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FRUIT PAPERS

YIELD OF SATSUMAS THE YEAR AFTER A FREEZE

Monte Nesbitt, Bill Dozier, Ron McDaniel, and Malcomb Pegues

A test was initiated at the Gulf Coast Substation in Fairhope to compare placement and flow rates of microsprinklers in 'Owari' satsumas for freeze protection. Budded trees were planted in March 1990. Tree spacing was 15 feet x 25 feet. Seven treatments were applied including: control with no protection, control with typical soil banking around the crown of the tree, low volume (11 gph) microsprinkler placed on ground under tree, high volume microsprinkler (24 gph) placed on ground under tree, high volume microsprinkler placed in canopy, high volume microsprinkler placed in canopy with low volume microsprinkler on ground, and high volume microsprinkler placed in canopy with high volume microsprinkler on ground. No significantly damaging frost or freeze events occurred until 1996.

On February 2, 1996, an advective freeze occurred at the Gulf Coast Substation. The lowest recorded temperature at the test site was 15°F. Temperatures ranged from 15°F to 34°F for a period of 85 hours. Irrigation was activated when temperatures dropped to 33°F, and ran continuously for 87 hours. A second significant freeze event occurred on March 8, 1996, with nightly low temperatures ranging from 27 to 32°F over a four day period. During this freeze, irrigation was applied at night, because daytime temperatures were well above freezing.

As shown in the 1996 and 1997 Fruit and Vegetable Research Reports, high volume microsprinklers decreased foliage loss in the 1996 freezes, and enabled the trees to produce a small amount of fruit (7 pounds/tree in the best treatment). Non-irrigated checks lost all their leaves, but did not sustain severe injury in the test plot. Unprotected satsumas were killed at other locations in the county in 1996. In mid-January of 1997, freezing temperatures as low as 23°F were recorded at the test site, and the freeze protection system was used again. Some leaf injury occurred on the outer periphery of the tree canopies, but did not appear to be significant. Yields in 1997 averaged from 306 to 361 pounds per tree. The differences in yield between treatments in 1997 were not statistically significant. The 1996 freezes were not severe enough in the test plot to have an effect on 1997 yields. Temperatures colder than 15°F could give different results.

AVERAGE YIELD OF OWARI SATSUMAS IN 1997

Treatment	Average yield (lb./tree)
Control (no protection)	306
Control (banked)	327
11 gph ground	358
24 gph ground	361
24 gph canopy	355
24 gph canopy/11 gph ground	310
24 gph canopy/24 gph ground	360

FIG CULTIVAR EVALUATION CREATES INTEREST AND FINE DINING

Bobby Boozer and Jim Pitts

In 1997, a fig planting was established at the Chilton Area Horticulture Substation to evaluate different cultivars of fig under Central Alabama growing conditions. Cuttings were collected from several sources, most of which the true name is unknown. The interest is not in the name, but in suitable cultivars with traits that would produce quality figs in small scale production and marketing and introduce home owners to figs varying from the typical "Brown Turkey", "Celeste", and "Magnolia" which are most common in our area.

While the 1997season produced a small amount of fruit on several of the cultivars, the 1998 season provided enough fruit to compare fruit. It became apparent that several of the cultivars were identical and others were not correctly named by the source. The ability to separate and correctly name each of the cultivars would be desirable, but may not ever fully be accomplished with certainty. This does not distract from the objectives stated earlier. Tree and fruit characteristics will be compiled and provided to anyone interested in following the progress of this study.

COMPARISON OF GUARDIAN ROOTSTOCKS SELECTIONS TO OTHER PEACH ROOTSTOCKS FOR USE ON PEACH SHORT LIFE SITES –AN UPDATE

Bob Ebel, Bryan Wilkins, Tom Beckman, Andy Nyczepir, David Himelrick, and Jim Pitts

Peach Tree Short Life (PTSL) is a problem in many peach orchards in Alabama. PTSL is associated with the ring nematode, *Criconemella xenoplax*. Soil fumigation has been a principle method of reducing the nematode populations before planting, but with the loss of methyl bromide and other fumigants, development of rootstocks that resist or tolerate the nematode is essential. Guardian rootstock has displayed significantly better survival than 'Lovell' rootstock on sites prone to PTSL. Survival of Guardian on sites prone to PTSL has been well-documented. At this time Guardian is a bulk mix of seed collected from the surviving seedlings of the original tree (which was unfortunately lost). Research has continued with selections out of these surviving seedlings. The current study is being conducted to determine horticultural performance of Guardian selections on a site that has not displayed symptoms of PTSL.

Trees were planted in 1994. Flower buds were killed by frost in 1996. We reported results from 1997 last year. In this year's report, we summarize tree and fruit performance for 1998. The date of full bloom varied slightly with the Guardian selections blooming a little earlier than the other rootstocks. Rate of photosynthesis did not vary across rootstocks except for BY520-9 selection 'SL1089' which was slightly lower. Fruit color at harvest varied slightly across rootstocks. Where different, the BY520-9 selections had slightly higher red blush than 'Lovell'. Yield was similar for the BY520-9 and BY520-8 selections as in 1997. 'SL1923' (BY520-8 selection) yielded the most of all rootstocks in 1997 and 1998 with no loss in fruit size. 'SL2170' (BY520-9 selection) yielded the least compared to all other rootstocks in both years. 'Nemaguard', 'Flordaguard' and BY520-8 selection 'SL4028' had variable results for 1998 compared to 1997, the other rootstocks had similar yield both years. Fruit weight was similar both years for all rootstocks. No trees died in 1998, so overall tree survival during the course of this study was the same as last year's.

In general, the 'Guardian' rootstock selections have performed as well or better than 'Lovell', 'Nemaguard', and 'Flordaguard' in terms of yield, fruit weight, and fruit color in this trial. We plan to continue to track the relative performance of the BY520-9 selections in the hopes of identifying a superior line.

COMPARISON OF GUARDIAN ROOTSTOCK SELECTIONS TO OTHER PEACH ROOTSTOCKS

	Full bloom 3/13/1998	Photosynthesis 1998	Fruit color 1998	Fruit weight 1998	Yield 1998	Tree survival 1998
	%	*µmoles $CO_2/m^2/sec.$*	%	*lb.*	*lb/tree*	%
Standard rootstocks						
Lovell	39ab	15.6a	52bc	0.373ab	101ab	100a
Nemaguard	46ab	15.4ab	66ab	0.347b	101ab	100a
Flordaguard	44ab	14.5bc	55abc	0.381ab	79b	100a
Guardian rootstock selections						
BY520-9 selections						
SL1089	58a	13.9c	53bc	0.386ab	108ab	100a
SL1090	41ab	15.9a	63abc	0.345b	110ab	98a
SL2165	37ab	15.9a	69a	0.391ab	103ab	100a
SL2170	43ab	15.9a	61abc	0.409a	85b	97a
SL3576	53ab	15.5a	62abc	0.358ab	102ab	94a
Other rootstock selections						
14DR51	46ab	15.4a	55abc	0.351b	116ab	98a
BY520-8 selections						
SL1923	32ab	15.3ab	54abc	0.385ab	132a	88a
SL2243	50ab	16.2a	50c	0.394ab	106ab	97a
SL4028	29ab	16.2a	65abc	0.412a	89b	86a

EVALUATION OF FUNGICIDE SPRAY PROGRAMS FOR PEACH SCAB AND BROWN ROT CONTROL ON PEACHES

Edward Sikora, Bobby Boozer, and Jim Pitts

Peach producers have a variety of fungicides available for use in a spray program. Factors such as effectiveness of disease control and cost per application should be considered when developing a fungicide spray program. Along with these factors, the need to choose a program that addresses disease resistance management should be considered. Growers should be aware that overuse or abuse of a fungicide can lead to development of fungal strains resistant to that fungicide, as well as all other fungicides within the same class.

Peach producers in Alabama commonly use sulfur as part of their fungicide spray program. Its is relatively cheap compared to synthetic fungicides on the market and can also control a number of fungal diseases (i.e. peach scab and brown rot). However, it is not considered as effective as Captan for scab or brown rot control when used in bloom and/or cover sprays.

An effective resistant management spray program relies on reducing the number of applications of a fungicide class during the season, using tankmixes of compounds when appropriate, and/or alternating different classes of fungicides within the spray program during the season. Growers who follow these practices will reduce the chances for the development of a resistant fungal strain in their area. In Alabama, peach growers usually apply two or three sprays of the fungicide Orbit alone in the preharvest period due mainly to its relatively low cost as well as its overall effectiveness in controlling brown rot. Continued use of Orbit in this manner could potentially lead to the development of resistant strains of brown rot and loss of Orbit, as well as other fungicides (i.e. Indar, Elite, Funginex) in the same class.

In this study, we compared fungicide spray programs that consisted of sulfur or Captan throughout the bloom and cover period. Each of these programs were follow with a preharvest spray program that evaluated alternatives to the industry standard (two-to-three sprays of Orbit) that follow a resistant management strategy.

The experiment was conducted at the Chilton County Horticultural Substation near Clanton, Alabama, on the cultivar Monroe. Treatments were replicated four times with four trees per replication in a randomized complete block design. Fungicides were applied using an air blast sprayer at 150 GPA.

Bravo was applied at bloom for all fungicide programs on 3/30 and 4/7. Cover sprays were applied on 4/15, 4/27, 5/8, 5/20, 6/3, 6/17, 6/25, 7/8, and 7/15. Preharvest applications were made on 7/22 and 7/28. Fruit were harvested on 7/29. A total of 40 fruit were picked from the center two trees of each treatment/replication. Percent of fruit with scab and percent marketable fruit was determined at harvest. Incidence of brown rot and Rhizopus rot were determined seven days after harvest following storage at 77°F.

