacy of root-knot nematodes in the soil (initial population, Table 1). All drip-applied fumigants gave good control of root-knot nematode at 4 weeks after planting (flowering stage) (Tables 1, 2). Root gall indices and nematode soil populations at this stage were high in the non-treated beds and similarly low in any of the fumigated beds. By harvest root gall indices in the fumigated beds, especially with the Vapam-InLine combination, were still lower than in the non-treated beds. Root gall indices were somewhat higher with Vapam only and with the lower InLine rate. However, root-knot nematode soil populations at final harvest were high for all treatments, and differences were limited. Stubby root nematodes may damage vegetables, but probably at higher populations than were present in our test. The nematode was reduced at flowering stage of cantaloupe, but no longer by harvest. The same was observed for free-living (non-parasitic nematodes).

Cantaloupe yields were low, due to severity of airborne pests and diseases (melon worm, gummy stem blight, downy mildew and papaya ringspot virus). Among the drip-fumigated treatments, the Vapam-Telone combinations and the higher application rates of Telone gave 20-35% higher yields than the lower application rates of Telone and the Vapam only drip (Table 3). Yield was extremely low in non-treated beds, due to severe root-knot nematode damage during the crop's early growth, which caused severe stunting (Tables 1, 2, 3).

Acknowledgments

The authors wish to thank Dow Agrosciences for financial support. Also, Tonya Jo Cravens, Unessee Hargett, Don Hickey, Lewis Mullis, and Chris Williamson for technical support.

Table 1. Nematode soil populations before fumigation (at harvest of first crop), at flowering and at harvest stage of cantaloupe cv. Athena, fall 2002, Black Shank Farm Tifton, GA.

		Nematodes per 150-cm³ soil						
		Pre-fumigation 18 June			At Flowering 28 August			
Treatment	Rate / acre	M.i.[a]	P.m.	N.par	M.i.	P.m.	N.par	M.i.
1. Telone EC	13.5 gal	1666	24	296	11b	6b	370b	203b
2. Telone EC	18 gal	1768	44	474	0	8b	588ab	1108ab
3. Telone C-35 Inline	13 gal	4690	26	610	9b	7b	491b	206b
4. Telone C-35 Inline	20.5 gal	2750	22	522	6b	3b	593ab	1632a
5. Vapam	75 gal	4678	27	668	2b	4b	534ab	598ab
6. Telone C-35 Inline + Vapam	13 gal 37.5 gal	2638	52	760	9b	2b	440b	441ab
7. Telone EC + Vapam	13.5 gal 37.5 gal	2808	34	398	0	1b	374b	398ab
8. Non-Treated	N/A	1008	20	358	372a	0.3333	962a	648ab

[a] M.i. = Meloidogyne incognita (southern root-knot nematode), P.m. = Paratrichodorus minor (stubby root nematode), N.par = non-parasitic (free-living) nematodes

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

Table 2. Effects of soil chemical treatments on plant vigor, shoot and root weights (at flowering), root-gall indices (at flowering and at harvest), and on defoliation due to disease of cantaloupe cv. Athena, fall 2002, Black Shank Farm Tifton, GA.

Treatment	Rate / acre	Vigor Rating[a] 20 August	Shoot Weight(g) 28 August	Root Weight(g) 28 August	Early Root gall index[b] 28 August
1. Telone EC	13.5 gal	6.8ab	1.4a	7.6ab	0.5b
2. Telone EC	18 gal	7.6ab	1.3a	7.6ab	0.8b

3. Telone C-35 Inline	13 gal	6.0a	1.2a	8.0ab	0.9b	4.4 b	33cde
4. Telone C-35 Inline	20.5 gal	7.6ab	1.3a	6.6b	0.9b	3.1bc	37cde
5. Vapam	75 gal	8.2a	1.8a	9.0ab	0.7b	3.8bc	48bcd
6. Telone C-35 Inline + Vapam	13 gal 37.5 gal	7.8ab	1.8a	8.8ab	0.1b	1.8c	17
7. Telone EC + Vapam	13.5 gal 37.5 gal	8.6a	1.6a	10.2a	0.3b	2.9bc	27de
8. Non-Treated	N/A	3.1c	0.4b	8.4ab	8.7a	9.2a	89a

[a] Vigor was done a 1-10 scale with 10= live and healthy plants and 1=dead plants.
[b] Root Gall Index 0-10 scale whereby, 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some big galls, 5 = 25 % of roots severely galled, 6 = 50 % of roots severely galled, 7 =75 % of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, 10 = plant and roots dead.
[C] Defoliation was due to gummy stem blight and downy mildew.
Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test. No letters indicate no-significant difference.

Table 3. Effect of soil chemical treatments on marketable yield of cantaloupe cv. Athena, fall 2002, Black Shank Farm Tifton, GA

Treatment	Rate / acre	Marketable number and weight (lbs) of fruits (20 ft bed) 10 October		16 October		Total	
		Number	Weight	Number	Weight	Number	Weight
1. Telone EC	13.5 gal	5.6 ab	13.3 ab	3.6 cd	7.1 cd	9.2 b	20.4 b
2. Telone EC	18 gal	4.8 ab	12.1 ab	7.0 a	15.6 a	11.8 ab	27.7 ab

3. Telone C-35 Inline	13 gal	3.2 bc	8.1 bc	6.8 ab	13.7 ab	10.0 ab	21.8 ab
4. Telone C-35 Inline	20.5 gal	7.4 a	18.2 ab	5.6 abc	10.6 abc	13.0 ab	28.8 ab
5. Vapam	75 gal	4.8 ab	14.0 ab	4.0 bcd	8.2 bc	8.8 b	22.2 ab
6. Telone C-35 Inline + Vapam	13 gal 37.5 gal	7.8 a	19.7 a	4.0 bcd	9.4 abc	11.8 ab	29.3 ab
7. Telone EC + Vapam	13.5 gal 37.5 gal	6.8 ab	17.2 ab	4.7 a	15.0 a	14.2 a	32.2 a
8. Non-Treated	N/A	0.2 c	0.6 c	1.2 d	2.1 d	1.4 c	2.7 c

Data are means of five replications. Means followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test.

Table 4. Effect of soil chemical treatments on cull yield of cantaloupe cv. Athena, fall 2002, Black Shank Farm Tifton, GA

Treatment	Rate / acre	Cull number and weight (lbs) of fruits (20 ft bed) 10 October		16 October		Total	
		Number	Weight	Number	Weight	Number	Weight
1. Telone EC	13.5 gal	2	3.5 a	2.8 ab	3.9 a	4.8 ab	7.4 ab
2. Telone EC	18 gal	0.8	0.8 ab	3.0 ab	4.0 a	3.8 ab	4.8 ab

3. Telone C-35 Inline	13 gal	0.4	0.4 abc	1.6 bc	2.7 ab	2.0 bc	3.1 bc
4. Telone C-35 Inline	20.5 gal	1.6	2.6 ab	3.2 ab	3.8 a	4.8 ab	6.3 ab
5. Vapam	75 gal	1.4	3.1 ab	4.6 a	5.7 a	6.0 a	8.8 a
6. Telone C-35 Inline + Vapam	13 gal 37.5gal	1	2.4 ab	2.6 ab	5.4 a	3.6 ab	7.8 ab
7. Telone EC + Vapam	13.5 gal 37.5gal	1.4	2.7 b	3.2 ab	5.5 a	4.6 ab	8.2 a
8. Non-Treated	N/A	0	0	0	0	0	0

Data are means of five replications. Means followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test.

