

1994 Vegetable Research Report

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Contents

Evaluation of Biological Insecticides for Control of Worm Pests of Cabbage

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Various "worm" pests attack cabbages grown in the Southeast, including the diamondback moth and cabbage looper. Because of concerns regarding overuse of synthetic insecticides, many growers are now using "biological" insecticides to control such pests. These materials contain an insect-active toxin from the bacterium *Bacillus thuringiensis* (Bt).

Each Bt strain is toxic to a different group of insect pests, but are nontoxic to beneficial insects and humans. Because several Bt products are available for worm pest control, a field test was conducted to evaluate them and determine optimal use rates in cabbage. Results indicated that the materials effectively control worms and protect cabbages from feeding damage.

Methods

'Fortuna' cabbage was transplanted on March 21, 1994 at the E.V. Smith Horticulture Substation in Shorter. Treatment plots consisted of single rows (bordered on each side by an untreated row). Treatment rows were sprayed each week until harvest using a backpack sprayer. Bond™ spreader-sticker (one pint per acre) was added to the spray mixture in all treatments. Spray volume was 55 gallons per acre; pressure was 40 pounds per square inch. Worm counts were recorded weekly on five plants per plot, and a damage rating was assigned to five plants per plot at harvest on June 15 (see table).

Results

Diamondback moth populations were moderate and cabbage looper populations low during the test. Although the highest labelled rate of Asana XL, a synthetic product, resulted in the lowest damage rating of all treatments, all Bt treatments effectively controlled and protected against worm feeding. The tank mix combination of low rates of Asana XL plus Javelin WG also provided excellent protection against worm damage. Under the low to moderate worm pressure during the test, low rates of Bt provided the same levels of worm control as the high rates.

[1] See listing of authors and titles on page 22.

Efficacy of Biological Insecticides Against Diamondback Moth and Cabbage Looper Larvae in Cabbage

Treatment	Rate per acre	Avg. larvae/plant[1]		Damage[2]
		DBM[3]	CL[4]	
Xentari	0.5 lb.	0.3	0.1	1.80
Xentari	1.0 lb.	0.2	0.05	1.80
Dipel 2X	0.5 lb.	0.4	0.2	1.80
Dipel 2X	1.0 lb.	0.4	0.05	1.80
Javelin WG	0.5 lb.	0.4	0.4	1.75
Javelin WG	1.0 lb.	0.3	0.1	2.50
Agree	1.0 lb.	0.5	0.05	2.40
Agree	2.0 lb.	0.2	0.3	2.10
Asana XL	9.6 fl. oz.	0.5	0.1	1.50
Asana XL + Javelin WG	4.8 fl. oz. + 0.5 lb.	0.05	0.0	1.55
Untreated check	—	2.2	0.6	4.05

[1]Worm counts on May 10 when peak insect counts were recorded.
[2]Damage rating: 1 = no apparent insect feeding; 2 = minor feeding on wrapper leaves; 3 = moderate feeding on wrapper leaves with no head damage; 4 = moderate feeding on wrapper leaves with minor feeding on head. A rating of 4 and above is considered unmarketable because even slight head damage is not acceptable.
[3]DBM, Diamondback Moth larvae.
[4]CL, Cabbage Looper larvae.

Weed Hosts of Cucumber Mosaic Virus in Alabama

Mahefapiana Andrianifahanana, Ed Sikora, and John Murphy

In 1992 and 1993, tomato production areas in North Alabama sustained severe yield losses due to a virus disease complex. Losses were mainly attributable to Cucumber Mosaic virus (CMV). The epidemiological patterns observed among affected tomato fields in north Alabama suggested the presence of virus source plants in close vicinity to these fields.

Previous research has shown that approximately 800 plant species are capable of acting as hosts to CMV. A 1994 survey of the weed population surrounding infected fields in Blount and St. Clair counties in north Alabama revealed that at least 11 weed species were hosts to CMV.

Methods

In spring 1994, weeds growing adjacent to previously affected tomato fields were identified and tested for the presence of CMV. Three fields, two in Blount County and one in St. Clair County, were used for the study. All three fields were planted to tomato in 1993, sustaining moderate to severe damage from CMV. Weeds were collected in February or March from a 30x300-foot area bordering each field. Plants were then tested for presence of CMV.

Results

A total of 490 specimens distributed among 16 species were collected and tested for CMV. Species that tested positive for the virus were wild garlic, sheperdspurse, hairy bittercress, marestail, Carolina geranium, wild prickly lettuce, common henbit, honeysuckle, curly dock, common chickweed, and dandelion. However, the majority of plants collected did not show virus-like symptoms.

These tests were conducted shortly before the first tomato settings. Thus, these weeds could have served as sources of CMV for the tomato plantings. The green peach aphid and potato aphid were identified in these fields in 1992 and 1993. Both are efficient carriers of the virus and potentially could transfer the virus from overwintering weed hosts to tomatoes.

Management of CMV in tomato in this region of Alabama might be improved through control of weed hosts. This may delay the entry of the virus into early tomato settings. The use of mulches to decrease CMV transmission rate by aphids is the subject of another Auburn study.

Incidence of CMV in Weed Hosts Growing Adjacent to Tomato Fields

Weed	No. with CMV / no. tested			Total
	Field 1	Field 2	Field 3	
Carolina geranium	18/20	14/20	11/20	43/60
Common chickweed	0/0	0/0	4/20	4/20
Common dandelion	0/0	19/19	0/0	19/19
Common henbit	4/13	0/5	5/20	9/38
Curly dock	4/10	12/20	8/20	24/50
Fescue	0/18	0/20	0/20	0/58
Hairy bittercress	10/20	0/0	0/0	10/20
Honeysuckle	20/20	0/0	0/0	20/20
Marestail	10/20	12/20	0/1	22/41
Narrow vetch	0/0	0/20	0/19	0/39
Sheperdspurse	0/0	0/0	11/20	11/20
Rye	0/7	0/0	0/0	0/7
White clover	0/0	0/0	0/20	0/20
Wild garlic	6/20	0/20	0/0	6/40
Wild prickly lettuce	9/9	0/0	6/9	15/18
Wild mustard	0/0	0/0	0/20	0/20

Double-Cropped Cucumbers and Tomatoes on Black Plastic Mulch

Joe Kemble and Jimmy Witt

Double-cropping is the production of two consecutive crops on the same land area in a successive growing season. This practice allows growers to maximize the efficiency of land, labor, equipment, and material use. To determine the potential of double-cropping in Alabama, a study was developed to determine the influence of cultivar on double-cropping trellised cucumbers following the production of staked, fresh-market tomatoes.

Methods

After the final harvest of tomatoes, plants were sprayed with the herbicide glyphosate. Care was taken to prevent the spray from coming in contact with the plastic mulch. After tomato plants died back, 30 pounds of N per acre from 20-20-20 were injected through the drip system. Thereafter, five pounds of N per acre were injected weekly — alternately from 20-20-20 and potassium nitrate (13-0-44) — continuing through the final harvest of cucumbers. The idea was to allow the cucumbers to use the dead tomato plants along with the attached strings and stakes for support.

Two weeks after the herbicide was applied, holes were punched through the plastic eight inches apart. Then, two to three seed of each cucumber cultivar were sown to a depth of one inch. Following emergence, plants were thinned to one plant per hill. Proper weed, insect and disease control were maintained. Cucumbers were harvested at maturity and graded according to appropriate USDA standards.

Results

Presently, this study is still underway. However, preliminary results indicate that this is a potential system of production for Alabama. As a result, more expansive testing is planned for next year involving several locations and several double-crop combinations. The first part of this research will focus on comparing bare ground production with plasticulture (production of vegetable crops on plastic using drip irrigation). This research is aimed at developing practical guidelines for proper fertility needed to make double-cropping function smoothly. Insect and disease pressure will also be monitored in each system.