Weather conditions were warm and wet, favorable for both scab and brown rot development. Programs that used Captan during the bloom and cover periods had less fruit with damage from scab and a significantly higher number of marketable fruit than programs that used sulfur. There were no apparent differences among spray programs with regards to brown rot or Rhizopus rot. Programs that alternated among classes of fungicides (we used Rovral or Captan) in the preharvest period controlled brown rot as well as the program that used two consecutive sprays of Orbit.

EFFECT OF DIFFERENT FUNGICIDE SPRAY PROGRAMS ON INCIDENCE OF PEACH SCAB AND BROWN ROT

Fungicide program[1] B - C - H1 - H2	% Fruit with scab	% Marketable fruit	% Brown rot	% Rhizopus rot
U U U U	100	6.2	2.5	25.0
B C O O	69.3	76.8	3.7	18.1
B S O O	86.2	42.5	15.6	26.2
B C C O	64.3	74.3	6.8	18.7
B C R O	68.1	71.8	5.0	15.0
B S C O	82.5	55.0	11.8	33.1
B S R O	92.5	46.8	17.5	26.8

[1] B = bloom sprays, C = cover sprays, H1 = first preharvest spray, H2 = second preharvest spray, U= Unsprayed, C = Captan 50WP (5 lb./acre), O = Orbit (4oz/acre), S = sulfur 80% (9 lb./acre), R = Rovral 50WP (2 lb./acre).

FERTIGATION EVALUATION WITH HARVESTER PEACH

Bobby Boozer, Bob Ebel, and Jim Pitts

Production of quality peaches requires close attention to many different practices and favorable climatic conditions. March 1998 brought late winter freeze conditions which reduced the overall crop load. The month of May brought temperatures more typical of July beginning a season of extremely high temperatures with several extended periods of drought.

Under these types of conditions many producers operate irrigation systems if available. This study, while not attempting to determine the merit of irrigation for Southeast peach production, has been set up to determine the potential utilization of irrigation for the purpose of supplying fertilizer. The supplying of fertilizer through an irrigation system is termed "fertigation." For three years fertigation has been carried out using three rates of calcium nitrate compared to standard surface applied calcium nitrate. The levels of nitrogen supplied represented 0.25 (1/2), 0.37 (3/4), and 0.5 pounds per tree (full rate, 70 pounds nitrogen per acre, 145 trees per acre) supplied by micro spray type emitters which supply eight gallons of water per hour; a drip emitter treatment which has two one-gallon per hour drip emitters per tree was used to supply a 3/4 rate per tree.

Fertigation treatments significantly affected total fruit number (Table 1), but total fruit weight produced was not significantly different. One important consideration given to nitrogen fertilization and to irrigation is the effect on soluble solids (sugar content) and fruit firmness. Both soluble solids and fruit firmness were significantly affected by treatments. The firmest fruit were produced from drip emitter (3/4-N), surface applied (split 2/3-1/3full-N), micro spray (3/4-N), and were significantly higher than micro spray (1/2-N), micro spray (full-N) and surface applied (split 1/3-2/3 full-N). Soluble solids (sugars) concentration were not as distinctive by treatment with some overlapping but ranged from a low of 10.6 % to a high of 11.5% (Table).

TOTAL FRUIT NUMBER, WEIGHT, FIRMNESS, AND SOLUBLE SOLIDS AS AFFECTED BY FERTIGATION TREATMENTS

Treatment	Fruit no. avg./tree	Fruit wt. kg/tree	Firmness lb.	Soluble solids %
Surface 2/3-1/3 Full - N	140ab	26	8.5a	11.0ab
Micro 1/2N	137ab	26	7.4b	10.5c
Micro 3/4 N	140ab	25	8.4a	11.5a
Micro Full N	123b	22	7.4b	10.5bc
Drip 3/4 N	178a	30	8.5a	11.5a
Surface 1/3-2/3 N	96b	19	7.4b	11.0abc
		ns		

Numbers with the same letter are not significant at P≤0.05.

This was the third year of this study and the second year to have fruit to evaluate the effects of fertigation and differing rates of nitrogen. In addition to nitrogen analysis, fruit samples were taken for calcium analysis starting at shuck-off and every two weeks until harvest. The 1997 season contrasted drastically from the 1998 season and so did the results; however, the potential to utilize the irrigation system and to reduce the amount of nitrogen fertilization continues to show promise.

GIBBERELLIC ACID AND ETHEPHON COMBINATION, SOUTHEAST ANSWER TO CHEMICAL FLOWER BUD THINNING AND EARLY SPRING FREEZES

Bobby Boozer, Bob Ebel, and Jim Pitts

Reducing the amount of hand labor needed for fruit thinning and taking advantage of early fruit thinning were the primary reasons behind this study which was initiated in 1996 at the Chilton Area Horticulture Substation. Gibberellic acid has been shown to inhibit fruit bud formation in the year following application when applied one to three weeks prior to fruit harvest. Due to the time of application and the cost of application many producers are apprehensive as to the potential use for Southeast peach production.

For the 1997 season the use of gibberellic acid significantly reduced the amount of time needed to hand thin. While the cost per acre for hand touch up thinning and the cost of gibberellic material was higher than hand thinning only, the net return per acre was higher due to an increase in percent of larger fruit. Due to the concern of late winter freezes, two treatments combined gibberellic acid for flower bud reduction and ethephon for winter bud hardiness and bloom delay.

Winter conditions for 1997 were mild and late freezes did not threaten the crop. As a result, the use of ethephon was not needed for freeze protection and both treatments had lower average fruit weight and resulted in lower net return per acre compared to the control. For 1997, the highest net return came from the use of 50 ppm gibberellic acid and 150 gallon per acre spray volume (Table 1).

Winter conditions for 1998 contrasted sharply with the winter of 1997. During March 1997, three days of sub-freezing temperatures threatened the crop. Fruit bud losses from February to late March averaged 55 percent for all treatments except for treatments which included the use of a fall ethephon application. Significantly higher thinning times were required by the three treatments receiving fall ethephon, but a larger number of fruit were also saved from freezing conditions. Net returns above labor costs for each treatment and chemical costs, if applicable for a treatment, were highest for 25 ppm gibberellic acid, 150 gallon spray volume, and ethephon (Table 2.).

Comparison of results for 1997 and 1998 for the same treatments are proportional. Where no ethephon was used the 1988 yields (total fruit number) were 87, 85, and 90% lower for the control, 50/150, and 50/300 respectively. Where ethephon was used, 50/150/E, there was no difference in yield from 1997 and 1998. The two year average net return was higher than that of the control for 50/150 and 50/150/E by $1794 and $2341, respectively.

Results from both years are encouraging for the combination use of gibberellic acid and ethephon as a potential for increasing freeze protection, reducing labor and increasing net returns. This study will continue using the 1998 treatments. Several years with both mild and harsh winter conditions typical of the Southeast are needed to build up confidence in any particular treatment. It should also be noted that neither of the chemicals used in this study are currently labeled for peach production in the Southeast.

TABLE 1. TOTAL FRUIT NUMBER, TOTAL WEIGHT, AND NET RETURNS IN 1997.

Treatment	Total fruit	Total weight	Net returns [1]
	avg./tree	*kg/tree*	*$/acre*
0 GA3	777	94	—
50ppm GA3, 150 gal H_2O/a	538	74	2610
50ppm GA3, 300 gal H_2O/a	380	57	1378
50ppm GA3, 150 gal H_2O/a, Ethephon	266	41	-691

TABLE 2. TOTAL FRUIT NUMBER, TOTAL FRUIT WEIGHT, AND NET RETURNS IN 1998.

Treatment	Total fruit	Total weight	Net returns [1]
	avg./tree	*kg/tree*	*$/acre*
0 ppmGA3	101	19	—
0 ppmGA3, Ethephon	272	36	2501
25 ppm GA3, 150 gal H_2O/a	147	28	1111
25 ppm GA3, 150 gal H_2O/a, Ethephon	317	46	3845
25 ppm GA3, 300 gal H_2O/a	64	13	-1590
50 ppm GA3, 150 gal H_2O/a	81	16	- 788
50 ppm GA3, 150 gal H_2O/a, Ethephon	265	41	3062
50 ppm GA3, 300 gal H_2O/a	37	8	-2402

[1]Return above control deducting expenditures for hand thinning labor and chemicals used in treatments.

EVALUATION OF ABOUND FOR PEACH SCAB AND BROWN ROT CONTROL ON PEACHES

Edward Sikora, Bobby Boozer, Mahefa Andrianifahanana, and Jim Pitts

This experiment was conducted at the Chilton County Horticultural Substation near Clanton, Alabama, on the cultivar Alred Elberta. Treatments were replicated five times with three trees per replication in a randomized complete block design. Fungicides were applied using an air blast sprayer at 150 GPA. Bloom spray treatments were applied on 3/16 and 4/3. A shuck-split spray was applied on 4/16. Cover sprays were applied on 4/27, 5/8, 5/20, 6/3, 6/17, 6/24, and 7/8. Preharvest sprays were applied on 7/15 and 7/20. Fruit were harvested on 7/21. Samples of 60 fruit picked randomly from the center tree of each three tree treatment/replication were rated for scab incidence and severity (recorded as marketability) at harvest. Fruit were stored at 77°F for seven days after which time the fruit were examined for incidence of brown rot and Rhizopus rot.

The weather conditions in 1998 were warm and wet which favored disease development. Brown rot blossom blight incidence in the orchard was extremely low so disease ratings for this disorder were not taken. Peach scab pressure was high considering only 36% of fruit from the control blocks were marketable at harvest due to the high incidence of peach scab. Incidence of brown rot fruit rot seven days after harvest was high as noted on the unsprayed control (63% disease). There were no significant differences among the three Abound treatments and Captan. All fungicide treatments performed significantly better then the unsprayed control for incidence of scab and brown rot and production of marketable fruit.