EVALUATION OF FUNGICIDES FOR CONTROL OF PHYTOPHTHORA CROWN AND FRUIT ROT OF SUMMER SQUASH

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Introduction

Phytophthora crown and fruit rot, caused by *Phytophthora capsici*, is a serious constraint to the production of yellow squash in Georgia and has increased in severity in recent years. The disease is common to a number of cucurbit species; however, yellow squash is known to be highly susceptible. The onset of symptoms is followed by rapid death in the case of root or crown infections, while infected fruit quickly decay and collapse. Favorable conditions for disease development include excessive rainfall or irrigation, poor soil drainage, and moderate temperatures. *Phytophthora capsici* produces numerous sporangia, which release motile zoospores that can be spread in irrigation or surface water. Sporangia may also be dispersed in air, or by splash dispersal of infested soil. Oospores (thick-walled resting spores) and mycelium in infected tissue are the principal means of survival of *P. capsici* between crops. Management of the disease has proven difficult with soil fumigation, cultural practices and crop rotation, and there are no labeled fungicides available in Georgia. Experiments were conducted in 2002 to evaluate a number of fungicides for their efficacy against *P. capsici* on yellow squash.

Materials and Methods

An experiment was conducted at the Blackshank Research Farm in Tifton, GA in a field that had previously been inoculated with *Phytophthora capsici*. The soil was a Fuquay loamy sand, and was prepared with a rototiller prior to planting. Guidelines established by the University of Georgia Cooperative Extension Service were followed for land preparation, fertility, weed management, and insect control. Summer squash were transplanted 12 in. apart on 15 Apr into non-mulched, raised beds. Each plot consisted of a single 15-ft row on 36 in. centers, with 5-ft borders between blocks. The experiment was laid out in a randomized complete-block design with 4 replications. The number of plants standing at 30 days after planting (DAP) was counted immediately prior to initiation of fungicide applications. Plots were given supplemental inoculum by placing three *P. capsici*-infected squash seedlings at equal distances within the row. Fungicides were then applied over the row with a CO_2-powered backpack sprayer through a 2-nozzle boom (18 in. spacing) fitted with TSX-18 hollow cone nozzles and set to deliver 60 gal/A at 75 psi. Fungicide applications were initiated at 21 DAP and continued weekly until maximum disease incidence was reached in the untreated check (total of 4 sprays). Supplemental overhead irrigation was applied to the test site after planting (0.5 in.), and twice weekly thereafter to achieve optimal moisture conditions for development of disease. Plant mortality was recorded in plots weekly beginning on 8 May and ending on 6 Jun (5 sprays), when maximum mortality was observed in untreated plots. The experiment was harvested on 23 May, 29 May, and 5 Jun.

Results and Discussion

Warm, wet conditions and the addition of inoculated seedlings contributed to high levels of crown and fruit rot in the trial. As an indicator of season-long efficacy of a given fungicide treatment, AUDPC was used to rank the fungicides in this trial. The lowest AUDPC values were found in plots treated with either Ridomil Gold 4EC or Ultra Flourish 2EC (applied at equivalent rates of the active ingredient mefenoxam), which were 86% lower than the AUDPC for the untreated check. Ranman 400SC applied alone at 2.75 fl oz/A reduced AUDPC by 38%, while the combination of Ranman 400SC and BAS500 20WG reduced AUDPC by 63%. No significant reduction of AUDPC was seen with the remaining treatments in the test. Highest yields (number and weight of marketable fruit) were found in plots treated with Ranman 400SC alone, Ranman 400SC plus BAS500, Ridomil Gold 4EC, and Ultra Flourish. Numerically, total number and weight of squash was highest in the Ranman/BAS500-treated plots. The broad-spectrum activity of BAS500 may have suppressed pathogens other than *P. capsici* and thus provided additional yield benefits. It must also be noted that while Ranman 400SC plus BAS500 was inferior to Ridomil Gold and Ultra Flourish in protecting squash plants against Phytophthora crown rot, the combination provided levels of protection to fruit that were equal to either Ridomil Gold or Ultra Flourish.

Table 1. Fungicide efficacy against *Phytophthora capsici* on yellow squash.

Treatment and rate/A	AUDPC[z]		Fruit yield per acre[y] (× 1000) No. marketable		Fruit yield per acre[y] (× 1000) Weight (lb)	
Untreated control	21.6	ab[x]	11.1	de[x]	2.3	cde[x]
Ranman 400SC 2.75 fl oz + Silwet L77 2.0 fl oz	13.5	c	21.6	bc	5.5	bc
BAS500 20WG 16 oz	21.2	ab	6.3	e	1.3	e
Ranman 400SC 2.75 fl oz + Silwet L77 2.0 fl oz + BAS500 20WG 16 oz	8.0	d	31.5	a	10.1	a
Ridomil Gold 4EC 1.0 pt	3.1	e	24.7	ab	6.6	b
Ultra Flourish 2EC 2.0 pt	3.0	e	25.9	ab	7.3	ab
Tanos 50WP 1.0 lb	19.4	b	15.3	cd	4.8	bcd
Tanos 50WP 2.0 lb	23.5	ab	**7.7**	de	1.8	de
Rhamnolipid 250SC 2 fl oz . . .	24.1	a	7.7	de	1.7	de
Rhamnolipid 250SC 8 fl oz	21.6	ab	7.6	de	1.4	e

[z]Final disease rating (percent incidence of plants with symptoms of Phytophthora crown rot) taken on 22 Jun; AUDPC=area under the disease progress curve, constructed from evaluations taken on 16 May, 23 May, 30 May, 6 Jun, and 30 Jun.

[y]Yield data are the total of three harvests - 23 May, 29 May, and 5 Jun.

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

EFFECT OF APPLICATION TIMING ON THE EFFICACY OF DRIP-APPLIED SOIL FUMIGANTS

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Introduction

The scheduled withdrawal of methyl bromide from use as an agricultural fumigant in 2005 has prompted a great deal of research aimed at finding economically acceptable alternatives. Researchers have determined that combination applications of metam sodium and chloropicrin or 1,3-dichloropropene plus chloropicrin (1,3-DC), injected via chisel, provide good control of soilborne fungal pathogens, nematodes, and weeds in vegetables grown under plastic mulch on raised beds. The recent introduction of emulsifiable formulations of 1,3-DC has made application of this material, as well as metam sodium, through drip irrigation to raised, mulched beds feasible.

The purpose of this study was to evaluate the effects of metam sodium and 65% 1,3-dichloropropene plus 35% chloropicrin on the survival *Fusarium* spp., *Pythium* spp., total fungal species, and the root-knot nematode (*Meloidogyne incognita*) when applied in combination via drip tape to raised, plastic-mulched plant beds, and to determine the optimum interval between application and planting for maximum suppression of these organisms.

Materials and Methods

An experiment was initiated March and April 2002 at the Blackshank Farm in Tifton, GA on a Fuquay loamy sand (loamy, siliceous, thermic Arenic Plinthic Paleudults). Applications of 1,3-dichloropropene (65% v/v) plus chloropicrin (35% v/v) EC (emulsifiable concentrate) in combination with metam sodium (42% EC) were made at rates of 93 l/ha and 349 l/ha, respectively, to raised beds at intervals simulating 4 weeks, 3 weeks, 2 weeks, and 1 week prior to transplanting of yellow crookneck squash. The materials were applied separately through drip tape for a period of approximately 6 hours (24 hour interval between 1,3-DC and metam sodium) at each application date. Metam sodium (42% EC) and 1,3DC EC were applied separately at 349 l/ha and 84 l/ha, respectively, and methyl bromide (chisel-injected at 224 kg/ha) were included as comparison treatments along with an untreated control.