Evaluation of New Insecticides for Control of Corn Earworm on Sweet Corn

Geoff Zehnder and Marlin Hollingsworth

Corn earworm (CEW) is a limiting factor in sweet corn production. Earworm moths lay eggs on silks, and developing larvae crawl down into ears, feeding on kernels. Once inside the ear, larvae are protected from insecticides; therefore, growers typically make frequent sprays from silking through harvest.

Two new insecticides were evaluated for CEW control and compared with two commonly used materials, Asana XL™ and Lannate LV™. The new insecticides were Decis™ (not yet registered for use on sweetcorn) and Larvin 80 DF™ (registered in Alabama for sweetcorn under a special state label). Under heavy earworm pressure, the new materials performed as well as Lannate LV™ but not as well as Asana XL™ for CEW control.

Methods

'Silver Queen' sweet corn was planted on May 24 at the North Alabama Horticulture Substation in Cullman. Treatment plots consisted of six rows, where the four middle rows of each plot were sprayed with insecticides beginning at "tassel push," when the tassels were first observed growing up from the whorl, and

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Corn Earworm on Sweet Corn, continued

on a 3-4 day schedule throughout the silking period until harvest.

Sprays were applied on July 19, 22, 26, and 29, and on Aug. 1 and 4. Spray application was made by a self-propelled high-clearance sprayer with one hollow cone nozzle over the row and 1-6 nozzles on drop extension tubes on either side of the row. Additional nozzles were added as corn height increased. Spray volume remained constant on all spray dates at 80 gallons per acre.

Treatment effectiveness was determined at harvest by examination of 25 randomly selected ears per plot (100 ears per treatment) for CEW feeding damage to the ear tips. Worm feeding damage not associated with the ear tip was classified as "side damage" (assumed to be caused by other insect larvae). Ears were considered unmarketable if CEW damage to the ear extended 1.5 inches beyond the tip of the ear, or if side damage was present.

Results

CEW damage was severe in the untreated check with 94% damaged ears. The most effective treatment (Asana XL™) still resulted in 26% damaged ears, indicating that the 3-4 day spray interval was inadequate. All treatments resulted in a significantly lower percentage of damaged ears compared with the untreated check. Of all treatments, Asana XL™ resulted in the lowest percentage of damaged ears (tip and side damage combined), and the lowest percentage of ears with tip (earworm) damage. The higher rates of Decis™ and Larvin 80 DF™ did not result in better worm damage control than the lowest rate, indicating that increasing the rate of these materials does not improve control.

Control of Corn Earworm Damage with Insecticides

Treatment	Rate	Damaged ears[1]	Unmarketable ears[2]	Tip damage[3]	Side damage[4]
	Lb. a.i./a.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Decis	0.0065	51	31	39	12
Decis	0.0125	69	28	55	14
Decis	0.025	55	21	45	10
Larvin 80 DF	0.50	41	5	39	2
Larvin 80 DF	0.75	61	18	50	11
Asana XL	0.05	26	16	15	11
Lannate LV	0.45	44	12	46	5
Untreated	—	94	43	82	11

[1]Percentages calculated based on numbers of ears damaged per 25 ears sampled in each replicate; 100 ears sampled per treatment.
[2]Percentages calculated based on numbers of unmarketable ears per 25 ears sampled in each replicate. Ears were classified unmarketable if insect damage extended further than 1.5 inches beyond the tip of the ear.
[3]This is considered earworm damage. Percentages calculated based on numbers of ears with tip damage per 25 ears sampled in each replicate.
[4]This is considered non-earworm damage. Percentages calculated based on numbers of ears with worm damage not associated with the tip (damage began farther than 1.5 inches beyond the tip of the ear) per 25 ears sampled in each replicate.

Growth and Development of Luffa Sponge Gourds in Central Alabama

Joe Kemble and Jimmy Witt

The fibrous interiors of fruit from the Luffa sponge gourd are used in the U.S. as bath sponges, but they also are good for scrubbing pots, pans, and even tires. The tough fibers can be processed into industrial products such as filters, insulation, and packing material. All of these products are biodegradable and could be used to replace similar petrochemical products.

Luffa sponges are imported from China, Columbia, El Salvador, Guatemala, Korea, Mexico, Taiwan, and Venezuela. Demand for Luffa sponge products is increasing, and Luffa sponge gourds grown in the U.S. are becoming competitive with foreign-grown sponges. This research was conducted to determine the potential of Luffa sponge gourd production in Alabama.

Luffa Sponge Gourds in Central Alabama, continued

Luffa sponge gourd production is costly and has some problems, but profit potential is great when a high-quality gourd is produced. As many as 20,000 gourds per acre can be expected, although few growers would actually produce an entire acre of gourds. Average gourd prices can be as high as 40 cents per gourd. However, lack of registered pesticides, and labor-intensive pruning, training, harvesting, and cleaning can pose problems.

Methods

Because Luffa is closely related to the cucumber, cultural practices similar to those for trellised cucumbers were used. Luffa gourds require a sturdy trellis system at least four feet tall, because developing fruit are susceptible to soil-borne rots and therefore need to be kept off the ground. In addition, good air circulation is needed around fruit and foliage to avoid disease problems associated with high relative humidity around the plant canopies.

Five-week-old transplants of three cultigens of Luffa sponge gourd were set on June 29, 1994. Plants were spaced 18 inches apart within rows, and each row was spaced eight feet apart. Plants received additional water through drip irrigation. Additional nutrients were applied by sidedressing during the growing season. Proper weed, insect, and disease control was maintained as outlined in "Integrated Pest Management: Commercial Vegetables. Insect, Disease, Nematode, and Weed Control Recommendations" (Alabama Cooperative Extension Service). Plants were pruned as they began to reached the top of the trellises.

Results

Presently, this study is not completed as most of the gourds have not matured. Gourds can be harvested as late as after the first killing frost. Gourds are considered mature when they turn brown and feel light and dry. More work will be done next year on Luffa sponge gourds and their potential for Alabama growers.

Evaluation of Biological Seed Treatments for Control of Soil-Borne Disease of Snap Beans

Ed Sikora, Walt Mahaffee, George Musson, and Joe Kloepper

The biological control seed treatment "Kodiak" received registration for cotton, peanut, soybean, and bean and pod vegetables in 1993. Kodiak is available as Kodiak Concentrate (a commercial seed treatment formulation) and Kodiak HB (powder formulation applied to seed in the hopper box). The active ingredient of Kodiak is a strain of the bacteria *Bacillus subtilis* which, when applied as a seed treatment, has been shown to increase yields, control soil-borne diseases, and improve overall plant health.

Methods

In 1993, a multiple-year study was initiated to evaluate two formulations of Kodiak and standard seed treatments (Captan, Thiram) for commercial bean production in Alabama. The main objectives of the study were to determine the effect of Kodiak on soil-borne disease control and yield of snap beans. Also, the root colonization potential of this biological control organism was studied throughout each season.

Results

Results from on-farm field tests in Chambers County in 1993 were inconclusive due to hot, dry weather conditions that prevented normal development of the crop. However, the bacterium was recovered from plant roots in low numbers late into the growing season. This may indicate that season-long benefits from the application of Kodiak are possible.

In 1994, test sites include Headland, LaFayette, Shorter, Cullman, and Crossville. These test sites were chosen to evaluate Kodiak under different weather conditions and soil types. Results from 1994 tests are pending.