EFFECT OF BLOOM, COVER AND PREHARVEST APPLICATIONS OF ABOUND ON PEACH SCAB AND BROWN ROT

Treatments/acre[1]	Fruit with scab	Marketable fruit	Brown rot	Rhizopus rot
Abound 2SC 0.05 lb. a.i.	27.0a	91.3a	30.3a	12.6a
Abound 2SC 0.10 lb. a.i.	22.3a	96.3a	30.0a	8.0a
Abound 2SC 0.15 lb. a.i.	15.6a	96.3a	27.0a	9.0a
Captan 4 lb./acre	23.6a	94.0a	46.0ab	12.0a
Unsprayed control	96.3b	36.3b	62.6b	13.3a

[1]All Abound sprays were mixed with Latron 1956.Treatments followed by the same letter are not significantly different. Marketable fruit based on severity of scab damage at harvest.

EVALUATION OF ACTIGARD (CGA-245704) FOR CONTROL OF BACTERIAL SPOT OF PEACH

Lee Campbell, Jim Pitts, and Mark Wilson

Field tests were conducted to evaluate the efficacy of Actigard [CGA-245704 (Novartis Crop Protection)] in controlling bacterial spot of peach. Bacterial spot of peach is caused by *Xanthomonas campestris* pv. *pruni* and is becoming a major concern for growers in Alabama for two reasons. First, new peach cultivars from California, which have little or no resistance to bacterial spot, are increasingly being grown in Alabama. Secondly, there is no adequate means of controlling this disease.

Currently, the only available means of control is through the use of oxytetracycline (Mycoshield) but growers are concerned that its effectiveness is not consistent. Actigard, which activates the natural defense mechanisms within a plant, has been successful in controlling bacterial diseases of many vegetable crops including those of tomato and lettuce. Actigard was tested alone and in combination with Mycoshield. These treatment were compared to an untreated control and a Mycoshield treatment. These tests were conducted on three peach cultivars each with varying degrees of resistance to bacterial spot (O'Henry-highly susceptible and Cresthaven and Fireprince-moderately susceptible). Actigard was applied weekly (4 oz. a.i./acre) beginning at first leaf bud break and re-applied until one week prior to fruit harvest.

Due to extremely dry weather during the spring and early summer, very little bacterial spot development was observed on the cultivars Fireprince and Cresthaven, but there was substantial infection on the cultivar O'Henry. Fruit was harvested and rated based on the percentage of fruit surface covered by bacterial spot lesions. Fruit ratings demonstrated that Actigard alone and in combination with Mycoshield reduced the number of infected fruit (disease incidence) when compared with the unsprayed control (Table 1). Mycoshield reduced the incidence of disease compared to no treatment, but consistent with grower results, this was not a significant decrease in disease. These results also showed that Actigard, Mycoshield, and Actigard + Mycoshield increased the number of marketable fruit by approximately 10%, 16%, and 20%, respectively (Table 2).

Actigard provides some control of bacterial spot on highly susceptible cultivars and will increase the amount of marketable fruit. Because copper bactericides are phytotoxic to peaches and Mycoshield is unreliable, Actigard may offer an alternative to these products that will allow growers in Alabama to plant new and improved California peach cultivars.

TABLE 1. INCIDENCE OF BACTERIAL SPOT ON FRUIT

Treatment	Total fruit harvested[1]	% Fruit infected
Control	500	63.8
Actigard[2]	486	43.2
Mycoshield	500	51.6
Actigard[2] +Mycoshield[3]	500	37.8

[1]Total represents the total amount of fruit harvested from 5 blocks from the 3 inside trees of each 5 tree block.
[2]Applied at a rate of 4 oz a.i./acre
[3]Tank mix

TABLE 2. SEVERITY OF BACTERIAL SPOT ON FRUIT

Treatment	Proportion of fruit rated[1] as either marketable or unmarketable	
	% Marketable fruit	% Unmarketable fruit
Control	67.2	32.8
Actigard[2]	77.8	22.2
Mycoshield	83.8	16.2
Actigard[2] + Mycoshield[3]	87.6	12.4

[1]Ratings: 0 = clean, no lesions; 1= trace 5 or fewer lesions; 2 = 5 to lesions, no cracking; 3 = 25% of fruit covered by lesions, cracking observed; 4 = > 25% of fruit covered by lesions, severe cracking.
[2] Applied at a rate of 4 oz a.i./acre
[3]Tank mix

GENETIC DIVERSITY EVALUATIONS OF THREATENED OZARK AND ALLEGHENY CHINKAPIN POPULATIONS

Fenny Dane

Conservation organizations must frequently choose which populations of a threatened or endangered plant species to protect. Two goals of any conservation program should be to ensure the long-term survival of the plant species and the maintenance of ecological and evolutionary processes. The short-term survival of a species can be accomplished by conserving a sample of a population in gardens or by storing seeds. The maintenance of evolutionary processes and long-term survival is dependent on the genetic diversity of the populations. Genetically diverse populations should be better able to withstand and adapt to environmental change.

Molecular markers make it possible to identify populations with high levels of genetic variation. Research has been conducted at Auburn University for the last several years studying the genetic variation of the American chestnut and the closely related Ozark and Allegheny chinkapin. Both species are threatened by their susceptibility to the Asian fungus, *Cryphonectria parasitica*. This fungus causes the disease chestnut blight, which over a short period of time has resulted in the demise of the American chestnut and severely affected Ozark chinkapin populations in the Ozarks and Allegheny chinkapins in several southern and eastern states.

Samples from representative populations of the Ozark chinkapin in Arkansas and Allegheny chinkapins from Louisiana to Florida to Ohio will be evaluated using different types of molecular markers. This research is sponsored by the Arkansas National Heritage Commission and the USDA Plant Germplasm Program. Some of the questions that will be addressed are:

1) How does variation in geographically isolated populations compare with the genetic variation of the species as a whole and to species with similar traits.

2) How does the existing genetic variation relate to biogeographic patterns across the range of the species?

3) What are the conservation implications of the distribution of genetic variation within and among populations of this species.

Thus far, the results have indicated that relatively high levels of genetic diversity are being maintained within the different Ozark chinkapin populations, as compared to species with similar geographic ranges and life history characteristics. Studies of Allegheny chinkapin populations have just been initiated. Research on these populations should lead to a better understanding of the species as a whole and its evolutionary relationship to other species and should be beneficial to conservation programs aimed to conserve this species.

EVALUATION OF FUNGICIDES FOR SCAB CONTROL ON PECANS

Edward Sikora and Jason Burkett

Pecan scab is the most limiting factor to pecan production in the Southeast. To control the disease, growers must maintain a calendar-based spray program from bud break through nut hardening. In 1998, a newly registered fungicide, Abound (Zeneca), was evaluated for its ability to control pecan scab on both leaves and nuts.

The test was conducted at the E. V. Smith Research Center in Shorter, Alabama, on a block of 'Cheyenne' pecan trees. Fungicide treatments were applied according to the spray schedule outlined below. Leaf scab ratings were taken on June 11 and nut scab ratings were taken on September 2.

Incidence of leaf scab was relatively low (6.9%) in 1998 and few differences were observed among fungicide treatments. All fungicide treatments had significantly less leaf scab then the unsprayed control. Nut scab pressure was relatively high (98.5%) and differences were observed among the fungicide treatments. All fungicide treatments had significantly less nut scab then the unsprayed control. Abound applied full season had the least amount of nut scab (5.5%). The Enable, Abound, Super Tin program also performed well in controlling nut scab (15.5%). Nut scab ratings ranged from 20 to 40% for the remaining fungicide treatments.

EVALUATION OF FUNGICIDE SPRAY PROGRAMS FOR PECAN SCAB CONTROL, 1998.

Fungicide (rate)[1]	% Leaf scab[2]	% Nut scab
Unsprayed control	6.9b	98.5d
Abound (9.6 oz)	0.2a	5.5a
Abound (9.6 oz) then Super Tin 80WP (7.5 oz)	0.2a	27.4bc
Enable 2E (8 oz) then Abound (9.6 oz) then Super Tin (7.5 oz)	1.3a	15.0ab
Enable (8 oz) then Super Tin (7.5 oz) then Abound (9.6 oz)	3.6ab	40.3c
Abound (6.4 oz) then Super Tin 80WP (7.5 oz)[3]	0.1a	20.2b
Super Tin 80WP (7.5 oz)	2.1a	39.5c

[1]Treatments with one fungicide listed consisted of three applications of the fungicide at 14-day intervals then six applications of the material at 21-day intervals; treatments with two fungicides listed consisted of three applications of the first fungicide listed at 14-day intervals then six applications of the second fungicide listed at 21-day intervals; treatments with three fungicides listed consisted of three applications of the first fungicide listed at 14-day intervals then three application of the second fungicide listed at 21-day intervals followed by three applications of the third fungicide listed at 21-day intervals.
[2]Treatments followed by the same letter are not significantly different.
[3]Consisted of four applications of Abound at 7-10 day intervals then six applications of Super Tin at 21-day intervals.

PECAN CULTIVARS FOR LOW-INPUT ORCHARDS AND HOME PLANTINGS

Bill Goff and Monte Nesbitt

By growing resistant cultivars, pecan growers can save $150-200 per acre, assuming a reduction of 10 pesticide applications at $18/application. Perhaps more importantly, genetic resistance provides insurance against pest-related disasters. In 1994, for instance, heavy rain in late June-early July in the Southeast prevented growers from applying sprays in a timely manner, and much of that year's crop was lost to the disease scab. A resistant cultivar, if the resistance were strong, would have weathered the storm with little scab loss. The purpose of this report is to update our list of cultivars suggested for trial plantings for low-input orchards.

The following table describes cultivars, which appear most promising, and that combine outstanding pest resistance with good horticultural traits. We can supply limited graftwood for testing. Nurseries are beginning to grow trees of the cultivars listed.

DESCRIPTION OF OUTSTANDING CULTIVARS FOR TRIAL PLANTING IN LOW-INPUT ORCHARDS.