Treatment effects on the survival of fungi were determined by assaying soil samples, taken for each treatment immediately prior to transplanting of yellow squash (10 April) and assayed on selective media to determine the numbers of colony forming units (CFU) per gram of soil of *Fusarium* spp., *Pythium* spp., and total fungal species. Nematode counts (numbers of juveniles per unit of soil) were determined from soil samples taken at harvest, and squash roots were evaluated for severity of root galling on a 0-10 scale where 0=no galls and 10=maximum galling. Squash were harvested 2-3 times per week for a total of 11 harvests. Analysis of variance (ANOVA) was performed on the data, and treatment means were separated using Fisher's protected least significant difference test (FLSD).

Results and Discussion

In general, populations of *Pythium* spp., *Fusarium* spp., and total soil fungi were significantly reduced by applications of 1,3-DC plus metam sodium, 1,3-DC alone, metam sodium alone, and methyl bromide when compared to the untreated control. Performance of drip-applied 1,3-DC EC, alone and in combination with metam sodium, was equal to or superior to chisel-applied methyl bromide No differences in populations of *Pythium* spp., or *Fusarium* spp., were found between application intervals of 1,3-DC plus metam sodium (Table 1). Total populations of fungi did not differ at 4, 3, or 2 weeks after application of 1,3-DC through drip tape. Total fungal populations and populations of *Fusarium* spp. were higher in plots treated with only 1,3-DC EC 4 weeks prior to transplanting than in those treated with the combination of 1,3-DC EC plus metam sodium EC at the same timing.

At harvest, only 1,3-DC EC plus metam sodium EC, applied at 4 weeks prior to transplanting, significantly reduced numbers of *M. incognita* juveniles as compared to the untreated control (Table 2). Gall indices taken at harvest were lowest in plots treated with 1,3-DC EC plus metam sodium EC, applied at 4, 3, and 1 weeks prior to transplanting of squash, and in plots treated with metam sodium alone at 4 weeks before transplanting. Yields, however, were highest, in comparison with the untreated check, in plots treated with methyl bromide or metam sodium EC (alone at 4 weeks prior to transplanting). The disparity between root gall indices and yield with regard to these treatments may reflect late-season colonization of the root systems in those plots. Yields in plots treated with 1,3-DC EC, alone or in combination with metam sodium EC, did not differ from those in untreated check plots. The poor yields in these treatments may reflect plant injury caused by 1,3-DC rather than damage caused by the root-knot nematode, given that, in general, root-gall indices were lower for these treatments than the untreated check.

In conclusion, the optimal time of exposure to 1,3-DC EC plus metam sodium EC needed to suppress fungal pathogens, when delivered to raised, mulched beds via drip irrigation, appears to be 1 week. Further work is needed to determine the reasons behind yield loss associated with the combination of 1,3-DC EC plus metam sodium EC.

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

Treatment[a]	Application rate	Application timing[b]	Fungal populations[c] *Fusarium*		*Pythium*		Total	
1,3-DC EC ‡ Metam sodium 42%	93 l/ha 349 l/ha	4 weeks	16	d	4.8	bc	384	def
1,3-DC EC ‡ Metam sodium 42%	93 l/ha 349 l/ha	3 weeks	16	d	0	c	128	f
1,3-DC EC ‡ Metam sodium 42%	93 l/ha 349 l/ha	2 weeks	32	d	0	c	192	f
1,3-DC EC ‡ Metam sodium 42%	93 l/ha 349 l/ha	1 week	0	d	0	c	528	de
1,3-DC EC	349 l/ha	4 weeks	1696	c	7.2	b	2208	c
Methyl bromide 98%	224 kg/ha	4 weeks	8800	b	0.8	bc	4368	b
Metam sodium 42%	349 l/ha	4 weeks	240	d	0	c	672	d
Untreated check	--	--	24912	a	41	a	26912	a

Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test (P?0.05).
[a]1,3-DC=Emulsifiable concentrate containing 1,3-dichloropropene (65%) plus chloropicrin (35%) and was drip-injected; metam sodium (42% EC) was drip-applied one day after 1,3-DC EC; methyl bromide 98% contained 2% chloropicrin by weight and was chisel-injected.
[b]Interval between application and planting.
[c]Populations of *Fusarium* spp., *Pythium* spp., and total fungi expressed as the number of colony forming units per gram of soil.

Table 2. **Population densities of Meloidogyne incognita, root gall indices, and yield of yellow squash taken at harvest in plots where alternatives to methyl bromide were drip-applied at various intervals prior to transplanting of squash**.

Treatment[a]	Application rate	Application timing[b]	*M. incognita*[c]		Gall index (0-10)[d]		Yield (kg/plot)	
1,3-DC EC ‡ Metam sodium 42%	93 l/ha 349 l/ha	4 weeks	19	b	0.6	b	66	c
1,3-DC EC ‡ Metam sodium 42%	93 l/ha 349 l/ha	3 weeks	178	ab	2.6	ab	64	c
1,3-DC EC ‡ Metam sodium 42%	93 l/ha 349 l/ha	2 weeks	102	ab	1.3	b	77	bc
1,3-DC EC ‡ Metam sodium 42%	93 l/ha 349 l/ha	1 week	81	ab	1.8	b	74	bc
1,3-DC EC	349 l/ha	4 weeks	333	ab	4.4	ab	75	bc
Methyl bromide 98%	224 kg/ha	4 weeks	843	ab	3.7	ab	117	a
Metam sodium 42%	349 l/ha	4 weeks	419	ab	2.2	b	105	ab
Untreated check	--	--	954	a	6.1	a	65	c

Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test (P?0.05).
[a]1,3-DC=Emulsifiable concentrate containing 1,3-dichloropropene (65%) plus chloropicrin (35%) and was drip-injected; metam sodium (42% EC) was drip-applied one day after 1,3-DC EC; methyl bromide 98% contained 2% chloropicrin by weight and was chisel-injected.
[b]Interval between application and planting.
[c]Populations of *M. incoginita*, expressed as numbers of juveniles per unit of soil.

EVALUATION OF FUNGICIDES FOR CONTROL OF DOWNY MILDEW AND GUMMY STEM BLIGHT ON WATERMELON

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Introduction

Gummy stem blight, caused by *Didymella bryoniae*, and downy mildew, caused by *Pseudoperonospora cubensis*, are among the most severe foliar diseases of watermelon in Georgia. Control of these diseases can be difficult with currently available materials, and in the case of gummy stem blight, fungicide options are limited. The situation has been complicated further by the appearance of strobilurin-resistant strains of *D. bryoniae*. The purpose of the current study was to evaluate fungicides for efficacy against both downy mildew and gummy stem blight, and to examine the effectiveness of strobilurin programs in an area where strobilurin resistance has been documented.

Materials and Methods

An experiment was conducted at the Attapulgus Research and Education Center, located near Bainbridge, GA. Guidelines established by the University of Georgia Cooperative Extension Service were followed for land preparation, fertility, weed management, and insect control. Watermelons (cv. 'Regency') were direct-seeded on 17 May into bare ground to achieve a final between-plant spacing of 42 in. and a row spacing of 6 ft. Each plot consisted of a single 30-ft row separated by 10-ft borders between blocks. Each treated row was separated by an untreated border row. The experiment was laid out in a randomized complete-block design with 4 replications. Fungicides were applied over the rows with a CO_2-powered backpack sprayer through a 4-nozzle boom (18 in. spacing) fitted with TSX-18 hollow cone nozzles and set to deliver 40 gal/A at 70 psi. Fungicide applications were initiated on 11 Jul and continued weekly until 9 Aug (total of 5 applications). Supplemental overhead irrigation was applied to the test site as required. Five evaluations of disease severity, estimated as the percentage of leaf area with symptoms of downy mildew and gummy stem blight (DLA), were made from 11 Jul to 9 Aug. Severity data were used to determine the area under the disease progress curve (AUDPC). The experiment was harvested on 15 Aug.