Evaluation of Foliar-applied Insecticides for Control of Whitefringed Beetle in Sweetpotatoes

Geoff Zehnder, Teri Briggs, and Jim Pitts

Whitefringed beetles (WFB) are second only to the sweetpotato weevil in terms of damage caused to Alabama sweetpotatoes. WFB larvae, or grubs, develop in the soil and feed on sweetpotato roots. Feeding damage usually occurs on the surface, but grubs sometimes bore into the root. This damage is not acceptable to consumers. In some years, entire fields of sweetpotatoes may be rejected because of WFB damage.

WFB adults cannot fly, so movement is restricted to walking or "hitching a ride" on machinery. However, they are very prolific because only females exist and mating is not needed for reproduction to occur. In central and north Alabama, WFB adults emerge from pupation in the soil in early July and begin laying eggs. If sufficient moisture exists, the eggs hatch and larvae crawl down into the soil.

Previous trials revealed that soil insecticides applied at planting are not generally effective, because the insecticide residue dissipates by the time larvae enter the soil. The most serious feeding damage occurs late in the season after larvae have matured. In a recent study, researchers evaluated applications of foliar insecticides for WFB control; controlling adults would reduce egg-laying and subsequent damage by larvae. Insect sampling from July through September indicated that adult and larval populations are reduced by foliar sprays.

Methods

'Cordner' sweetpotatoes were planted on May 18 at the Chilton Horticulture Substation in Clanton. Treatment plots consisted of eight rows bordered on both sides by eight untreated rows. Beginning the first week in July, treatment plots were sprayed either weekly or biweekly with a tank mix of the insecticides Sevin 80S™ (one pound per acre) plus Penncap-M™ (one pint per acre). Sprays were applied with a tractor-mounted sprayer delivering 40 gallons per acre. Adults were sampled approximately weekly by examining sweetpotato foliage and the soil surface in four locations per plot. Larvae in the soil were sampled every 2-3 weeks by taking soil core samples in four locations per plot.

Results

Foliage and soil samples taken to date indicate that foliar insecticide sprays reduce numbers of adults and larvae by at least three and four times, respectively, compared with untreated check plots. As of this writing, sweetpotatoes have not been harvested, but it is likely that control of egg-laying adults and subsequent larval populations in the soil will result in a lower percentage of damaged sweetpotato roots. In addition, results indicate that weekly sprays are not necessary. Biweekly sprays will result in effective suppression of adult populations and subsequent egg-laying.

Table 1. Effect of Foliar Insecticides on Whitefringed Beetle Populations in Sweetpotato

Treatment[1]	Timing	Adults[2]	Grubs[3]
Sevin plus methyl parathion[3]	Weekly	0.09	0.12
Sevin plus methyl parathion[3]	Biweekly	0.13	0.06
Untreated	—	0.40	0.50

[1]Sevin 80S and Penncap-M applied at one pound and one pint per acre, respectively, using a tractor-mounted sprayer.

[2]Adult counts averaged over eight sample dates in July, August and September. Each time, foliage and the soil surface were examined in four 90-centimeter row sections per plot.

[3]Grub counts are from soil core samples from three sample dates in August and September. Samples were 10 cm in diameter and 30 cm deep.

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Whitefringed Beetle in Sweetpotato, continued

TABLE 2. EFFECT OF FOLIAR INSECTICIDES ON WHITEFRINGED BEETLE ADULT COUNTS IN SWEETPOTATO

Treatment[1]	Timing	No.							
		July 26	Aug. 2	Aug. 5	Aug. 16	Aug.23	Aug. 30	Sept. 16	Sept. 20
Sevin plus methyl parathion	Weekly	0.25	0.00	0.08	0.17	0.00	0.08	0.17	0.00
Sevin plus methyl parathion	Biweekly	0.17	0.25	0.25	0.25	0.00	0.0	0.00	0.08
Untreated check	—	0.67	0.42	0.46	0.67	0.17	0.33	0.00	0.42

[1]Sevin 80S™ and Penncap-M™ applied at one pound and one pint per acre, respectively, using a tractor-mounted sprayer.

Evaluation of Nonconventional Controls for CMV on Tomatoes

Ed Sikora, Joe Kemble, and Geoff Zehnder

Since 1992, a series of Cucumber Mosaic virus (CMV) epidemics have significantly reduced tomato production in north Alabama. Statewide production has been reduced by an estimated 20-25% each year due to this problem.

CMV, an aphid-transmitted virus, appears to be responsible for the majority of damage. The virus was found in 90% of fields surveyed and in over 70% of plants tested in 1992. Total crop failures (100% yield losses) were not uncommon in many grower fields. In recent years, Alabama appears to be have the most serious outbreak of the disease in the United States.

Conventional CMV control methods involve the use weed control, reflective mulches, crop oils and/or barrier crops, and altering planting dates and sites to avoid high aphid populations. Under high virus pressure, as has been experienced in Alabama recently, these practices are often ineffective.

In 1994, a study was initiated to evaluate nonconventional methods of CMV control. These methods included the use of (1) a CMV-resistant, transgenic tomato line; (2) an organic, biological control spray product; and (3) a systemic insecticide.

Methods

A CMV-resistant, transgenic tomato line was greenhouse-tested. It exhibited a broad spectrum of resistance to different strains of CMV, including the highly aggressive north Alabama strain. Currently, there are no commercial tomato varieties available with resistance to CMV. If the resistance in the transgenic tomato holds up in Alabama fields, then CMV-resistant commercial varieties may be feasible in the near future.

Also being evaluated is an organic product, made from decomposed plant material, that reportedly will control a broad spectrum of virus diseases on a variety of vegetables. The test material, which is applied as a spray prior to and shortly after transplanting, makes plants more tolerant to mosaic-type viruses. The material reportedly improves plant growth and yield and is considered nontoxic and nonpolluting.

Another product being evaluated is a systemic insecticide that is effective against aphids. Aphids are the main carriers of CMV and transmit the virus to tomato plants during feeding. The insecticide is applied as a soil drench at transplanting and will provide protection against aphids for a period after application. Complete control of CMV with a systemic insecticide is unlikely since it takes less than a minute of feeding for an aphid to transmit the virus. However, if the product reduces aphid populations or deters feeding, then it may have some benefit in an overall virus management program.

Results

The three nonconventional control programs are being evaluated in comparison to a standard program in two fields in north Alabama that experienced outbreaks of CMV during summer 1994. Treatments are being evaluated through visual observations of CMV symptoms as well as laboratory analysis of leaf tissue to determine the presence or absence of the virus. Results from this project are pending.

Evaluation of Fungicides for Early Blight Control on Tomatoes

Ed Sikora, Ellen Bauske, and Jim Pitts

Growing high-quality tomatoes in Alabama usually requires frequent fungicide applications during the growing season. Tomato growers may make 10 or more applications to control diseases such as early blight and Septoria leaf spot. When warm, wet conditions prevail, unmanaged fungal diseases such as these can cause severe defoliation and reduced yields.

Studies have shown that two common fungicides, Bravo and Manzate, effectively control early blight, whether they are applied on a seven-day, calendar-based schedule or according to Tomato Disease Forecaster (TOM-CAST). However, the TOM-CAST program was shown to reduce the amount of fungicide used without reducing disease control.

TOM-CAST is a weather-based model for timing fungicide applications on tomatoes. The program was developed to control foliar diseases such as early blight and Septoria leaf spot. It measures leaf wetness and air temperature to determine disease risk and optimum spray intervals. This program is used elsewhere in the United States, as well as in Canada and Mexico.

Methods

This experiment was conducted at the Chilton Area Horticultural Substation in Clanton. Manzate 200 DF was applied at the rate three pounds per acre; and Bravo 720, two pints per acre. Some applications were made at seven-day intervals beginning three days after transplanting and continuing through harvest. Others were made according to TOM-CAST. Bravo 825 was applied at 1.8 pounds per acre at seven-day intervals only. Early blight severity was assessed weekly. Tomatoes were harvested weekly and total yield determined.