Jenkins 55 nuts/lb 54% kernel
Scab rating: Outstanding, consistent at all locations observed
This cultivar has a large nut and appears to be an excellent tree with regard to pest resistance. Nut quality is outstanding. Nuts resemble Desirable, except a little smaller.

McMillan 56 nuts/lb 51% kernel
Scab rating: Very good, light scab observed at some locations.
This cultivar has been highly productive and consistent, and scab damage on nuts has been very light. Harvest is about three days after Stuart.

Syrup Mill 53 nuts/lb 46% kernel
Scab rating: Outstanding, consistent at all locations observed.
This cultivar has produced good yields, is extremely vigorous, and retains foliage well. Kernels are bright.

Carter 45 nuts/lb 49% kernel
Scab rating: Good, light to moderate scab observed at some locations.
This cultivar has an estimated harvest date of October 18, and produces a large nut. Veins have been visible on kernels in some years.

Esneul 60 nuts/lb 52% kernel
Scab rating: Very good, light scab observed at some locations.
This cultivar has good nut quality and is a little smaller than Stuart. It has had good crops under undesirable circumstance.

Tinker 50 nuts/lb 47% kernel
Scab rating: Excellent, Consistent, light scab at some locations.
This cultivar has very bright and attractive kernels. The tree has remarkable vigor. Little is known about long-term yield potential.

Gafford 56 nuts/lb 50% kernel
Scab rating: Excellent, light scab observed at some locations.
This cultivar produced a good quality nut, and has excellent resistance, but little is known on long-term yield potential.

EVALUATION OF HOUSEHOLD BLEACH FOR PECAN SCAB CONTROL

Monte Nesbitt and Edward Sikora

Pecan Scab is the primary disease problem facing commercial pecan growers. Chemical cost alone for a calendar-based spray schedule is approximately $115/acre per year. Pecan Scab is polycyclic, meaning that the infection process repeats itself multiple times each growing season. Good control of scab usually requires six to10 fungicide applications per year. Pecan growers seeking low cost alternatives for pecan scab control have reported that household bleach is effective when sprayed on a calendar schedule in the growing season. Sodium hypochlorite, the active ingredient in bleach, when reacting with organic matter releases chlorine, an effective fungicide. It has no residual activity once the bleach solution dries and the chlorine evaporates.

A controlled experiment was conducted at the Gulf Coast Research and Extension Center in Fairhope in 1998. The test cultivar, Desirable, was used which is highly susceptible to Pecan Scab. At budbreak, branches on 16-year-old trees having six to eight terminal shoots were flagged for identification throughout the growing season.

Treatments were applied to flagged branches with a hand sprayer (atomizer). Treatments included an untreated check, four concentrations of bleach (0.5%, 1%, 5%, 10% v/v), two standard fungicides (Super Tin and Abound), and a tank-mix treatment of Super Tin with 1% bleach. Treatment solutions were prepared from a straight dilution using the field rate of 150 gallons of spray solution per acre. Super Tin was applied at 7.5 oz./acre. Abound was applied at 6.4 oz./acre pre-pollination and 9.6 oz./acre post pollination. Treatments were applied eight times, using the standard schedule of three sprays every 14 days beginning at budbreak, and cover sprays applied every 21 days. Treatments were replicated 10 times.

Disease pressure was low in 1998 from budbreak to mid July, yet bleach treatments of 0.5 and 1.0% provided no control of leaf scab. Bleach treatments of 5-10% controlled leaf scab as good as Super Tin; however, these bleach concentrations caused leaf burn typical of sodium toxicity (Table). Bleach, used alone, did not reduce nut scab severity. Bleach mixed with Super Tin gave numerically better control of leaf and nut scab than Super Tin alone, but the differences were not significant. Nut scab control with Abound was significantly better than Super Tin at end of season. Household bleach is not effective in controlling Pecan Scab, because it does not provide residual protection after application. To be effective, bleach would have to be applied every time conditions were favorable for new spore germination and infection.

PERCENTAGE OF LEAF AND NUT SCAB ON TWO EVALUATION DATES

Treatment	Leaf scab[1] July 27	Nut scab[2] July 27	Nut scab[2] Sept. 26
	Pct.	*Pct.*	*Pct.*
Abound	1.60	0.18	28.7
Super Tin	2.48	0.62	46.6
Bleach 1/2%	5.64	9.01	94.8
Bleach 1%	4.86	9.12	93.2
Bleach 5%	4.18	8.86	92.7
Bleach 10%	4.11	5.43	93.5
Super Tin + Bleach 1%	1.66	0.36	40.1
Untreated Check	6.56	9.8	94.7

[1] % of leaf area covered with scab lesions
[2] % of nut surface covered with scab lesions

VEGETABLE PAPERS

GENOME MAPPING IN WATERMELON POPULATIONS SEGREGATING FOR FUSARIUM WILT RESISTANCE

Leigh K. Hawkins and Fenny Dane

Genetic linkage maps consisting of several closely-spaced DNA markers allow breeders and geneticists to characterize and manipulate plant genes linked to horticulturally important traits, such as disease resistance. These markers or tags would aid considerably in incorporating the genes of interest from wild relatives for the breeding of new cultivars. There are two types of markers: (1) morphological markers, which include traits that can be easily seen such as fruit color, seed size, rind color, etc.; and (2) molecular markers based on DNA or protein (isozyme) molecules. In cases where few morphological and isozyme differences (polymorphisms) are seen, DNA-based molecular markers are often used for their ability to detect several polymorphisms. These DNA markers include random amplified polymorphic DNAs (RAPDs), amplified fragment length polymorphisms (AFLPs), and simple sequence repeats (SSRs).

Watermelon (*Citrullus lanatus*) suffers from a number of fungal and bacterial diseases that slow plant development and thus reduce financial returns. Worldwide, one of the most economically devastating of these diseases is Fusarium wilt, caused by the soilborne fungus *Fusarium oxysporum* f.sp. *niveum* (FON). FON has been divided into three races (races 0, 1, and 2) based on responses to different cultivars. Most commercial cultivars are resistant to races 0 and 1, but there are no cultivars resistant to race 2, which is much more aggressive. Race 2 has been found in Texas, Oklahoma, and Florida.

Generating a map of the watermelon genome would be helpful in map-based pre-selection for resistance genes, which would reduce the number of plants to be grown for screening assays. Because there are few morphological and isozyme polymorphisms in the watermelon, it is desired to maximize the number of markers that can be used for generating a highly-saturated linkage map of the genome, particularly around genes of interest. Thus several types of DNA markers will be employed.

For this study, the following breeding populations were used to detect markers linked to Fusarium wilt resistance. The resistant plant introduction PI-296341 is resistant to all three races of FON. This wild watermelon has small, round fruit with bitter, white flesh. The susceptible parent, the red-fleshed watermelon cultivar 'New Hampshire Midget', is susceptible to all three races. A cross between the two parents was used to generate the F_1 generation (hybrid). The F_1 was selfed to create the F_2 population and individual F_2 plants were selfed to create F_3 lines. Several polymorphic RAPD markers were detected in the F_2 progeny. Those markers that fit the expected segregation (3:1) ratio were used in generating a map of the watermelon genome on which 23 linkage groups were detected. Three groups had 2 markers each and one group had 30 markers. The remaining linkage groups each contained one marker. This map will be expanded using AFLP, SSR, isozyme, and morphological characters.

6-Carbon Volatile Compounds Differentially Alter *Xanthomonas campestris* Metabolism

Bob Ebel, Shay Bomberger, and Fenny Dane

Plant metabolism changes in response to attack by pathogens in order to produce chemicals toxic to the pathogen. Some of these toxic compounds are volatile compounds but the mechanism by which these compounds affect the pathogen are poorly understood. In order to study the effects of some of these compounds on growth and metabolism of a plant pathogen *Xanthomonas campestris*, we used a genetically altered strain of the bacterium that emits light, or is bioluminescent. Bioluminescent bacteria can be used to study the effect of volatile compounds on metabolic processes within the bacteria. Knowledge of the mechanism by which volatile compounds affect pathogens allows us to develop novel methods of artificially stimulating plant metabolism to enhance its resistance to pathogens.

We used three compounds that are produced by plants in response to pathogenic attack, and which were previously shown to be inhibitory to bacterial growth. *Xanthomonas campestris* was grown in petri plates on nutrient agar. The inhibitory, volatile compounds were applied to the petri plates. We measured bioluminescence using a CCD camera 48 hours after exposing the bacteria to the volatile compounds.

The volatile compounds trans-2-hexen-1-ol and cis-3-hexen-1-ol slightly reduced bacterial growth whereas *trans*-2-hexenal had a strong inhibitory effect compared to the controls and as shown by the total area of the colony (Table). However, bacteria treated with *trans*-2-hexen-1-ol and *cis*-3-hexen-1-ol showed much higher bioluminescence per pixel. The reason for the higher bioluminescence is not known, but the volatile compounds may be directly converted to a substrate that is metabolized by the bacteria. When we replaced the volatile compounds with decanal, a known precursor of the luciferase enzyme responsible for producing light in the bacteria, bioluminescence did not increase for *trans*-2-hexen-1-ol and *cis*-3-hexen-1-ol suggesting that these volatile compounds are converted to substrates for the enzyme. We are conducting studies to determine the mechanism by which these volatiles affected growth and bioluminescence.

COLONY AREA AND BIOLUMINESCENCE OF *X. CAMPESTRIS* AS AFFECTED BY VOLATILE COMPOUNDS

Volatile compounds	Total area of colony (pixel)	Bioluminescence per pixel	Bioluminescence per pixel after adding decanal
Water control	45000	61	245
Propanediol control	47000	41	244
trans-2-hexen-1-ol	30000	390	163
cis-3-hexen-1-ol	35000	439	329
trans-2-hexenal	11000	19	91

GUMMY STEM BLIGHT RESISTANCE IN WATERMELON

Fenny Dane and Young-Seok Kwon

Worldwide, gummy stem blight, caused by the fungus *Didymella bryoniae* (*Db*) is one of the most destructive fungal diseases of watermelon. As resistance to other diseases has been incorporated into commercial varieties, losses to gummy stem blight have increased. Satisfactory chemical control may be obtained by regular applications of fungicides, but isolates of the fungus resistant to currently used fungicides have been detected in commercial watermelon fields in the eastern U.S.