Results and Discussion

Drier than normal conditions resulted in late onset of gummy stem blight in the trial, and the simultaneous appearance of downy mildew necessitated evaluation of the two diseases as a complex. In general, Bravo 720SC at 2 pt/A, Echo 720F, and Echo 90DF, and tank-mixes or alternations with Bravo 720SC significantly reduced the severity of disease (AUDPC) as compared to the untreated check (Table 1). Folicur 3.6F, applied at either 6.0 or 8.0 fl oz/A, did not differ from the untreated check. Given the strong performance of chlorothalonil containing products and the poor performance of Folicur, normally a strong material for the control of gummy stem blight, it is likely that downy mildew was the more important of the two diseases found in the experiment. TD 2448-01 at 19.2 fl oz/A reduced AUDPC in comparison to the control, as did the alternation of Quadris 2.08 SC (12.3 fl oz/A) and Switch 62.5WG (14.1 oz/A). BAS516 38WG, at 10.5 and 14.7 oz/A had lower AUDPC values than the untreated control. As with disease control, chlorothalonil products, alone or alternated with other materials, had higher fruit numbers and weight/A than the untreated control. No phytotoxicity was observed for any product.

Table 1. Effect of fungicides on the severity of disease and yield in 'Regency' watermelon in Attapulgus, GA (2002)

Treatment and rate/A	Application Timing[z]	AUDPC[y]		No. m
Untreated control	--	7.8	a[x]	182
Bravo 720SC 2 pt	A-E	2.8	fg	1089
Quadris 2.08SC 12.3 fl oz + Bravo 720SC 2 pt	ACE + BD	2.9	fg	726
Quadris 2.08SC 12.3 fl oz + Bravo 720SC 2 pt	ACE + A-E	2.7	g	968
Quadris 2.08SC 12.3 fl oz + Switch 62.5WG 14.1 oz	ACE + BD	4.7	b-g	484
Bravo 720SC 2 pt + Switch 62.5WG 14.1 oz	ACE + BD	3.8	c-g	786
Bravo 720SC 2 pt + Switch 62.5WG 14.1 oz	ABC + DE	3.5	c-g	1150
Quadris 2.08SC 12.3 fl oz + Bravo 720SC 2 pt + Switch 62.5WG 14.1 oz	AD + BE + C	3.1	efg	907
TD 2448-01 3.34 SC 4.8 fl oz	A-E	7.3	ab	363
TD 2448-01 3.34 SC 9.6 fl oz	A-E	6.9	ab	121
TD 2448-01 3.34 SC 19.2 fl oz	A-E	4.1	c-g	968
Echo 720F 2 pt	A-E	2.9	fg	847
Echo 90DF 2 lb	A-E	2.9	fg	1150
Phosphonic Acid 1210 2% vol/vol	A-E	5.8	a-d	121
BAS516 38WG 10.5 oz	A-E	4.1	c-g	1029
BAS516 38WG 12.6 oz	A-E	5.2	a-g	666
BAS516 38WG 14.7 oz	A-E	3.2	d-g	968
BAS516 38WG 10.5 oz + Bravo 720SC 2 pt	ACE + BD	4.0	c-g	1210
Scala 400SC 27.4 fl oz	A-E	5.0	b-g	424
Folicur 3.6F 6.0 fl oz	A-E	6.1	abc	121
Folicur 3.6F 6.0 fl oz + Induce 0.06% vol/vol	A-E	5.8	a-e	242
Folicur 3.6F 8.0 fl oz	A-E	5.4	a-f	726
Folicur 3.6F 8.0 fl oz + Induce 0.06% vol/vol	A-E	7.6	a	423

[z]Fungicides applied on a 7-day schedule beginning 11 Jul (A) and ending 9 Aug (E).
[y]AUDPC=area under the disease progress curve, taken from four evaluations beginning on 11 Jul and ending on 9 Aug.
[x]Means followed by the same letter do not differ significantly at $P \leq 0.05$ as determined by Fisher's protected LSD test.

EVALUATION OF FUNGICIDES FOR CONTROL OF GUMMY STEM BLIGHT ON WATERMELON

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Introduction

Gummy stem blight, caused by *Didymella bryoniae* is a significant constraint to the production of watermelons in Georgia. Control of this disease can be difficult with the limited number of currently available materials. The situation has been complicated further by the appearance of strobilurin-resistant strains of *D. bryoniae*. The purpose of the current study was to evaluate fungicides for efficacy against both downy mildew and gummy stem blight, and to examine the effectiveness of strobilurin programs in an area where strobilurin resistance has been documented.

Materials and Methods

An experiment was conducted at the Blackshank Farm in Tifton, GA. Guidelines established by the University of Georgia Cooperative Extension Service were followed for land preparation, fertility, weed management, and insect control. Watermelons (cv. 'Crimson Sweet') were direct-seeded on 15 July into bare ground to achieve a final between-plant spacing of 42 in. and a row spacing of 6 ft. Each plot consisted of a single 30-ft row separated by 10-ft borders between blocks. Each treated row was separated by an untreated border row. The experiment was laid out in a randomized complete-block design with 4 replications. Fungicides were applied over the rows with a CO_2-powered backpack sprayer through a 4-nozzle boom (18 in. spacing) fitted with TSX-18 hollow cone nozzles and set to deliver 40 gal/A at 70 psi. Fungicide applications were initiated on 13 Aug and continued weekly until 11 Sep (total of 5 applications). Two applications of Ridomil Gold 4EC (1 pt/A) were applied to the entire experiment to suppress downy mildew. Supplemental overhead irrigation was applied to the test site as required. Five evaluations of disease severity, estimated as the percentage of leaf area with symptoms of gummy stem blight (DLA), were made from 21 Aug to 11 Sep. Severity data were used to determine the area under the disease progress curve (AUDPC). The experiment was not taken to yield.

Results and Discussion

Warm, wet conditions and inoculum pressure from nearby watermelon trials contributed to high levels of gummy stem blight in the trial. Strobilurin fungicides applied alone, or alternated with other materials, performed poorly in the trial. Resistance to the strobilurin class of fungicides has been documented and is widespread, and is the reason for the lack of control observed in the experiment. Quadris (12.3 oz/A) applied on an alternating schedule with Bravo (2 pt/A, 7-day schedule), was effective in reducing gummy stem blight; however, all disease control most likely came from Bravo (Table 1). Bravo (2 pt/A) alternated with Switch (14.1 oz/A) reduced the severity of gummy stem blight by more than 70% as compared to the untreated check. The combination was more effective in reducing disease than Bravo alone, although no differences were seen between the combination and Bravo with regards to area under the disease progress curve (AUDPC). Final disease ratings and AUDPC values were numerically the lowest in the test for this treatment. Three applications of Bravo (2 pt/A) followed by 2 applications of Switch (14.1 oz/A) reduced gummy stem blight severity by 64% at the final evaluation date, and AUDPC by 70%, compared to the untreated check. TD-2448-01 3.34 SC (19.2 oz/A) reduced AUDPC of gummy stem blight by 70% as well, although final disease severity was reduced by only 47%. No phytotoxicity was observed.