Results

More disease was observed on the unsprayed control at all rating periods than in treated plots. No difference was observed in total fruit number or weight among treatments. The TOM-CAST treatments, however, required only five sprays compared to 14 for the calendar-based spray treatments. Hot, dry conditions throughout most of the growing season reduced disease pressure and showed the benefit of using the TOM-CAST program. Growers using TOM-CAST in 1993 could have reduced the number of fungicide applications by 64%. Results of related studies in 1994 are pending.

Fungicide Evaluation Trial, Weekly Disease Severity Ratings and Yield Data, Clanton, 1993[1]

Treatment	Foliar blight			Tomatoes	Total yield
	July 15	July 22	July 29		
	Pct.	*Pct.*	*Pct.*	*No./plot*	*Lb./plot*
Control	9.0	16.2	32.6	155.6	38.2
Manzate 200 DF-CAL	1.4	3.2	4.0	166.4	41.4
Manzate 200 DF-TC	2.6	3.8	5.4	149.2	36.6
Bravo 825-CAL	2.6	3.4	6.0	155.6	36.6
Bravo 720-CAL	3.6	4.4	7.2	178.0	39.8
Bravo 720-TC	3.4	4.4	6.0	173.2	41.5

[1]CAL = calendar-based, seven-day intervals; TC = TOM-CAST. Application rates discussed in text.

Low-Input Fungicide Spray Programs for Early Blight Control on Tomatoes

Ed Sikora, Ellen Bauske, Geoff Zehnder, and Marlin Hollingsworth

Alabama tomato growers may make 10 or more fungicide applications during the growing season to control early blight, a fungal disease that can reduce yields by causing severe defoliation. Results of an ongoing research program show that two low-input spray programs reduce fungicide use without reducing yield or quality, compared to traditional early blight control methods.

Calendar-based spray schedules usually consist of a fungicide such as mancozeb applied at seven-day intervals throughout the growing season. In 1992, a study was initiated to evaluate two new options for early blight control: Tomato Disease Forecaster (TOM-CAST); and a Low Volume-Constant Concentration (LV-CC) fungicide spray program. Both low-input spray programs appear to be viable alternatives for tomato growers in Alabama.

TOM-CAST, a weather-based model for timing fungicide applications, was developed to control foliar diseases such as early blight. It uses two weather measurements, leaf wetness and air temperature, to assess disease risk and determine optimum fungicide spray intervals.

Some pesticide labels recommend a range of rates that change with the size of the crop. These rates are often written such that they call for an excessive amount of material to be applied when the crop is young. In fact, the mancozeb concentration recommended for transplants may be five times the concentration applied to a mature crop. Assuming that these mancozeb concentrations control early blight on mature tomatoes, then that same concentration should control the disease on young tomatoes. This LV-CC fungicide spray program is based on using reduced amounts of fungicide early in the season, when less water is necessary for complete coverage, without reducing the concentration of the product.

Methods

Tests were conducted on two spring (1993 and 1994) and three fall (1992-1994) tomato crops at the North Alabama Horticultural Substation in Cullman. Mancozeb (Manzate 200 DF) was (1) applied at the labeled rate on a seven-day schedule, (2) applied according to the LV-CC program, (3) applied according to the TOM-CAST program, or (4) applied at LV-CC rates according to TOM-CAST. Disease severity was assessed weekly and total yield determined at harvest.

Results

In 1992, the LV-CC and TOM-CAST treatments used 38 and 49% less fungicide, respectively, compared to the calendar spray program. In 1993, LV-CC, TOM-CAST, and LV-CC+TOM-CAST treatments used 23, 59 and 63% less fungicide, respectively, in the spring; and 35, 59 and 61% less, respectively, in the fall. No differences were observed in disease severity or yield among the various treatments in any of the tests. The spray programs were evaluated further in 1994 with results pending.

Number of Mancozeb Sprays Applied and Total Product Used[1]

Spray method	Spring 1992		Spring 1993		Fall 1993	
	Sprays	Amount	Sprays	Amount	Sprays	Amount
	No.	*Grams*	*No.*	*Grams*	*No.*	*Grams*
ST	13	668	12	890	11	815
LV-CC	13	414	12	680	11	525
TC	9	340	5	371	5	334
LV-CC+TC	—	—	5	334	5	315

[1]ST = standard, calendar-based fungicide application. LV-CC = low volume-constant concentration. TC = TOM-CAST.

The Effects of Sources and Percentages of Drip-Applied Nitrogen Fertilizer on Tomato Yields

Timothy Motis and Jim Dangler

Applying fertilizer at rates and times corresponding to plant needs is essential for successful vegetable crop production. "Fertigation," applying fertilizer through a drip irrigation system, allows growers to precisely control the time and amount of water and fertilizer applied to a crop.

An investigation was conducted to determine the effects of two nitrogen sources and five percentages of drip-applied nitrogen on the yield of 'Solarset' tomatoes. Results indicated that fertigation may not be the best method for producing tomatoes, but nitrogen source did affect yield.

Methods

Nitrogen was applied at 200 pounds per acre as ammonium nitrate or coated urea, a slow release fertilizer. Plants received rates of the nitrogen ranging from 0-100% through the drip-system in equal weekly applications over a 10-week period. The remaining portion was incorporated throughout raised beds before planting. The drip-applied portion of the coated urea was applied as a band close to the drip tape to simulate a drip application.

Samples were buried two and nine inches deep representing the drip-applied and incorporated portions, respectively, to determine the rate of release of coated nitrogen fertilizer. Samples buried at two inches were placed close to the drip tape, whereas samples buried at nine inches were placed on the side of the bed away from the drip tape. Samples were removed from the field, dried and weighed weekly. Soil temperatures were recorded to determine the effect of temperature on the release of coated urea. The research was conducted at the E.V. Smith Research Center in Shorter.

Irrigation scheduling was determined by switching tensiometers. Beds were fumigated with Busan at 70 gallons per acre 15 days before planting to prevent disease and insect problems.

Results

Higher total season yields of extra-large, large, medium, and total marketable tomatoes were obtained with ammonium nitrate than coated urea. Due to its high solubility, ammonium nitrate was probably available more quickly for plant uptake than coated urea. Leaf samples obtained for nutrient analysis should confirm this hypothesis. Yield differences could also be attributed to nitrogen source.

Early-season total marketable fruit yield decreased with increasing amounts of drip-applied ammonium nitrate. The incorporated ammonium nitrate was available sooner than ammonium nitrate applied through the drip-system later in the season. Percentage of simulated drip-applied coated urea had no effect on yield, probably due to its slow release rate.

Results from this experiment demonstrate the importance of early nitrogen availability or nitrogen source for obtaining high tomato yields. Although fertigation may be an effective method for applying nutrients and has become a standard practice in many vegetable production systems, this study suggests that incorporating all or most of ammonium nitrate before planting may be the best nitrogen fertilization practice for drip-irrigated tomatoes.

Effect of Mulch on Development and Yields of Compact-growth-habit Tomatoes

Joe Kemble and Jimmy Witt

Compact-growth-habit (CGH) fresh-market tomatoes do not require staking, pruning, or tying — all practices generally required for tomato production in Alabama. Furthermore, CGH tomato transplants can be produced in small transplant cell volumes without sacrificing total season marketable yields. These advantages afford great cost savings to a grower.

To further reduce inputs and increase the sustainability of fresh-market tomato production in Alabama, it would be beneficial to reduce the need for polyethylene mulch. This experiment explored the economics of using alternatives to polyethylene mulch for the production of CGH tomatoes. Over the next few years, more work will be done to develop a system growers can easily implement.