It remains imperative to gain a better understanding of the inheritance of disease resistance to this disease in watermelon and to be able to incorporate durable resistance into commercial varieties. Diagnostic molecular markers linked to gummy stem blight disease resistance are being identified. These markers should facilitate breeding for disease resistance and provide a step toward the identification and manipulation of disease resistance genes in watermelon.

Watermelon seedling populations derived from crosses between a susceptible watermelon cultivar (SS4 from Korea) and resistant plant introductions (PI 189225 and 271778 from Africa) were inoculated by spraying plants until runoff with suspensions of *Db*. Disease severity was rated four days after inoculation. Results from three different seedling tests indicated that gummy stem blight resistance in PI 189225 was inherited as a quantitative trait with additive dominant features, possibly influenced by several genes as well as the environment (Table). Resistance in PI 271778 was negligible.

This makes it more difficult to transfer gummy stem blight resistance into susceptible plant material. It is our intent to facilitate this process using molecular markers. Diagnostic markers linked to disease resistance can then be used as selection tools. A innovative technique (Amplified fragment length polymorphism) has been used to identify markers linked to disease resistance. So far one marker appears associated with disease resistant seedlings. This kind of finding warrants more detailed investigation.

GUMMY STEM BLIGHT DISEASE SCREENS OF WATERMELON.

Population	Mean disease index[1]
Susceptible parent S	3.6ab[2]
R1 (PI 189225)	2.4def
R2 (PI 277178)	3.1abc
(S x R1) hybrid F_1	3.0abcd
(S x R1) F^2	2.9bcd
(S x R1) x R1	3.2abc
(S x R1) x S	3.7ab
(S x R2) hybrid F_1	3.1abc
(S x R2) F_2	3.4ab
(S x R2) x R2	3.5ab
(S x R2) x S	3.5ab
(R1 x R2) hybrid F_1	2.1ef
(R1 x R2) F_2	2.4def
(R1 x R2) x R1	1.9f
(R1 x R2) x R2	2.7cde

[1]Disease scale: 1(< 10% infection) to 5 (75-100% of area infected)
[2]Means with the same letter are not significantly different

VIRUSES IN COMMERCIAL CANTALOUPE AND WATERMELON IN ALABAMA

John F. Murphy, Ruhui Li, Joseph Kemble, Mahefa Andrianifahanana, Edward Sikora, Mary Baltikauski, Gary Gray, Richard Beauchamp, Daniel Porch, and Richard Murphy

Plant viruses are a persistent threat to crop production. While some viruses occur on a frequent basis from one year to the next, others appear on a more sporadic basis. Knowledge of which viruses occur in a crop and their relative abundance from year to year provides a foundation for the development of management strategies. We have initiated a series of statewide surveys to identify viral diseases in commercial vegetable crops. This report describes our findings from the first year of a two-year survey of viruses in cantaloupe, pumpkin, and watermelon with an emphasis on watermelon.

Through assistance of County Extension personnel, selected cantaloupe, pumpkin, and watermelon fields were surveyed in Geneva and Houston Counties (June, 1998), Autauga, Chilton, and Elmore Counties (July, 1998) and Blount County (August, 1998). Typically, 20 randomly selected plants were sampled within a field with each sample consisting of three leaves taken from a single vine. Leaves from each plant (representing a single sample) were wrapped in a moistened paper towel, placed in a plastic bag, and transported on ice to Auburn University for analysis. Each sample was tested, using the serological assay ELISA, for each of four viruses known to occur on a frequent basis in cucurbits: cucumber mosaic cucumovirus (CMV), papaya ringspot potyvirus (PRSV), watermelon mosaic potyvirus 2 (WMV 2) and zucchini yellow mosaic potyvirus (ZYMV).

Fields in three areas of the state were surveyed, South, Central and North Alabama. A visual assessment for virus-like symptoms revealed that a large percentage of plants in some fields were infected with a virus, though no distinguishing types of symptoms were apparent. Generally, two types of symptoms were observed: a typical viral-induced mosaic pattern on leaves (light and dark green patches throughout a leaf) or a bright yellow mottled symptom (bright yellow and green patches throughout a leaf).

VIRUSES DETECTED IN CANTALOUPE AND WATERMELON CROPS IN ALABAMA IN 1998

County/Field	Viruses
South Alabama	
Geneva	
Field 1 (cantaloupe)	PRSV
Field 2 (watermelon)	PRSV
Field 3 (watermelon)	ZYMV
Field 4 (watermelon)	ZYMV
Houston	
Field 1 (cantaloupe)	ZYMV
(watermelon)	ZYMV
Field 2 (watermelon)	ZYMV
Central Alabama	
Autauga	
Field 1 (watermelon)	WMV 2
Chilton	
Field 1 (watermelon)	WMV 2
Field 2 (watermelon)	WMV 2, ZYMV
Elmore	
Field 1 (watermelon)	No virus detected
North Alabama	
Blount	
Field 1 (watermelon)	PRSV, WMV 2
Field 2 (watermelon)	WMV 2
Field 3 (watermelon)	PRSV
Field 4 (watermelon)	WMV 2
Field 5 (watermelon)	WMV 2
Field 6 (pumpkin)	WMV 2

Serological analysis of foliar tissues (Table) revealed the occurrence of each of the potyviruses (PRSV, WMV 2 and ZYMV) whereas CMV was not detected in any of the cantaloupe, pumpkin, or watermelon samples. In South Alabama, PRSV and ZYMV were detected with ZYMV occurring on a more frequent basis. Plants in Central Alabama were infected with WMV 2 and ZYMV with WMV 2 clearly being the predominant virus. In North Alabama, PRSV and WMV 2 were identified with WMV 2 occurring more frequently than PRSV. Interestingly, a tomato crop heavily infected with CMV was immediately adjacent to the pumpkin crop in Blount Co., and yet, no CMV was detected in any of the pumpkin samples.

SUMMER HEAT TAKES TOLL ON BELL PEPPER PRODUCTION, BUT ORGANIC MULCHES IMPROVE PRODUCTION POTENTIAL

Bobby Boozer, Eric Simonne, Joe Kemble, and Jim Pitts

Black plastic mulch for spring vegetable production has dominated much of the commercial production in the Southeast. For some vegetables, the extreme heat that is encountered early is intensified by the use of black plastic. While returning to bare ground production is not desirable for obvious reasons, the use of organic mulches shows promise.

Continued research in organic mulches for bell pepper production was conducted at the Chilton Area Horticulture Substation. Treatments were bare ground, black plastic, hairy vetch, crimson clover, and rye. Fertilization was accomplished through the irrigation system at a rate of 150 pounds N per acre except for one rye treatment which received 30 percent higher nitrogen. Weeds were controlled in plot middles by the use of Gramoxone. Additional hand weeding was needed in all of the organic mulch and bare ground plots.

Due to extremely high temperatures, plant stand survival was reduced on all treatments. Plant stand counts were made on three different dates, four days after planting, 56 days after planting, and 116 days after planting. There were no significant differences in plant stand by day four, but treatments significantly affected plant stands by day 56 and 116 (Table). Plant growth was affected by the hot climatic conditions and was too variable to be considered significant. Visually, however, the organic mulches appeared to have taller plants. When measurements were made, the average plant heights were: 15-, 16-, 20-, 21-, 21-, 22-inches for black plastic, bare ground, vetch, clover, rye (additional N), and rye, respectively. Fruit production was reduced and fruit size was small for all treatments. A strip harvest was made on 14 July and a graded harvest was made on 4 September. While yields were extremely low, there were significant differences in yields related to mulch treatments (Table).

Spring bell pepper production has had problems the last several years and this year was no exception. Several growers in the area plan not to grow bell pepper again due to poor overall performance on black plastic. Where climatic conditions get hot quickly, organic mulches may be the best means to increase production.

BELL PEPPER PRODUCTION ON DIFFERENT MULCHES COMPARED TO BARE GROUND.

Treatment	Plant stand	Strip harvest	Graded harvest
	116 DAP	*lb./acre*	*lb./acre*
Bare Ground	14b	172b	103b
Black Plastic	26a	416ab	117b
Hairy Vetch	25a	708a	890a
Rye	31a	416ab	915a
Crimson Clover	27a	757a	1121a
Rye (adj. N)	27a	684a	1388a

Numbers within a column followed by the same letter are not significantly different at $P \leq 0.05$.

NITROGEN SOURCES AND RATES FOR BELL PEPPER PRODUCTION

Beth Guertal and Randy Akridge

Slow-release nitrogen (N) materials are often used to reduce N leaching losses from sandy soils and extend N availability over a growing season. Because of high cost, slow-release N materials are usually reserved for use in high value production systems such as with turf and horticultural crops. Previous studies have also shown that preplant applications of sulfur-coated urea (SCU) produces yields of vegetables equal to those observed with split applications of soluble fertilizers.

Advances in fertilizer technology have produced a new type of slow-release fertilizer - urea coated with a polyolefin resin (PCU). Unlike other slow-release materials, where nutrient release may be controlled by water solubility of the material, microbial decomposition, or diffusion through an impermeable coating, release of nutrients from resin-coated materials is controlled by the moisture permeability of the resin coating and soil temperature. Since these are relatively new materials, research which examines the use of resin-coated N fertilizers in vegetable production systems is scarce. Since previous research has shown that preplant applications of SCU may produce yields equal to split applications of soluble materials, it was our objective to determine if similar results could be obtained with these new resin-coated fertilizers.