Table 1. Effect of strobilurin and experimental fungicides on gummy stem blight of 'Crimson Sweet' watermelon,

Treatment and rate/A[z]	Application Timing[y]	Dise	
		% DLA (11 S	
Untreated control	--	100	a[v]
Bravo 720SC 2 pt	A-E	58	cde
Quadris 2.08SC 12.3 fl oz + Bravo 720SC 2 pt	ACE + BD	93	a
Quadris 2.08SC 12.3 fl oz + Bravo 720SC 2 pt	ACE + A-E	48	def
Quadris 2.08SC 12.3 fl oz + Switch 62.5WG 14.1 oz	ACE + BD	85	ab
Bravo 720SC 2 pt + Switch 62.5WG 14.1 oz	ACE + BD	30	g
Bravo 720SC 2 pt + Switch 62.5WG 14.1 oz	ABC + DE	36	fg
Quadris 2.08SC 12.3 fl oz + Bravo 720SC 2 pt + Switch 62.5WG 14.1 oz	AD + BE + C	68	bc
TD 2448-01 3.34 SC 4.8 fl oz	A-E	69	bc
TD 2448-01 3.34 SC 9.6 fl oz	A-E	62	cd
TD 2448-01 3.34 SC 19.2 fl oz	A-E	53	cde
Flint 50WG 4.0 oz	A-E	100	a
BAS500 20WG 12.0 oz	A-E	100	a
Folicur 3.6F 8.0 fl oz + Induce 0.06% vol/vol	A-E	40	efg

[z]Two applications of Ridomil Gold 4EC (1 pt/A) were applied to the entire experiment to suppress downy mildew.

yFungicides applied on a 7-day schedule beginning 13 Aug (A) and ending 11 Sep (E).

[x]%DLA=percentage of leaf area showing symptoms of gummy stem blight at the final evaluation of disease (11 Sep).

[w]AUDPC=area under the disease progress curve, taken from four weekly evaluations beginning on 21 Aug and ending on 11 Sep.

[v]Means followed by the same letter do not differ significantly at $P \leq 0.05$ as determined by Fisher's protected LSD test.

EVALUATION OF FUNGICIDES AND TIMINGS FOR CONTROL OF SOUTHERN BLIGHT OF CARROT

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Introduction

Carrots are produced on over 4000 acres in Georgia and generate more than $13 million in revenue (Georgia Agricultural Statistics Service, 2002). Soilborne diseases are common in carrot, and have the potential to significantly reduce yield and quality. White mold, or southern stem rot, caused by *Sclerotium rolfsii*, can become problematic when soil temperatures become warm in spring, as would be encountered in late carrot plantings. The disease is characterized by the presence of a robust, white mycelium on the top of the carrot root and surrounding soil, which may be accompanied by numerous tan-to-brown, spherical sclerotia. The mycelium may extend 2-4 inches below ground, and infected root tissue often displays a soft, rotted appearance. Cultural practices such as rotation with non-hosts of *S. rolfsii* and deep turning are recommended, along with avoidance of fields with a heavy infestations. Because control options for this disease are limited, experiments were conducted in 2002 to evaluate azoxystrobin (Quadris 2.08SC) and fluzinam (Omega 500F), two materials with proven efficacy against *S. rolfsii*, for the control of southern stem rot in carrot.

Materials and Methods

An experiment was conducted at the Blackshank Research Farm in Tifton, GA in a field that had previously been planted to watermelon. The soil was a Fuquay loamy sand, and was prepared with a rototiller prior to planting. Guidelines established by the University of Georgia Cooperative Extension Service were followed for land preparation, fertility, weed management, and insect control. Carrots were seeded with a Monosem planter on 24 Sep 01 into non-mulched, raised beds. Each plot consisted of a three 15-ft rows on 14 in. centers (one bed), with 5-ft borders between blocks. The experiment was laid out in a randomized complete-block design with 6 replications. Plots were inoculated by evenly distributing 5 grams of sclerotia of *S. rolfsii* around the crowns of plants within each plot on 19 Mar. Fungicides were then applied over the row with a CO_2-powered backpack sprayer through a 4-nozzle boom (18 in. spacing) fitted with TSX-26 hollow cone nozzles and set to deliver 60 gal/A at 40 psi. Fungicide applications were made on 19 Mar and 3 Apr, roughly 45 and 30 days before harvest (DBH). Bravo WeatherStik 720SC was applied to the entire experiment on a weekly basis beginning 19 Mar for control of foliar diseases. Plots were irrigated with 1 inch of water immediately after each treatment to incorporate the fungicides. The center row of each plot was harvested on 3 May and carrots were graded and weighed.

Results and Discussion

Despite inoculation of the test plots with *S. rolfsii*, disease pressure was low in the trial. The application of fungicides at 45 and 30 days prior to harvest significantly reduced the severity of southern blight in the experiment. Single applications of Quadris 2.08 SC (20.0 fl oz/A) 45 days before harvest (DBH) controlled white mold as effectively as applications made 30 DBH, or two applications made at 45 and 30 DBH

(Table 1). All rates and timings of Quadris were as efficacious as Omega 500F against southern blight. The rate and timing of Quadris applications had an impact on the number of marketable carrots per plot and the weight of marketable carrots. Single applications of Quadris at 20 fl oz/A made 30 days DBH, or applications made at 45 and 30 DBH, produced more marketable carrots than two applications of Quadris at 12.3 fl oz/A and increased the number of marketable carrots by more than 23% as compared to the untreated check. However, no significant differences were observed between treatments with regard to weight of carrots per plot. Quadris applied at 12.3 fl oz/A did not increase the number of carrots per plot as compared to the untreated check. No phytotoxicity was observed for any treatment.

Table 1. Effect of Quadris and Fluazinam on southern stem rot and yield of carrot

Treatment, rate/A, and timing (DBH)	% Diseased carrots		Carrot yield/Acre (× 1000) No. marketable		Weight (lb)	
Untreated control	8.3	a*	219	c*	40.6	a*
Quadris 2.08SC 20.0 fl oz/A (45)	0.5	b	279	ab	51.0	a
Quadris 2.08SC 20.0 fl oz/A (30)	0.8	b	289	a	50.0	a
Quadris 2.08SC 20.0 fl oz/A (45/30)	0.6	b	286	a	50.0	a
Quadris 2.08SC 12.3 fl oz (45/30)	0.6	b	234	bc	43.8	a
Omega 500F (45/30) 1 pt	0.5	b	306	a	53.3	a

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

EVALUATION OF FUNGICIDES FOR CONTROL OF PHYTOPHTHORA CROWN AND FRUIT ROT OF SUMMER SQUASH

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Introduction

Phytophthora crown and fruit rot, caused by *Phytophthora capsici*, is a serious constraint to the production of yellow squash in Georgia and has increased in severity in recent years. The disease is common to a number of cucurbit species; however, yellow squash is known to be highly susceptible. The onset of symptoms is followed by rapid death in the case of root or crown infections, while infected fruit quickly decay and collapse. Favorable conditions for disease development include excessive rainfall or irrigation, poor soil drainage, and moderate temperatures. *Phytophthora capsici* produces numerous sporangia, which release motile zoospores that can be spread in irrigation or surface water. Sporangia may also be dispersed in air, or by splash dispersal of infested soil. Oospores (thick-walled resting spores) and mycelium in infected tissue are the principal means of survival of *P. capsici* between crops. Management of the disease has proven difficult with soil fumigation, cultural practices and crop rotation, and there are no labeled fungicides available in Georgia. Experiments were conducted in 2002 to evaluate a number of fungicides for their efficacy against *P. capsici* on yellow squash**.**