Methods

Five-week-old transplants of NC 115G-1 (F_1) were set into double-rows (double-rows of plants within each bed) in the field on April 21 and July 28. Plants were spaced 18 inches apart within rows and 12 inches apart between rows within 36-inch-wide double beds. All beds were raised, fumigated, and drip irrigated. Fertility was based on soil test results. Nutrients were injected weekly through the drip system beginning one week after transplanting and continuing through the final harvest. There were four treatments: black polyethylene mulch, white polyethylene mulch, paper mulch (similar to rolls of black poly mulch), and bare ground. Plots were harvested weekly.

Yield was determined by weight, quality, and fruit number of each marketable grade. Tomatoes were separated into USDA categories: jumbo, extra large, large, medium, No. 3's, and culls. Results from the fall experiment are not yet available as the study is not completed as of the writing of this report.

Results

There were few differences in yield between the four treatments. Overall, the plants grew well and produced significant yields. While the black plastic treatment produced the highest total yield, only 67% of its total yield was marketable. Marketable yields of the other treatments averaged 80% of their total yields.

Although paper mulch produced reasonable yields, it was difficult to apply and had other inherent problems. This product comes in rolls just as polyethylene, but it tears easily. In addition, the edges of the paper that come into direct contact with the soil degrade rapidly, resulting in loose ends that move freely with little wind. This problem compromises the benefits of using this paper.

Yields of Compact-growth-habit Tomatoes Grown Under Four Mulch Treatments in Spring 1994

Treatment	Total yield	Total marketable yield[1]	Combination[2]	25-lb. boxes/acre
	Lb./a.	*Lb./a.*	*Lb./a.*	*No.*
Paper mulch	69,780	54,300	49,300	2,170
Black plastic	79,140	53,280	48,940	2,130
White plastic	77,750	62,460	55,360	2,500
Bare ground	70,700	58,000	52,000	2,320

[1]Total marketable yield is the combined weight of Jumbo, Extra-large, Large, Medium, and No. 3 grade fruit.
[2]Combination grade is the combined weight of Jumbo, Extra-large, Large, and Medium fruit.

Evaluation of Biological and Synthetic Insecticides for Control of Tomato Fruitworm

Geoff Zehnder and Marlin Hollingsworth

Tomato fruitworms cause severe damage to tomatoes by feeding directly on the fruit. Fruitworm moths are attracted to tomato flowers, and lay eggs on the upper plant foliage near the open blooms. After hatching, larvae feed for a short time on foliage before boring into tomato fruit where they complete development. One larva can damage several fruit.

Because of the recent emphasis on reducing use of synthetic insecticides, two "biological insecticides" were evaluated: Javelin WG™ (Sandoz Crop Protection Co.) and Dipel 2X™ (Abbot Laboratories). These products include a form of *Bacillus thuringiensis* (Bt) that is harmful only to caterpillar larvae and not to beneficial insects or humans. The Bt insecticides act as stomach poisons, so insects must ingest treated foliage for control to occur.

The Bt insecticides were tested, along with low and high rates of synthetic insecticides — Asana XL™ and Lannate LV™ — for tomato fruitworm damage control. Under low fruitworm pressure that existed during the test, all treatments gave satisfactory control of fruitworm damage.

Methods

'Olympic' tomatoes were transplanted on May 13, 1994, at the North Alabama Horticulture Substation in Cullman. Treatment plots consisted of three rows, where the center row of each plot was sprayed with insecticide beginning at flowering and continuing weekly throughout the season until harvest. Sprays were applied on June 21 and 27, and on July 5, 19, and 26. Spray application was made by a self-propelled high-clearance sprayer with one hollow cone nozzle over the row and 1-6 nozzles on drop extension tubes on either side of the row (additional nozzles were added as plant height increased). Spray volume remained constant on all spray dates at 80 gallons per acre. Treatment effectiveness was determined at harvest on Aug. 4 by picking all pink and red fruit and examining for signs of fruitworm feeding damage.

Results

Fruitworm pressure was low during the test with only 11% damaged fruit in the untreated check plots at harvest. All insecticide treatments gave satisfactory fruitworm control, with 3.8% damaged fruit in the least effective treatment — Javelin WG™. The high rate of Asana XL™ resulted in the least fruitworm damage (0.5%). All other treatments resulted in less than 2% damage.

One important finding is that the extra cost involved with using higher rates of Asana XL™ and Lannate LV™ is probably not justified by the small increase in damage control. Only about 1-2% lower damage was seen in the high-rate treatments compared with the low-rate treatments. However, conditions of higher fruitworm pressure may warrant use of the higher rates.

Another finding is that the Bt insecticides were effective in reducing fruitworm damage given the test conditions. Previous trials showed that biological insecticides were not as effective when fruitworm pressure was high. However, growers who wish to reduce the use synthetic insecticides on tomatoes should be able to do so by using biological insecticides, applying reduced rates of synthetic insecticides, or by combining low rates of synthetic and biological insecticides.

Tomato Fruitworm Damage in Plots Treated with Various Insecticides

Treatment	Rate per acre	Pct. damage
Untreated check	—	11.0
Javelin WG	1.0 lb.	3.8
Lannate LV	1.5 pt.	3.5
Phaser	1.3 pt.	3.3
Phaser	2.6 pt.	2.6
Dipel 2X	1.0 lb.	2.1
Asana XL	5.8 fl. oz.	1.6
Asana XL + Javelin WG	5.8 fl. oz + 1.0 lb.	1.3
Lannate LV	3.0 pt.	1.3
Asana XL	9.6 fl. oz.	0.5

Breeding Watermelons for Disease Resistance

Joe Norton, George Boyhan, and Bruce Abrahams

Watermelons are one of Alabama's most important crops in terms of revenue and acreage. Considering the potentially devastating effects of diseases, such as gummy stem blight, fusarium wilt, anthracnose, and cucurbit viruses, the development of resistant watermelon varieties is crucial. Fungicides may control some viruses under favorable weather conditions, but resistant melons are needed to assure success in wet, humid years.

An Alabama Agricultural Experiment Station (AAES) watermelon breeding program has developed multiple-disease-resistant breeding lines with high yields of excellent-quality fruit.

Variety Development

The AAES varieties were developed from crosses of high-quality commercial types with disease resistance. Resulting disease-resistant varieties include AU-Jubilant, AU-Producer, and AU-Sweet Scarlet. Superior disease resistance of these new varieties was established in comparisons with similar commercial varieties in north, central, and south Alabama (Table 1). Yield and melon quality were equal or better than those of similar commercial varieties (Table 2). Similar results were reported from the Southern Cooperative Watermelon Variety Trials conducted across the South.

AU-Jubilant produces fruit that are large and elongate with uniform diameter the length of the melon. The rind has a light green background color with dark green irregular stripes running the length of the fruit. The rind is hard, tough, and about 4/5-inch thick. The flesh is an attractive bright red.

Fruit from AU-Producer are round, mostly in the 20- to 30-pound range, but weights of 35 pounds are not uncommon. It produces very few culls. The rind is hard, tough, and about 3/4-inch thick. The flesh is bright red and firm, but not tough.

AU-Sweet Scarlet produces round melons, with a rind that has a light green background with dark green irregular stripes running the length of the melon. The rind is hard, tough, and about 1/2-inch thick. The flesh is firm with an attractive dark red color. In a market acceptance study of AU-Sweet Scarlet, the melon received superior ratings for size, appearance, and rind color, as well as for flesh color, taste, firmness, texture, and sweetness. A strong preference for buying AU-Sweet Scarlet was observed.