The three-year experiment was located on a Benndale fine sandy loam in Brewton, AL. Green bell peppers ('King Arthur') were grown on raised beds covered with white plastic polyethylene mulch with drip irrigation. Eight-week-old transplants were planted into double rows of 25 foot long plots with within- and between-row spacings of 12- and 24-inches, respectively.

The experiment consisted of N rates and N sources, with each rate/source treatment repeated four times. Selected N sources were: (1) sulfur coated urea - 39-0-0 (N-P-K), (2) ammonium nitrate - 34-0-0, and, (3) polyolefin resin-coated urea - 40-0-0. Nitrogen rates were 80, 120, 160, or 200 lb N/acre. An additional zero N control treatment was included, for a total of 13 treatments in the study. For the slow-release N sources (sulfur- and resin-coat ureas) all of the fertilizer was applied in a preplant broadcast application, with fertilizer incorporated into the planting bed during fumigation and planting bed construction. To simulate application of a soluble N source via fertigation, twenty percent of the ammonium nitrate was applied as a preplant broadcast application, with the remaining N applied every other week in five equal applications.

In each year of the study both N source and N rate affected some component of fruit quality and total marketable pepper yield. Typically, yield of each grade of pepper increased quadratically with increasing N rate, maximizing somewhere between 120 and 200 lb N/acre. Total marketable yield of pepper was maximized at 204, 110, and 118 lb N/acre in 1995, 1996, and 1997, respectively. Thus, in two of three years yield was maximized near the AU recommended N rate of 120 lb N/acre. When examined as a percent of total yield (non-marketable + marketable) N source rarely affected the partitioning of harvested peppers into grade groups. Adding N from any N source decreased percent non-marketable (cull) yield and increased the percentage of marketable yield that was large (US # 1) peppers. This effect was observed in all three years of the study.

In 1995, total marketable yield of peppers grown in SCU was equal to that of the unfertilized check, and less than total marketable yield with PCU or AN treatments. In 1996, yields were the same for each N source, and those yields were all greater than yields obtained without N. In 1997 yield of green pepper grown with ammonium nitrate at 80 lb N/acre was lower than from either of the slow-release N sources. At that N rate there simply may not have been sufficient soluble N continuously available for crop uptake and growth precisely when plant need was greatest. At the recommended rate of 120 lb N/acre yield of pepper from all sources was equal. As N rates increased above 120 lb/acre yields decreased with PCU but remained constant for SCU and AN.

In conclusion, there were few differences in pepper yield or quality due to N source, except in 1995 when peppers grown in SCU had a yield as low as those from unfertilized plots. In this preliminary experiment, it appears that preplant slow-release N fertilizers may be a viable alternative for vegetable crop production.

PICKING METHODS AFFECT YIELD, GRADE DISTRIBUTION, AND RETAIL VALUE OF COLORED BELL PEPPER

Eric Simonne, John Owen, and Christine Harris

Green peppers usually cost between 69-99 cents per pound whereas colored bell peppers cost between $1.99 and $5.99 per pound. Colored bell peppers and green bell peppers have similar production requirements. Yet, most of the colored bell peppers sold in the state are imported from Florida, South America, or Holland.

Bell pepper varieties with unusual colors include yellow ('Valencia'), orange ('Oriole'), and red ('King Arthur'). In addition, bell peppers can also be black ('Black Bird'), brown ('Chocolate Bell'), purple ('Blue Jay'), or white ('Ivory') in color. Most bell peppers are green at the immature stage and come to full color during ripening. Consequently, it takes a few more days to harvest a colored bell pepper as compared to the mature green ones. Color changes in bell pepper can be induced in storage by exposing them to ethylene, but this practice is not common in Alabama. Because of this, bell pepper growers have to leave the fruit on the plant three to five extra days in order to develop 1/3 color. Therefore, colored bell peppers need to stay longer on the plant, thus increasing the risk of mechanical damage and sunscald. This study was designed to determine if yield, grade distribution, and retail value of colored bell pepper was affected by picking bell pepper at different levels of development.

Selected varieties were 'Bell Star', 'Capistrano' (green to red varieties), 'Goldcoast', and 'Admiral' (green to yellow varieties). The peppers were grown from transplants on bare ground with drip irrigation in 22-feet long, single-row plots at the Piedmont Substation in Camp Hill, Alabama. Fertilization consisted of 70-70-100 N-P_2O_5-K_2O applied preplant and 10 lb. N as $Ca(NO_3)_2$ sidedressed every other week. The picking methods were 0/3 colored (mature green, by size), 1/3 colored (by size), and 2/3 colored (by size). Treatments picked "by size" correspond to commercial standards. The peppers were harvested 15 times between June 24 and November 28 and graded.

Early yields were affected by picking method. Early marketable yields were 7,641 lb./acre for 'Admiral', 7,168 lb./acre for 'Bell Star', 5,227 lb./acre for 'Goldcoast', and 4,673 lb./acre for 'Capistrano'. No significant difference was shown between total marketable yield among varieties. The average total marketable yield was 28,409 lb./acre for each variety. Total fancy yields ranged between 8,481 lb./acre for 'Bell Star' and 12,733 lb./acre for 'Goldcoast'.

Bell pepper grade distribution, yield, and retail value did respond significantly to picking method (Table). A large percentage of the early marketable yield of each variety was graded as fancy (71% for 'Goldcoast', 68% for 'Admiral' and 'Capistrano', and 49% for 'Bell Star'). As expected, yield decreased as the fruits were allowed to develop color due in part to the increased risk of sunburn with prolonged time on the plant. Using $0.99 and $1.99 as expected retail value for green and colored bell peppers, respectively, resulted in retail values of $32,039, $55,803, and $50,621/acre for each picking method (0/3, 1/3, and 2/3 colored, respectively). These results suggest that although yields of colored bell peppers may be lower than those of green bell peppers, the higher expected prices for the colored stages of bell pepper make up for the lower yield.

THE EFFECTS OF PICKING METHOD ON RETAIL VALUE AND YIELD.

Method	Total marketable yield	Fancy yield	Total retail value
	(lb./acre)	*(lb./acre)*	*(US $)*
0/3 colored	32,363	5,394	$10,788[1]
1/3 colored	28,042	4,076	$24,456[2]
2/3 colored	25,438	2,353	$14,118

[1] Retail value based on $1.99/lb for fancy grade peppers.
[2] Retail value based on $5.99/lb for fancy grade peppers.

ALTERING SIZE AND YIELDS OF IRISH POTATOES

Joe Kemble, Arnold Caylor, and Tony Dawkins

Last year, we reported on a study that examined the effect of in-row spacing on yields of Grade B Irish potatoes ("Small potatoes can bring big returns"). In that study, we reported that by decreasing in-row spacing, potato growers can produce more Grade B sized potatoes. At the 4 inch spacing, 51.5% of the total marketable yields were Grade B potatoes (131.44 CWT/acre). With the exception of 1998, many Alabama potato growers were receiving a premium for Grade B potatoes (1.5-inch minimum diameter to 2.25-inch maximum diameter). These smaller potatoes are often sold as "new potatoes" to restaurants and grocery store chains.

Results from 1997 were promising, but we needed to repeat this study. In 1998, this study was conducted at the North Alabama Horticulture Substation (NAHS) in Cullman and also at the Sand Mountain Substation (SMS) in Crossville. In March, seed of the red-skinned Irish potato 'LaRouge' was planted into furrows at five different in-row spacings: 4, 6, 8, 10, and 12 inches. As a result, the number of seed pieces increased with decreasing in-row spacings. The narrowest in-row spacing, 4 inches, required three times as many seed pieces as the 12-inch spacing (the 12-inch spacing is presently the conventional spacing used by growers).

At both locations, Irish potatoes were grown in accordance with accepted guidelines for producing Irish potatoes in Alabama. There were few insect and disease problems at either location likely due to the dry, hot summer weather that began in early May. Potatoes were harvested in early July at NAHS and in the beginning of August at SMS.

Due to elevated soil temperatures and little rainfall, yields were considerably lower that expected at NAHS. Yields were an average of 60% lower at NAHS compared to SMS and as a result only yield data from SMS is presented here. Overall, yields were lower in 1998 than in 1997. This can be attributed to higher than normal air and soil temperatures and lack of rainfall that occurred from early May until harvest. Soil temperatures higher than 85°F can inhibit tuberization in Irish potatoes and thus yields are reduced. In 1998, yield of Grade A, B, C or total marketable tubers did not differ significantly at any in-row spacing. In 1997, the total weight of Grade B potatoes increased with decreasing in-row spacings. It was found that more Grade B tubers were produced at the 4-inch in-row spacing (131.4 CTW/acre) than at any other spacing. However, in 1998, this was not the case. No statistical differences were observed at any in-row spacing although there was a trend towards a higher percentage of Grade B potatoes as in-row spacing decreased as in 1997. We will repeat this study next year and hope for a better, less stressful growing season.

THE EFFECT OF IN-ROW SPACING ON YIELD COMPONENTS OF 'LAROUGE' IRISH POTATO AT SAND MOUNTAIN SUBSTATION.

In-row spacing	Grade distribution (CWT/acre)			Total marketable yield[1]	% Grade B[2]
	A	B	C		
4	99.9	53.4	5.4	158.7	62
6	83.1	47.5	7.2	137.8	56
8	96.6	53.1	6.7	156.4	40
10	110.0	47.7	6.2	163.9	53
12	91.0	42.5	6.8	140.3	49

[1]Total marketable yield is calculated as the sum of A, B, and C grade potatoes.
[2]Percent Grade B potatoes is of the total marketable yield

DESPITE THE WEATHER – THE IRISH POTATOES LAROUGE AND NDO 2686-6R PERFORMED WELL

Joe Kemble, Arnold Caylor, and Tony Dawkins

The Irish potato industry struggled a great deal in 1998. Early in the season, excessive rain prevented many growers from planting on-time. By the time the spring floods were turned off at the start of May, the heat was turned on. High soil temperatures inhibited tuberization throughout much of the potato acreage. Yields were down and quality was an issue. Many growers complained of poor storage life for their potatoes as well as low prices offered to them by brokers. Irrigation would have benefited some growers, but irrigation was not the answer to all of their production problems.