Materials and Methods

An experiment was conducted at the Blackshank Research Farm in Tifton, GA in a field that had previously been inoculated with *Phytophthora capsici*. The soil was a Fuquay loamy sand, and was prepared with a rototiller prior to planting. Guidelines established by the University of Georgia Cooperative Extension Service were followed for land preparation, fertility, weed management, and insect control. Summer squash were transplanted 12 in. apart on 15 Apr into non-mulched, raised beds. Each plot consisted of a single 15-ft row on 36 in. centers, with 5-ft borders between blocks. The experiment was laid out in a randomized complete-block design with 4 replications. The number of plants standing at 30 days after planting (DAP) was counted immediately prior to initiation of fungicide applications. Plots were given supplemental inoculum by placing three *P. capsici*-infected squash seedlings at equal distances within the row. Fungicides were then applied over the row with a CO_2-powered backpack sprayer through a 2-nozzle boom (18 in. spacing) fitted with TSX-18 hollow cone nozzles and set to deliver 60 gal/A at 75 psi. Fungicide applications were initiated at 21 DAP and continued weekly until maximum disease incidence was reached in the untreated check (total of 4 sprays). Supplemental overhead irrigation was applied to the test site after planting (0.5 in.), and twice weekly thereafter to achieve optimal moisture conditions for development of disease. Plant mortality was recorded in plots weekly beginning on 8 May and ending on 6 Jun (5 sprays), when maximum mortality was observed in untreated plots. The experiment was harvested on 23 May, 29 May, and 5 Jun.

Results and Discussion

Warm, wet conditions and the addition of inoculated seedlings contributed to high levels of crown and fruit rot in the trial. As an indicator of season-long efficacy of a given fungicide treatment, AUDPC was used to rank the fungicides in this trial. The lowest AUDPC values were found in plots treated with either Ridomil Gold 4EC or Ultra Flourish 2EC (applied at equivalent rates of the active ingredient mefenoxam), which were 86% lower than the AUDPC for the untreated check. Ranman 400SC applied alone at 2.75 fl oz/A reduced AUDPC by 38%, while the combination of Ranman 400SC and BAS500 20WG reduced AUDPC by 63%. No significant reduction of AUDPC was seen with the remaining treatments in the test. Highest yields (number and weight of marketable fruit) were found in plots treated with Ranman 400SC alone, Ranman 400SC plus BAS500, Ridomil Gold 4EC, and Ultra Flourish. Numerically, total number and weight of squash was highest in the Ranman/BAS500-treated plots. The broad-spectrum activity of BAS500 may have suppressed pathogens other than *P. capsici* and thus provided additional yield benefits. It must also be noted that while Ranman 400SC plus BAS500 was inferior to Ridomil Gold and Ultra Flourish in protecting squash plants against Phytophthora crown rot, the combination provided levels of protection to fruit that were equal to either Ridomil Gold or Ultra Flourish.

Table 1. Fungicide efficacy against *Phytophthora capsici* on yellow squash.

Treatment and rate/A	AUDPC[z]		Fruit yield per acre[y] (× 1000) No. marketable		Weight (lb)	
Untreated control	21.6	ab[x]	11.1	de[x]	2.3	cde[x]
Ranman 400SC 2.75 fl oz + Silwet L77 2.0 fl oz	13.5	c	21.6	bc	5.5	bc
BAS500 20WG 16 oz	21.2	ab	6.3	e	1.3	e
Ranman 400SC 2.75 fl oz + Silwet L77 2.0 fl oz + BAS500 20WG 16 oz	8.0	d	31.5	a	10.1	a
Ridomil Gold 4EC 1.0 pt	3.1	e	24.7	ab	6.6	b
Ultra Flourish 2EC 2.0 pt	3.0	e	25.9	ab	7.3	ab
Tanos 50WP 1.0 lb	19.4	b	15.3	cd	4.8	bcd
Tanos 50WP 2.0 lb	23.5	ab	**7.7**	de	1.8	de
Rhamnolipid 250SC 2 fl oz	24.1	a	**7.7**	de	1.7	de
Rhamnolipid 250SC 8 fl oz	21.6	ab	**7.6**	de	1.4	e

[z]Final disease rating (percent incidence of plants with symptoms of Phytophthora crown rot) taken on 22 Jun; AUDPC=area under the disease progress curve, constructed from evaluations taken on 16 May, 23 May, 30 May, 6 Jun, and 30 Jun.

[y]Yield data are the total of three harvests - 23 May, 29 May, and 5 Jun.

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

EVALUATION OF FUNGICIDES AND PLANT DEFENSE ACTIVATORS FOR CONTROL OF ALTERNARIA LEAF SPOT AND BLACK ROT OF CABBAGE

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Introduction

Alternaria leaf spot (*Alternaria* spp.) and black rot (*Xanthomonas campestris* pv. *campestris*) are two of the most common and destructive diseases of cabbage and collards in Georgia. Generally, warm, wet weather enhances both of these diseases. Black rot, unlike Alternaria leaf spot, is generally a seedborne disease that can spread rapidly under favorable conditions. Copper products are the only labeled materials that can be used to treat black rot once it is discovered in the field, however, applications of copper are marginal at best in suppressing black rot spread. The plant defense activator Actigard® (acibenzolar-s-methyl) has been useful in reducing losses to foliar bacterial pathogens in tomato. The primary objective of this study was to evaluate the effect of Actigard on black rot of cabbage.

Materials and Methods

Plots located at the Mountain Branch Experiment Station in Blairsville, GA were transplanted to 'Rio Verde' cabbage on 20 May. Rows were 36 in. apart with a 1.0 ft in-row spacing. Plots were 20 ft long and were arranged in a randomized complete block with 4 replications. A 10-ft buffer separated plots on each end. Plots were bordered on each side by a non-treated border row that was inoculated with a suspension of the black rot bacterium. The concentration (1×10^7 CFU per ml^{-1}) was prepared in sterile tap water. Inoculation was achieved by soaking a towel with inoculum and dragging it over the non-treated border row on the morning of 21 May when the dew was still present on the foliage. Standard practices for managing fertility, weeds, and insects were used according to University of Georgia Cooperative Extension Service recommendations. All treatments were applied using a CO_2-pressurized backpack sprayer calibrated to deliver 40 gal/A at 60 psi through TX-18 hollow-cone nozzles. Cabbage were harvested by counting and weighing the number of marketable heads in the center 10 ft of each plot. The months of May – Jul were warm and dry with average rainfall 2.6 in. below the 68 year normal.

Results (see following table)

Black rot pressure was low despite inoculation at planting. Symptoms of both black rot and Alternaria leaf spot were observed initially on 16 Jul after receiving more than 2.0 in. of rain the week before. No significant differences were noted in black rot incidence on 23 Jul compared to the non-treated control. However, Alternaria leaf spot was significantly reduced by applications of Quadris tank-mixed with Actigard, Actigard applied 2 – 3 times at 0.75 oz/acre, and Actigard applied twice at 1.0 oz/acre. There were no significant differences in the number of marketable heads per plot. Total yield in lb per plot was significantly decreased below the non-treated check when six applications of Actigard were applied at either rate.