Bee pollination was used to produce hybrid seed from the cross of AU-Sweet Scarlet with a glabrous, male-sterile breeding line. This finding eliminates the need for hand pollination in hybrid seed production and offers possible price savings for hybrid seed. Yield and quality of the hybrid were shown to be satisfactory. Breeding lines are being developed with emphasis on the use of bee pollination to produce triploid seed for seedless melons.

Additional research is underway using an African watermelon variety that is resistant to zucchini yellow mosaic virus and watermelon mosaic virus. A backcross breeding program with this melon has proceeded, and field selection and testing should begin next summer.

Table 1. Comparative Disease Resistance of Watermelon Varieties at Four Alabama Locations[1]

Variety	Disease index[2]		
	Anthracnose	Fusarium wilt	Gummy stem blight
Charleston Gray	5	3	5
Crimson Sweet	5	2	5
Jubilee	3	3	5
AU-Producer	2	1	2
AU-Golden Producer	2	1	2
AU-Sweet Scarlet	2	1	2

[1]Comparisons made at the E.V. Smith Research Center in Shorter, Chilton Area Horticulture Substation in Clanton, North Alabama Horticulture Substation in Cullman, and Sand Mountain Substation in Crossville.
[2]Disease index: 0 = no injury, 5 = all plants severely injured.

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Breeding Watermelons for Disease Resistance, continued

TABLE 2. YIELD AND FRUIT CHARACTERISTICS OF VARIETIES OF WATERMELONS, FOUR ALABAMA LOCATIONS[1]

Variety	Yield	Fruit wt.	Soluble solids[2]	Quality[3]	Width/length ratio	Rind thickness	Days to maturity	Rind color
	Lb./a.	*Lb.*	*Pct.*			*In.*		
Charleston Gray	37,850	19.2	9.8	7.3	0.44	0.56	80	Gray
Crimson Sweet	31,974	18.0	10.4	8.0	0.62	0.86	75	Striped
Jubilee	37,696	21.3	9.6	7.9	0.43	1.00	90	Striped
AU-Producer	39,558	19.0	10.8	8.2	0.84	0.75	75	Striped
AU-Golden Producer	39,393	18.8	10.8	8.2	0.84	0.75	75	Striped
AU-Sweet Scarlet	31,666	19.3	11.4	9.0	0.86	0.50	75	Striped

[1]Test locations are the same as listed in Table 1.
[2]Soluble solids is a measure of a fruit's sweetness.
[3]Quality: 10 = best; 5 and below = unacceptable.

TABLE 3. 1994 WATERMELON TRIAL AT E.V. SMITH RESEARCH CENTER (EXTRACTED FROM SOUTHERN COOP. WATERMELON TRIAL)

Entry	Yield	Flesh color	Fruit weight	Fruit length	Fruit width	Rind thickness	Soluble solids[1]
	Lb./a.		*Lb.*	*In.*	*In.*	*In.*	*Pct.*
AU-Allsweet[2]	41,357	red	19.0	12.0	9.3	0.4	10.5
Jubilee	35,741	red	22.1	12.0	9.2	0.5	10.4
AU-Golden Producer	33,875	yellow	18.4	10.0	9.4	0.6	10.5
AU-Producer	28,481	red	19.6	10.5	9.5	0.5	11.3
Sweet Scarlet x MS F1[2]	28,437	red	16.1	13.9	9.3	0.6	11.0
Sweet Scarlet SS[2]	25,559	red	17.9	12.9	9.1	0.4	11.0
Sweet Scarlet	23,123	red	18.2	12.0	8.8	0.6	10.8

[1]Soluble solids is a measure of a fruit's sweetness.
[2]Advanced lines, not yet released.

Black Plastic Mulch Increases Muskmelon Yields

James Brown and Joe Kemble

Black plastic mulch and row covers, used together or alone, have allowed greater latitude in crop production systems, resulting in two- to threefold increases in some crop yields, as well as enhanced earliness in crops. A recent study showed that using black plastic mulch and row covers in muskmelon production resulted in better crop growth, performance, and yield.

Methods

This study was conducted in Jefferson County, Ala. Treatments were: (1) black plastic mulch; (2) black plastic mulch plus clear, slitted plastic row tunnel; (3) black plastic mulch plus white, tinted, slitted plastic row tunnel; (4) black plastic mulch plus spunbonded polyester row cover; and (5) bare ground. Pesticide and fertilizer applications followed recommended cultural practices and soil test results.

Four-week-old 'AUrora' muskmelon transplants were set in April, spaced two feet apart within rows. After transplanting, the different row cover materials were applied. After three weeks, row covers were removed, but black plastic mulch remained in place throughout the growing season.

Results

Mulches and row cover treatments were the most productive, ranging from 105-160% increase in yield, compared to the bare ground treatment; 39-73% of this total yield was produced during the first two weeks of the harvest period (see table). These benefits are due to an increase in air and soil temperatures, an increase in soil moisture retention, and a reduction in competition from weeds in the growing environment. In addition, muskmelons in mulched plots were generally cleaner than those grown on bare ground.

Black plastic mulch used alone and together with row covers did not significantly affect melon size or fruit marketability. This suggests that growers may anticipate little or no economic loss because of melon size and marketable quality when using either the black plastic mulch or the row covers.

Effect on Black Plastic Mulch and Row Cover on Muskmelon Production

Treatment	Early fruit	Total fruit
	Pct.	*No.*
Black plastic mulch	67	8,385
Black plastic mulch w/ clear, slitted plastic row tunnel	73	9,910
Black plastic mulch w/ white, tinted, slitted plastic	39	7,841
Black plastic mulch w/ spunbonded polyester floating row cover	73	8,384
Bare ground	28	3,812

Watermelon Virus Survey

Ed Sikora, George Boyhan, Joe Norton, and Roberto Vargas

Watermelons are susceptible to a number of different viral diseases that, when severe, can result in a 100% loss to a grower. A 1994 survey conducted to determine the distribution and severity of viruses affecting watermelon production in Alabama revealed that viruses are widespread in the state and can reach dangerously high levels.

In Alabama, four viruses are known to regularly affect watermelon production: Cucumber Mosaic virus (CMV), Papaya Ringspot virus (PRSV), Watermelon Mosaic virus (WMV), and Zucchini Yellow Mosaic virus (ZYMV). These viruses differ in methods of survival and spread, and in their range of host plants. Management of virus diseases is determined on the basis of this information. Therefore accurate virus identification is the first step in planning a virus control program.

Methods

Little is known about the distribution and severity of these viruses in regard to watermelon production in Alabama. In 1994, a two-year study was initiated to determine the distribution and frequency of the four most common viruses affecting production in the state. A survey was conducted involving the main watermelon production areas in Alabama. The survey included 27, one- to two-acre production fields in the southeast (Houston County), southwest (Baldwin and Mobile counties), central (Chambers, Chilton, Elmore, and Macon counties), and north-central (Blount County) regions of the state.

Symptoms caused by different viruses on watermelon are frequently similar. Therefore, it is not possible to identify viruses with certainty on the basis of symptoms alone. Usually, special laboratory techniques are required to provide accurate virus identification. Approximately 25 plant samples were taken from each of the 27 fields near first harvest and screened for CMV, PRSV, WMV, and ZYMV.

Results

All four viruses were found in each of the regions surveyed. CMV and WMV were found in 40% of fields tested, PRSV in 48%, and ZYMV in 63%. ZYMV appeared to be more common in the southeastern and southwestern counties (83% of fields tested) as opposed to CMV, PRSV and WMV (25-33%). Few viruses were recorded in the eight fields tested in Chilton and Elmore counties, whereas the one field tested in Macon County appeared heavily infected with most of the viruses. Virus pressure was greatest in Blount County.