Almost 13,000 acre of Irish potatoes were planted in 1998 among Baldwin, Cullman, Dekalb, and Jackson counties. However, only about 12,000 acres were harvested. The poor growing conditions described above were the primary culprits for this reduction in harvested acreage.

Last year, we reported on the appearance and performance of several selected red-skinned Irish potato cultivars grown at the North Alabama Horticulture Substation (NAHS) in Cullman and at the Sand Mountain Substation (SMS) in Crossville. Yields last year were greater at SMS than at NAHS. At SMS, marketable yields of COO 86107-1 (204.9 CWT/acre), ND 2225 (171.3 CWT/acre), NDO 2686-6R (123.6 CWT/acre), and LaRouge (160.8 CWT/acre) were greater than the other cultivars tested. At NAHS, the marketable yields of ND 2225 (160.6 CWT/acre), Red LaSoda (152.9 CWT/acre), Ida Rose (150.2 CWT/acre), and LaRouge (133.0 CWT/acre) were greatest.

At NAHS and SMS, seed pieces of each of ten Irish potato cultivars were sown into plots 40 feet long and 3.5 feet wide. Seed potatoes were provided by Irish potato breeding programs in North Dakota, Oregon, and Idaho. Seed pieces were spaced 12 inches apart within the row at the end of March at SMS and in the beginning of April at NAHS. Potatoes were harvested at the start of July at NAHS and in the beginning of August at SMS.

Yields at SMS were low due to the conditions described above. Yields did not differ among grades (A=48.0 CWT/acre; B=26.3 CWT/acre; C=5.8 CWT/acre) or for total marketable potatoes (avg.=80.1 CWT/acre) between any of the cultivars tested. However, yields and separations between the different cultivars tested were apparent at NAHS (see table below).

As in 1997, LaRouge and NDO 2686-6R performed well. Approximately 50% of their total marketable yields graded as As. Additionally, NDO 4588-5, NDO 4592-3, and Ida Rose all produced over 100 CWT/acre with most of their potatoes graded as As.

Skin color was also measured to determine just how red each cultigen was as compared to the others. This was measured with an instrument that quantified the redness of the skin. Ratings below reflect how close the skin color of each potato was to true red (i.e., how intense the redness of each potato was). As you move down the list, the skin colors became lighter red. Most red to the least red: Ida Rose, COO 86107-1R, LaRouge, NorDonna, NDO 4592-3, ND 2225-1R, NDO 2686-1R, ND 5084-3R, NDO 4300-1R, NDO 4588-5.

YIELD AND GRADE DISTRIBUTION OF SELECTED IRISH POTATO CULTIVARS AT NAHS.

	CWT/acre[1]					
	Total marketable[2]	Total yield[3]	A	B	C	Cull
LaRouge	189.1	203.6	109.8	58.3	21.1	14.5
NDO 2686-6R	170.1	186.2	93.8	53.1	23.1	16.1
NDO 4588-5	146.8	160.5	46.2	76.9	23.8	13.7
NDO 4592-3	122.4	135.0	67.5	32.3	22.6	12.5
Ida Rose	110.0	114.4	68.6	31.9	9.4	4.4
NDO 4300-1R	99.3	100.7	27.0	38.6	33.7	1.5
COO 86107-1R	84.2	96.2	43.3	32.6	8.4	12.0
ND 2225-1R	80.0	84.0	29.0	30.4	20.6	4.0
NorDonna	79.5	83.2	23.3	29.3	26.9	3.7
ND 5084-3R	42.0	43.8	14.3	16.4	11.3	1.8
LSD[4]	*77.2*	*76.9*	*48.3*	*33.4*	*26.3*	

[1] 1 CWT/acre = 100 lb/acre
[2]Total marketable yield is calculated from the sum of weights for A, B, and C grade potatoes.
[3]Total yield is calculated as the sum of weights for total marketable yield and cull.
[4]Least significant difference ($P \leq 0.05$).

IRRIGATION INCREASED YIELD OF IRISH POTATO

Eric Simonne, Arnold Caylor, and Christine Harris

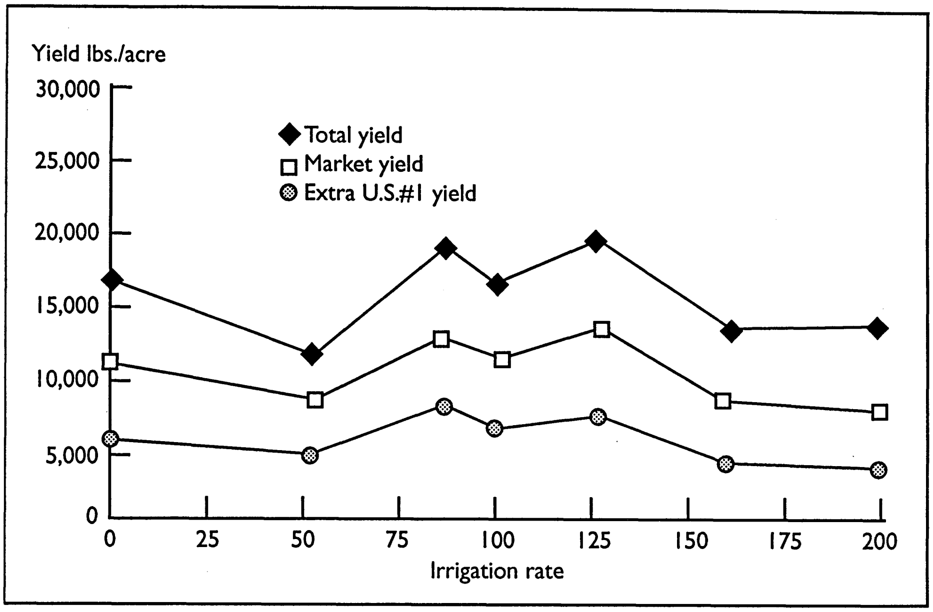
Approximately 13,000 acres of Irish potato are harvested in Alabama each year. Yet, most of this production is done without irrigation. Thirty-year rainfall averages for Alabama show that approximately two to three inches of rain can be expected monthly between March and July. These dates correspond to the period of Irish potato production. While average water supply from rain may seem adequate for Irish potato production, it is not uncommon for spring rains to provide more than one inch of water in one single day, followed by two to three weeks of drought. The effects of uneven rainfall are more pronounced on sandy soils than on heavy-textured soils because of a lower soil water holding capacity.

Irrigation scheduling is used to determine when to irrigate and how much water to apply. When daily water use is calculated from class A pan evaporation and cumulated over several days, it is possible to use the water balance method to schedule irrigation of Irish potato. While limiting the number of calculations to perform, this method adjusts water application to crop age, actual rainfall, real-time water use, and soil type. The objective of this study was to evaluate the effect of irrigation on Irish potato yield under two N fertilization rates using a water budget to schedule irrigation.

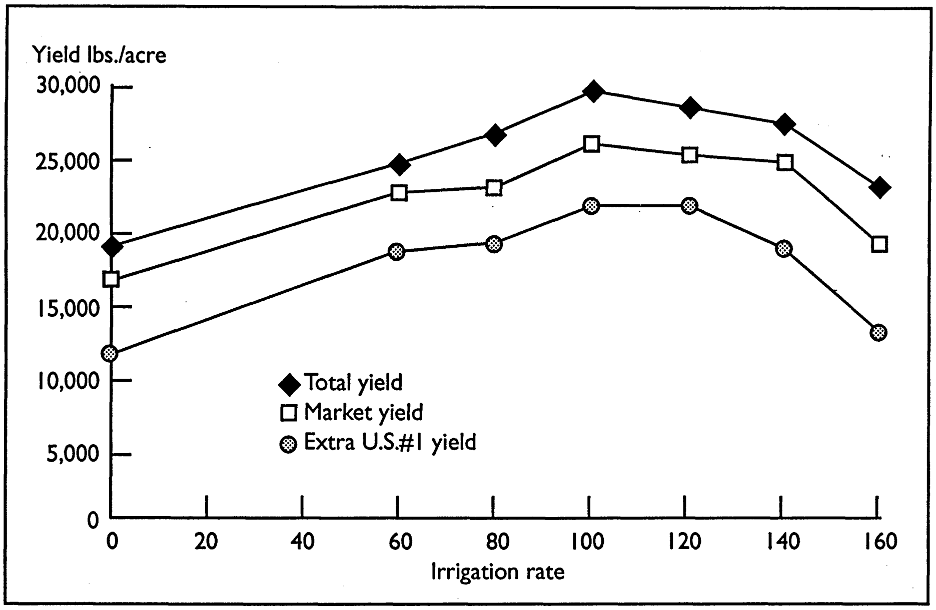
In this study, water use was calculated by adjusting class A pan evaporation to crop age and calculated over several days. Adequate corrections were made for rainfall. Irrigation practices used were done according to the "checkbook method" and were adjusted to actual daily weather conditions (class A pan evaporation, rainfall), crop age, and soil type. The checkbook method calculates the quantity of water available to the crop by counting as "Income" factors those factors that add water to the root zone (rain and irrigation) and as "Expenditure" factors those factors that remove water from the root zone (crop evapotranspiration, deep percolation, run-off). The checkbook method actually calculates a daily balance, for an account expressed in gallons of water/acre.