Treatment and rate/A[z]	AS[y] 23 Jul	BR[x] 23 Jul	No.[w] Heads	Total[v] Yield
Actigard 50WG, 0.75 oz (1, 2)	3.0 d[u]	9.8 a	8.8 a	40 ab
Actigard 50WG, 0.75 oz (1, 2, 3)	4.8 de	8.8 a	10.0 a	40 ab
Actigard 50WG, 0.75 oz (1 - 6)	12.0 bc	6.0 a	8.8 a	32 bc
Actigard 50WG, 1.0 oz (1, 2)	5.8 c-e	13.0 a	9.3 a	42 a
Actigard 50WG, 1.0 oz (1, 2, 3)	7.5 b-e	11.5 a	9.3 a	41 ab
Actigard 50WG, 1.0 oz (1 - 6)	23.0 a	5.8 a	7.3 a	23 c
Kocide 101 WP, 1.0 lb (1 - 6)	10.8 b-d	8.3 a	9.8 a	44 a
Kocide 101 WP, 2.0 lb (1 - 6)	9.0 b-e	7.5 a	8.8 a	38 ab
Quadris 2.08F, 9.2 fl oz + Actigard 50WG, 0.75 (1, 2, 3)	2.0 e	14.8 a	9.5 a	41 ab
Non-treated	15.0 ab	13.0 a	9.3_a	44 a

[z]Spray dates are shown parenthetically and are as follows: 1=20 May; 2=28 May; 3=5 June; 4=17 June; 5=28 June; 6=3 July.
[y,x]Ratings represent the number of lesions of Alternaria leaf spot (AS) and black rot (BR) per plot.
[w]Data represents the total number of marketable cabbage heads per plot on 23 July.
[v]Data represents the total weight in pounds of cabbage heads per plot on 23 July.
[u]Means in columns with the same letter(s) are not significantly different according to Fisher's Protected LSD test at P=0.05.

CONTROL OF ALTERNARIA LEAF SPOT OF CANTALOUPE WITH BIOFUNGICIDES AND REDUCED-RISK FUNGICIDES ALTERNATED WITH CHLOROTHALONIL

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Introduction

Alternaria leaf spot (*Alternaria cucumerina*) is one of the most common diseases affecting cantaloupe in Georgia. This disease is generally easy to control with currently labeled fungicides, however, biopesticides and reduced-risk fungicides may be used to reduce the total amount of non-reducded-risk fungicides applied. This work was conducted as part of a federally-funded CSREES grant to determine if biopesticides and reduced-risk fungicides could be incorporated into fungicide programs for controlling Alternaria leaf spot without compromising yield and quality of cantaloupe.

Materials and Methods

Cantaloupe seeds ('Athena') were planted to black plastic-covered beds in a commercial drip-irrigated field in Mitchell Co., GA on 11 Apr. The planting pattern consisted of plants 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 followed University of Georgia Extension recommendations. The experiment utilized a randomized complete block design with 4 replications. Fungicide plots were 30-ft long and utilized a 6-ft buffer zone between plot ends. Fungicides were applied using a CO_2-pressurized backpack sprayer calibrated to deliver 40 gal/A at 60 psi through TX-26 hollow cone nozzles. Mature fruit at full- and half-slip stages were harvested from the center 20 ft of each plot on 10, 12, 14, 17, 19, and 21 Jun. Each week, one harvest was chosen from which soluble solids (Brix) were measured on three fruit from each plot using a hand-held refractometer. Weather during the experiment was warm and dry with total rainfall 4.4 in. below the 50-yr average.

Results

Alternaria leaf spot was first observed on 3 Jun at low levels. Dry weather during the experiment inhibited the disease from spreading initially. Disease did progress more rapidly after 1.0 in. rain on 7 Jun and non-treated plots were almost completely defoliated by the last harvest. Actigard-treated plots demonstrated phytotoxicity after the first treatment and appeared as white, necrotic flecks on ca. 50% of the leaf area. All fungicide treatments significantly suppressed AUDPC compared to the non-treated check with no clear advantage demonstrated among any of the treatments. Actigard significantly reduced total marketable yield due to phytotoxicity. No significant differences were observed in Brix measurements.

Treatment, rate/A[z]	AUDPC[y]		Marketable[x] Yield (lb/plot)		Brix[w]
Actigard 50WG, 0.5 oz (1, 3, 5) Echo 720 SC, 3.0 pt (2, 4, 6)	33.3	b[v]	99	b	7.0 a
Messenger 3WG, 4.5 oz (1, 5) Echo 720 SC, 2.0 pt (2, 3, 4, 5, 6)	17.1	b	143	a	8.0 a
Milsana, 25.6 fl oz + Tween 20, 0.02 % vol/vol (1, 3, 5) Echo 720 SC, 3.0 pt (2, 4, 6)	63.4	b	132	a	7.9 a
QRD 283 WP, 4.0 lb (1, 3, 5) Echo 720 SC, 3.0 pt (2, 4, 6)	33.3	b	152	a	8.4 a
QRD 137 WP, 4.0 lb (1, 3, 5) Echo 720 SC, 3.0 pt (2, 4, 6)	19.7	b	147	a	7.7 a
Oxidate, 25.6 fl oz (1 - 6) Echo 720 SC, 2.0 pt (1 - 6)	24.1	b	131	a	8.0 a
Manzate 75DF, 3.0 lb (1 - 4) Echo 720 SC, 3.0 pt (5, 6)	13.1	b	133	a	8.1 a
Echo 720 SC, 2.0 pt (1 - 6)	23.2	b	138	a	7.9 a
Echo 720 SC, 3.0 pt (1, 3, 5)	14.4	b	128	a	8.0 a
Non-treated	469.9	a	144	a	7.9 a

[z]Spray dates are shown parenthetically and are as~~ as~~ follows: 1=2 May; 2=9 May; 3=16 May; 4=24 May; 5=31 May; 6=10 Jun~~e~~.
[y]Area under disease progress curve calculated from severity ratings (modified Horsfall-Barrett 0-10) taken 3, 10, and 17 Jun.
[x]Total marketable yield taken from the center 20 ft of each plot.
[w]Measured on fruit picked on 18 Jun.
[v]Means followed by the same letter(s) are not significantly different according to Fisher's Protected LSD test at P=0.05.

A COMPARISON OF NEW FOLIAR OOMYCETE FUNGICIDES FOR CONTROL OF DOWNY MILDEW OF ZUCCHINI SQUASH

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Introduction

Downy mildew (caused by *Pseudoperonospora cubensis*) is one of the most destructive diseases of squash in Georgia. Since no resistant varieties exist, and cultural practices offer little suppression, fungicides are relied on heavily for disease control. The purpose of this study was to determine the most efficacious fungicides for control of downy mildew in Georgia.

Materials and Methods

Squash seeds were planted on 8 Aug in white plastic mulch covered beds at the Ponder Farm, a unit of the Coastal Plain Experiment Station in Tifton, GA. Mulched beds had a 32-in. top and were planted on 6-ft centers. Seeds were planted in one row and were spaced 2 ft apart within the row, resulting in 8 plants per plot. Plots were 15 ft long, were separated on each end by 3 ft of bare plastic, and were arranged in a latin square design with 5 replications. Fertility, insect and weed control were managed according to standard University of Georgia Extension Service recommendations. Fungicide treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 40 gal/A at 75-80 psi through TX-18 hollowcone nozzles. Plots were oversprayed with Nova at 4.0 oz/acre on 3 and 20 Sep, and with Quintec (quinoxyfen) at 8.1 fl oz/acre on 11 Sep to control powdery mildew. Weather during the experiment was near the 77 year average for temperature and rainfall.

Results

Downy mildew was first observed on 11 Sep and increased to high levels by 2 Oct. All treatments significantly reduced disease by on 20 Sep compared to the non-treated check. Reason significantly outperformed other treatments on both rating dates. On 2 Oct, Reason and Zoxium were the only treatments to significantly reduce downy mildew compared to non-treated plots. No phytotoxicity was observed with any of the treatments.