Results of Virus Survey by Region and County[1]

County	Fields sampled	CMV	PRSV	WMV	ZYMV
Houston	5	1/5	1/2	1/3	4/33
Baldwin	3	1/32	1/26	1/3	4/33
Mobile	4	2/12	2/3	1/3	3/36
Chambers	1	1/14	1/41	1/24	1/28
Chilton	4	0/0	1/4	1/17	1/1
Elmore	4	0/0	1/4	1/17	1/1
Macon	1	1/88	1/96	1/100	0/0
Blount	5	5/55	5/79	5/64	3/12
Totals	27	11/20	13/25	11/23	17/19

[1]Fields with virus/percent plants infected.

Drip Irrigation and Black Plastic Mulch Promote Bell Pepper Yields

James Brown and Joe Kemble

Because of economic constraints in the production of some major agronomic crops, such as corn and soybeans, many growers who had depended largely on income from these crops are turning to the intensive production of vegetable crops. Thus, the use of black plastic mulch and drip irrigation has increased in recent years in efforts to increase crop yields and maximize economic returns per unit of land.

The use of black plastic mulch in vegetable production is a common practice in the Southeast, but less is known about its use in combination with drip irrigation. A recent study showed that using both methods together can increase bell pepper performance.

Methods

This study was conducted in Dekalb County, Ala. Treatments were as follows: (1) black plastic mulch alone; (2) black plastic mulch plus drip irrigation; (3) bare ground plus drip irrigation; and (4) bare ground alone. Pesticide and fertilizer applications followed recommended cultural practices and soil test results. An additional 45 pounds per acre of actual nitrogen was sidedressed at flowering. Peppers received water and additional nutrients through the drip system.

Black plastic mulch and the drip irrigation tubing were laid simultaneously to form plots 20 feet long, spaced seven feet apart. Transplants of 'Keystone Resistant #4' peppers were set on May 6 through punched holes, spaced 18 inches, and harvested from July 19 to Oct. 4.

Results

The black plastic mulch plus drip irrigation and black plastic mulch alone resulted in similar yields, both higher than those produced on bare ground (Table 1). Percentage of non-marketable peppers was greater on the bare ground treatment, compared to other treatments. Peppers produced on bare ground were more likely to be affected by disease than those produced on black plastic with drip irrigation. On plastic, peppers were prevented from touching the ground, decreasing disease incidence and increasing the number of marketable fruits.

Effect of Drip Irrigation and Black Plastic Mulch on Bell Pepper Yield

Treatment	Marketable yield		Culls
	Ton/a.	*No./a.*	*Pct.*
Black plastic mulch plus drip irrigation	9.6	76,375	16
Black plastic mulch	8.7	69,764	14
Bare soil plus drip irrigation	4.4	41,532	23
Bare soil	1.5	13,844	29

Evaluation of Chemical and Biological Agents for Control of Bacterial Spot of Peppers

Ed Sikora, Mark Wilson, Paul Backman, Jimmy Witt, and Marlin Hollingsworth

Bacterial spot is considered the main limiting factor to the successful production of bell peppers in Alabama. In 1994, spray trials were conducted at two locations to evaluate the effectiveness of commercially available products, as well as biological agents, for their ability to control this disease. Results suggested that the combination of Kocide DF plus Manex provided the best control of bacterial spot.

Methods

Field tests were conducted at the North Alabama Horticulture Substation in Cullman and the E. V. Smith Research Center in Shorter. The bell pepper variety 'Ranger' was used at both locations and transplanted onto raised, fumigated beds. Commercial treatments were applied at the following per-acre rates: (1) three pounds of Kocide DF plus one quart of Manex; (2) three pounds of Kocide DF; (3) four pints of Kocide LF; and (4) five pounds of Aliette. The biological treatments consisted of strains of the bacteria *Pseudomonas flourescens* and *Bacillus cereus* combined with chitin, a food-source and enzyme enhancer for beneficial microorganisms.

Results

At both test sites, the Kocide DF/Manex treatment resulted in the least bacterial-spot-related defoliation and the greatest yields. At Cullman, all Kocide treatments significantly reduced the disease compared to the other commercial and biological treatments. Biological control agents performed poorly at Cullman where disease pressure was greater. Differences among treatments were more apparent at the Cullman site most likely due to this factor.

Defoliation of Bell Peppers Under Various Bacterial Spot Treatment at Two Sites

Treatment	Shorter	Cullman
	Pct.	Pct.
Kocide DF + Manex	12	10
Kocide DF	19	10
Kocide LF	18	15
Aliette	16	27
Pf A506[1]	22	25
Bc + chitin[2]	14	30
Control	18	32

[1] Pf = *Pseudomonas flourescens*
[2] *Bacillus cereus* plus chitin.

Timing of Insecticide Applications for Control of Pickleworm on Squash

Geoff Zehnder, Teri Briggs, and Jimmy Witt

Pickleworm damage in Alabama is most severe in squash, followed by melons and cucumbers. Pickleworms attack squash more often than cucumbers, but in the pickle industry even a small percentage of pickleworm-damaged cucumbers can result in rejection of the entire harvest.

Fruit with pickleworm feeding holes are considered unmarketable. Pickleworm moths are active at dusk when egg-laying occurs. Hatching larvae feed on foliage in the developing stem tips and flower buds, but also bore into the fruit where they will complete development. It is not uncommon to see a single squash fruit with 5-6 pickleworm entry holes.

Beginning at flowering, growers spray insecticides on a seven-day or more frequent schedule to protect fruit from pickleworm damage. However, researchers found that this spray schedule may begin too late to prevent damage, because pickleworm larvae were found in buds before the flowers opened. Results of this study indicate that the most effective pickleworm control occurs when sprays begin as soon as larvae are spotted on foliage.

Methods

'Straight 8' squash was planted on Aug. 1, 1994 at the E.V. Smith Horticulture Substation in Shorter. Treatment plots consisted of single rows (bordered on each side by an untreated row), which were sprayed with Asana XL at the rate of 9.6 fluid ounces per acre using a backpack sprayer with three hollow-cone nozzles per row (see table). Spray volume was 55 gallons per acre; pressure was 40 pounds per square inch. Pickleworm larvae were counted twice weekly on foliage. As of this writing, six harvests have been made in which the fruit from each plot was visually inspected for pickleworm damage.

Results

The lowest pickleworm damage was recorded in plots where the first spray was applied after larvae were first observed in foliage and subsequent sprays were made on a four- to seven-day schedule. This suggests that monitoring plants for pickleworm infestations is the best method for effective timing of insecticide sprays. Data also indicate that a 10-day spray interval is too long, and that subsequent sprays should be made at least once per week during the period when pickleworm larvae are present.

PICKLEWORM DAMAGE TO SQUASH IN UNDER VARIOUS INSECTICIDE TREATMENT REGIMES

First spray[1]	Frequency[2]	Peak damage[3]	Overall damage[4]
		Pct.	Pct.
First sign of buds	4-day	7.9	9.2
"	7-day	9.1	3.6
"	10-days	3.4	8.0
First open bloom	4-day	2.8	4.9
"	7-day	6.0	10.8
"	10-day	4.2	6.0
First larval infestation	4-day	0.0	1.5
"	7-day	0.0	1.6
"	10-day	5.2	8.5
Untreated control	—	20.1	9.7

[1]All treatments sprayed with Asana XL at the rate of 9.6 fl. oz. per acre.
[2]Intervals at which the treatments were repeated.
[3]Greatest pickleworm damage occurred on Sept. 23.
[4]Damage averaged over six harvest dates throughout the season.

Aluminum Reflective Mulch Increases Yield, Reduces Aphid Populations and Mosaic Viruses in Summer Yellow Crookneck Squash

James Brown and Joe Kemble

Mosaic virus diseases can devastate summer squash yields in Alabama, particularly late in the growing season. Reflective mulches help control these diseases of cucurbits by reducing populations of aphids, the insects that can spread mosaic virus.