Treatment and fungicide rate/A[Z]	Downy Mildew[y] 20 Sep	Downy Mildew 2 Oct
Reason 500SC, 6.8 fl oz	2.4 c[x]	2.9 c
Zoxium 80WP, 5.0 oz	4.0 bc	4.5 b
Acrobat 50WP, 6.4 oz	5.4 b	6.2 a
Curzate 60DF, 3.2 oz	5.2 b	6.5 a
Non-treated	7.4 a	7.5 a

[z]Spray dates were: [z]Application dates were 3, 11, 20 Sep.
[y]Downy mildew was rated on a 1-10 scale where 1=1-10% leaf area affected by downy mildew and 10=100% leaf area affected by downy mildew.
[x]Means followed by the same letter(s) are not significantly different according to Fisher?s Protected LSD test at P=0.05.

EVALUATION OF FUNGICIDES AND BIOLOGICAL CONTROL MATERIALS FOR CONTROL OF CERCOSPORA LEAF SPOT OF TURNIP

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Introduction

The foliar leaf spot diseases caused by *Cercosporella brassicae* and *Cercospora brassicicola* are the most common and destructive diseases of turnips in Georgia. Crop rotation and resistant varieties can reduce losses to these diseases but unacceptable losses still occur despite our best cultural controls. Fungicides have been heavily relied on for control of these diseases but Benlate®, which was the backbone of our fungicide programs, was removed from the market in 2001. Maneb® has a special state label for Georgia but is only marginally effective against leaf spot diseases. Recently, Quadris® and Cabrio® have both been labeled for turnips. Also, the biofungicide Serenade may show potential against these diseases. This study was conducted to determine the most effective compounds against leaf spot of turnip greens.

Materials and Methods

Turnip seed ('Just Right') were planted in 36 in rows at 4 lb/A on 24 Oct in Hortense, GA. Standard practices for management of fertility, weeds, nematodes and insects were followed throughout the season. The experiment utilized a randomized complete block design with 4 replications. Each fungicide plot consisted of two 15-ft long rows that utilized a 3-ft buffer zone between plot ends. Foliar fungicide treatments were initiated at the first symptoms of disease (26 Nov). 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 (see table)

Weather during the experiment was warm and very dry with rainfall accumulations during the test period of only 0.92 in. Leaf spot caused by *Cercospora brassicicola* was the primary pathogen in the test. Treatments that significantly reduced leaf spot compared to the non-treated check on the 04 Dec rating date were both Cabrio treatments, Pristine, Quadris at 5.0 fl oz/A, and Benlate. All fungicide treatments significantly reduced leaf spot by 17 Dec. No phytotoxicity was observed with any of the treatments.

Treatment, rate/A[z]	Leaf Spot Ratings[y] 04 Dec		17 Dec	
Cabrio 20EG, 0.75 lb	5.5	d[x]	2.0	e
Cabrio 20 EG, 1.0 lb	4.5	d	2.3	e
Pristine 38WG, 0.66 lb	7.8	cd	4.8	de
Quadris 2.08F, 5.0 fl oz	14.0	b-d	13.8	cd
Quadris 2.08F, 8.0 fl oz	19.0	a-c	15.0	cd
Benlate 50WP, 0.5 lb	9.3	cd	9.4	de
Bravo Weatherstik 720 SC, 1.5 pt	26.5	a	23.8	c
Maneb 75DF, 2.0 lb	24.0	ab	35.0	b
Serenade 10WP, 4.0 lb	21.3	ab	45.0	b
Non-treated check	30.0	a	60.0	a

[z]Spray dates are as follows: 1=26 Nov; 2=4 Dec.
[y]Percent leaf area affected by leaf spot.
[x]Means in columns with letter(s) in common are not significantly different according to Fisher's Protected LSD test at P=0.05.

EVALUATION OF FUNGICIDES FOR CONTROL OF DOWNY MILDEW OF ZUCCHINI SQUASH

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Introduction

Downy mildew (caused by *Pseudoperonospora cubensis*) is one of the most destructive diseases of squash in Georgia. Since no resistant varieties exist, and cultural practices offer little suppression, fungicides are relied on heavily for disease control. The purpose of this study was to determine the most efficacious fungicides for control of downy mildew in Georgia.

Materials and Methods

One row of squash seed ('Spineless Beauty') was planted on 8 Sep in raised, 32-in. black plastic mulched beds laid on 6 ft centers. Beds were sprayed with flat white exterior latex paint prior to planting to reduce heat. Plots were 15 ft long, arranged in a randomized complete block design, and were replicated four times. A 3-ft buffer separated each plot. Standard practices for managing fertility and controlling weeds and insects were implemented according to University of Georgia Cooperative Extension Service recommendations. Plots were over-sprayed with Quintec (quinoxyfen) at 8.1 fl. oz/acre on 8 Oct to control powdery mildew. Fungicide treatments were applied using a CO_2-pressurized sprayer calibrated to deliver 40 GPA at 75-80 psi using TX-18 nozzles. Weather was warm and wet during the experiment with rainfall accumulations for the months of Sep through Nov over 7.0 in. above the 77 year average.

Results

Downy mildew was observed at low levels on 8 Oct. By 30 Oct, downy mildew had caused severe foliar symptoms. On the 30 Oct rating date, only Cabrio, Reason, Dithane, and Ridomil Gold Bravo significantly reduced the severity of downy mildew compared to the non-treated check. Defoliation was significantly reduced below the check on 11 Nov by Cabrio, Reason, Quadris, Flint, Gavel, Dithane, and Ridomil Gold Bravo. No phytotoxicity was observed with any of the treatments.

Treatment and rate/A[z]	Downy Mildew[y] 30 Oct		Defoliation[x] 11 Nov	
Cabrio 20EG, 12.0 oz (1, 2, 3, 4)	4.2	f[w]	4.0	e
Reason 500SC, 6.8 fl oz (1, 2, 3, 4)	5.2	ef	5.0	de
Quadris 2.08F, 15.0 fl oz (1, 2, 3, 4)	6.4	c-e	5.9	c-e
Flint 50WG, 4.0 oz (1, 2, 3, 4)	6.2	de	5.9	c-e
Aliette 80WG, 3.0 lb (1, 2, 3, 4)	6.3	c-e	6.3	b-d
Gavel 75DF, 2.0 lb (1, 2, 3, 4)	6.4	c-e	5.4	de
Dithane DF, 3.0 lb (1, 2, 3, 4)	5.5	ef	4.5	de
Ridomil Gold Bravo 72.4WP, 2.0 lb (1, 2, 3, 4)	5.6	ef	5.4	de
Bravo Weather Stik 720 SC, 2.0 pt (1, 2, 3, 4)	6.8	de	6.5	b-d
QRD 286 AS, 1.0 gallon (1, 2, 3, 4)	8.6	a	9.4	a
QRD 283 WP, 2.0 lb (1, 2, 3, 4)	7.8	a-d	7.8	a-c
QRD 283 WP, 4.0 lb (1, 2, 3, 4)	8.0	a-c	8.9	a
QRD 283 WP, 2.0 lb (1, 3) + Ridomil Gold Bravo 72.4WP, 2.0 lb (2, 4) ..4ab8.0ab				
Non-treated	7.8	a-d	8.0	ab

[z]Spray dates are as follows: 1=8 Oct; 2=15 Oct; 3=25 Oct; 4=31 Oct.
[y]Downy mildew rated on a 1 - 10 scale where 1=0 to 1% leaf area affected and 10=100% leaf area affected.
[x]Defoliation rated on a 1 - 10 scale where 1=0 to 1% defoliation and 10=100% defoliation.
[w]Means with letter(s) in the same column are not significantly different according to Fisher's Protected LSD at $P \leq 0.05$.

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