Methods

A study focusing on the use of various reflective mulches in summer squash production was conducted at the E.V. Smith Research Center in Shorter. Treatments were: (1) black plastic mulch; (2) yellow-painted plastic mulch; (3) white plastic mulch; (4) bare ground as a control; (5) aluminum-painted plastic mulch; and (6) bare ground with Diazinon insecticide.

Pesticide and fertilizer applications followed recommended cultural practices and soil test results. An additional 40 pounds per acre of nitrogen was sidedressed at flowering.

On Aug. 3, 'Dixie' hybrid yellow crookneck summer squash was direct-seeded through holes punched at 18-inch intervals in rows of the mulch treatments. The Diazinon treatment was applied every seven days after plants emerged.

Aphids were collected four times during the study. Plots were harvested nine times beginning Oct. 10. Plants from each treatment were examined for mosaic virus symptoms, including the degree of discoloration and malformation that would cause the fruit to be unmarketable. The mosaic viruses were identified from plants by the enzyme-linked immunosorbent assays (ELISA) test.

Results

Aluminum-painted mulch was most effective in delaying the onset of mosaic virus disease, as well as reducing virus symptoms in plants during the first three weeks of harvest. As the plants grew, however, their foliage gradually covered the mulch, reducing its ability to reflect light into the plant canopy. This factor resulted in an increase in the aphid population as the growing season progressed. Despite this effect, aluminum-painted plastic mulch still produced the highest yield and fewest virus-infected squash.

TABLE 1. THE EFFECTS OF REFLECTIVE MULCHES ON THE PRODUCTION OF YELLOW CROOKNECK SUMMER SQUASH

Treatment	Total Yield
	Ton/a.
Aluminum	11.1
White	11.3
Yellow	10.0
Black	7.9
Bare soil w/ Diazinon	6.9
Bare soil	5.7

Squash Transplants Increase Summer Squash Yield

James Brown and Joe Kemble

Alabama farmers have the potential of producing higher-yielding, earlier-maturing summer squash by using black plastic mulch in combination with spunbonded, polyester row covers. This approach provides greater benefits than plastic mulch alone. Though the benefits of black plastic mulch and row covers in cucurbit production are well-documented, information is limited on response of summer squash using these materials. The objective of this study was to investigate the effect of plastic mulch and polyester row covers on direct-seeded and transplanted summer squash.

Methods

An experiment was conducted at the E.V. Smith Research Center in Shorter. Pesticide and fertilizer applications followed recommended cultural practices and soil test results. Trickle irrigation tubing and methyl bromide fumigation were applied in all plots before planting. At flowering, water and additional nutrients were applied through the drip system.

'Dixie' hybrid summer squash was direct-seeded or transplanted, using one of two soil treatments (bare ground or black plastic mulch), and one of two covering treatments (none or row cover). Seedlings were transplanted into the mulch or into bare ground on 18-inch in-row spacing. At the same time, seed were sown at the same in-row spacing. After planting, five-foot wide spunbonded row cover was applied by hand over the rows. Row covers remained in place for approximately 20 days after planting.

Results

Planting method had an effect on total crop yield, where transplants produced more fruit than the direct-seeded plants (see table). Direct-seeded squash were the poorest performers regardless of mulch or row cover treatment. Early squash yield (8-10 days earlier) was most pronounced with treatments using transplants on black plastic mulch with or without row cover (data not shown).

This study showed the advantages of the transplant method for squash production. Transplants were more vigorous, growing rapidly and resulting in earlier harvests and higher total yields.

Effects of Soil Treatment, Covering, and Planting Method on Total-season Summer Squash Yields

Treatment	Marketable Fruit
	Tons/a.
Soil treatment	
Black plastic mulch	2.9
Bare soil	2.7
Covering	
Row cover	2.9
No row cover	2.8
Planting Method	
Transplant	3.4
Direct-seeding	2.3

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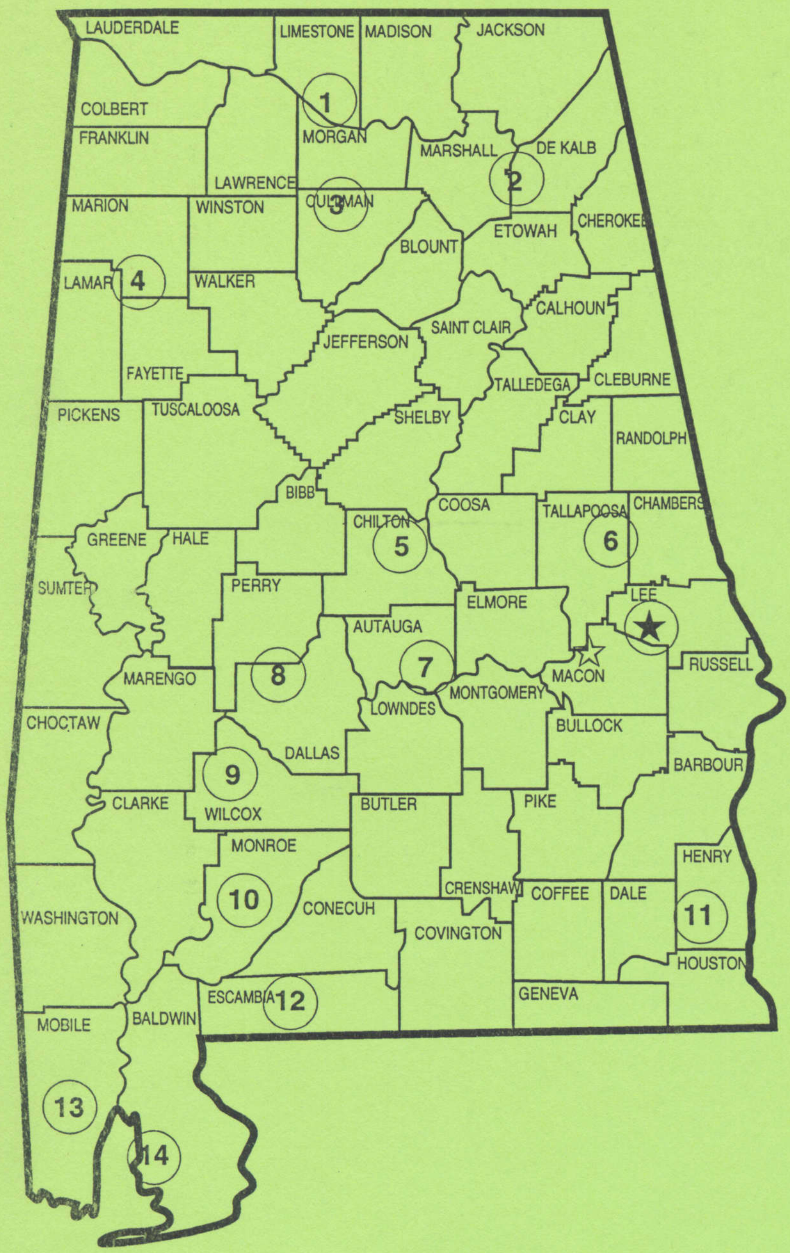

★ Main Agricultural Experiment Station, Auburn.

☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Chilton Area Horticulture Substation, Clanton.
6. Piedmont Substation, Camp Hill.
7. Prattville Experiment Field, Prattville.
8. Black Belt Substation, Marion Junction.
9. Lower Coastal Plain Substation, Camden.
10. Monroeville Experiment Field, Monroeville.
11. Wiregrass Substation, Headland.
12. Brewton Experiment Field, Brewton.
13. Ornamental Horticulture Substation, Spring Hill.
14. Gulf Coast Substation, Fairhope.