Irish potatoes were planted at North Alabama Horticulture Substation in Cullman in 1996, 1997, and 1998. Seed pieces of 'Red LaSoda' were planted in 20-foot single row plots at one-foot within row spacing on April 9, 1996; March 12, 1997; and April 7, 1998. Cultural practices were similar each year and followed current recommendations for commercial Irish potato production. Seven controlled irrigation levels were created by accurately controlling the rate and time of irrigation from the drip tapes placed on each bed. A treatment with no irrigation was used as a control. Potatoes were harvested 85 days after hilling (DAH) in 1996, 70 DAH in 1997, and 82 DAH in 1998 and graded as U.S. Extra #1 ("A"), U.S. #1 ("B"), U.S. #2 ("C"), and cull.

In 1997, 21 consecutive days with rainfall in June for a total of 26-inches of rainfall induced water movement in excess of field capacity and no irrigation was used. Consequently, the effect of irrigation could not be evaluated that year. Interaction between irrigation and N rate was not significant for 1996 and 1998. In 1996, five irrigation events were applied between 35 and 60 DAH and 7 irrigation events between 33 and 64 DAH in 1998. Each year, irrigation significantly influenced total and marketable tuber yield. Total, marketable, and U.S. Extra #1 yields responded quadratically to irrigation in both 1996 and 1998 (Figure). N levels did affect yield in 1996 and 1998. In both years, higher yields were reported under the high N treatment. In 1996, marketable yield averaged 23,000 lb./acre for the high N treatment and 21,000 lb./acre for the low N treatment. Marketable yield in 1998 averaged 16,800 lb./acre (high N) and 14,400 lb./acre (low N). The results of this study suggest that supplementing rainfall with irrigation can increase Irish potato yields during dry years. Also, adjusting irrigation to actual class A pan evaporation and rainfall may increase potato yields.



Effect of irrigation on Irish potato yield at North Alabama Horticulture Station in 1998.



Effect of irrigation on Irish potato yield at North Alabama Horticulture Station in 1996.

OPTIMIZING IN-ROW SPACING FOR SWEETPOTATOES

Joe Kemble and Arnold Caylor

Sweetpotatoes are a mainstay of vegetable production in Alabama. In 1998, almost 14,000 acres of sweetpotatoes were grown in Alabama. With conventional production practices, sweetpotato slips are spaced 12 inches apart within rows with 3 to 3 1/2-feet between rows. At this spacing, most sweetpotato varieties produce a higher percentage of US #1 roots compared to Canners, Jumbos, or Culls. Last year at North Alabama Horticulture Substation (NAHS), the variety Beauregaurd produced 176 CWT/acre of US #1 roots accounting for 58% of the total marketable yield.

NC 93-17, a variety from the breeding program at North Carolina State University, produced good quality roots with nice skin and flesh, but most of the roots were Canners. A study was initiated at NAHS to evaluate the effect of increasing in-row spacing on root size of NC 93-17 in order to determine if by increasing in-row spacing, a higher percentage of US #1 roots could be produced.

Slips of NC 93-17 were planted into the field in June at 5 different in-row spacings: 12-, 14-, 16-, 18-, and 20-inch in-row spacings with three feet between rows. Sweetpotatoes were harvested and graded in the end of August.

Statistically, there were no differences in yield between any of the in-row spacings (see table below). However, yields of NC 93-17 in 1998 were greater than those in 1997. In 1997, NC 93-17 produced 50 CWT/acre US #1's, 48.8 CWT/acre Canners, 33.2 CWT/acre Culls, and 100.4 CWT/acre total marketable yield. In 1998, NC 97-13 produced more US #1 roots than Canners or Culls. US #1 root yields were between 66 and 71% of the total marketable yield compared to approximately 50% in 1997.

Why the difference in 1998? It is likely that the hot, dry summer of 1998 was more conducive to sweetpotato production than the wet, overcast, and rainy season of 1997. This study will be repeated in 1999 with wider in-row spacings as well as those tried in 1998.

YIELD AND GRADE DISTRIBUTION FOR NC 93-17 AT 5 IN-ROW SPACINGS AT NAHS.

Spacing	CWT/acre[1] US # 1	Canner	Cull	Total marketable[2]	Total yield[3]	US #1[4] %
12-inch	279.1	63.7	64.7	342.8	407.5	68
14-inch	279.9	110.0	34.0	389.9	423.9	66
16-inch	325.3	112.5	25.4	437.8	463.3	70
18-inch	293.4	80.3	39.0	373.7	412.7	71
20-inch	255.2	65.8	39.2	321.1	360.3	71

[1] 1 CWT/acre = 100 lb/acre
[2]Total marketable yield is calculated from the sum of weights for US #1 and Canner roots.
[3]Total yield is calculated as the sum of weights for total marketable yield and cull.
[4]Percent US #1: calculated by dividing weight of US #1 by the total marketable weight.

SWEETPOTATO YIELD RESPONSE TO IRRIGATION AT TWO NITROGEN RATES

Eric Simonne, Edgar Vinson, III, Christine Harris, Jim Bannon, Jason Burkett, and Marvin Ruf

Sweetpotato is grown extensively in the southern United States as a dry-land crop. Although sweetpotato is considered to be a moderately drought-tolerant crop, recent research reports found that sweetpotato yields may be increased with irrigation. The objectives of this study were (1) to determine if sweetpotato yields respond to irrigation under the growing conditions of Alabama and test an irrigation scheduling model for sweetpotato and (2) to determine any interaction of irrigation and nitrogen (N) fertilization on sweetpotato yield.

This experiment was conducted at E.V. Smith Research Center (EVSRC) and Sand Mountain Substation

(SMS) in 1997. Preplant fertilization consisted of 20-0-20 (N-P_2O_5-K_2O) at a rate of 440 lb./ acre (448 kg/ha) at EVSRC and 3-15-30 (N-P_2O_5-K_2O) at a rate of 200 lb./acre (224 kg/ha) as broadcast on June 27 at SMS. An additional 600 lb./acre (672 kg/ha) of 13-13-13 was applied one day after establishment (DAE) at SMS. Selected varieties were 'Beauregaurd' at EVSRC and 'Georgia Jet' at SMS. Slips were planted on June 20 and 27, 1997, respectively (DAE = 0).

At both locations, total nitrogen (N) fertilization (preplant + sidedress) was 120 and 150 lb./acre (132 and 165 kg N/ha) for the low N and high N treatments, respectively. Low N treatments corresponded to the medium recommended rate. Sweetpotatoes were harvested October 21 (122 DAE) at EVSRC and October 9 (103 DAE) at SMS and graded as U.S. #1, Canner, Jumbo, and Cull.

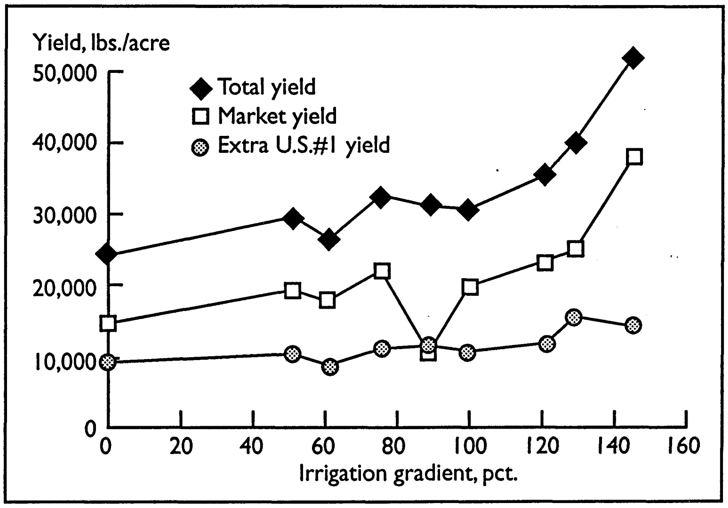
Eight (at EVSRC) and seven (at SMS) irrigation rates were created by a line-source irrigation system consisting of a single row of closely spaced sprinklers. Irrigation regimes ranged between 0% and 140% of the model rate providing uniform water applications parallel to the line (along a bed) and decreasing water applications perpendicular to the line (from the line to the outside row). A treatment with no irrigation was used as a control. Soil water tension was measured at an 8-inch depth with gypsum blocks.

In our study, water use was calculated by adjusting class A pan evaporation to crop age and cumulated over several days. Class A pan evaporation was adjusted using a variable crop factor developed in South Georgia for 'Georgia Jet'. This crop factor allowed a maximum soil water tension of 25 centibars (25kPa). Adequate corrections were made for rainfall. We scheduled an irrigation when cumulative water use exceeded the soil moisture reserve in the root zone. The amount of irrigation water applied was equal to the cumulative water use.

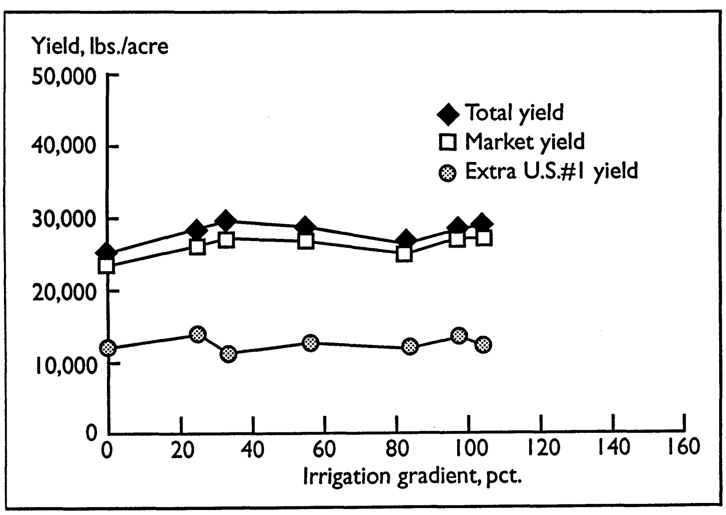
Total rainfall was 11 inches at EVSRC and 13.5 inches at SMS. Under the weather conditions of 1997, the model called for 11 irrigation events at both locations. Total irrigation applied was 10.34 inches at EVSRC and 7.6 inches at SMS.

The effect of irrigation was similar at both N rates. No significant difference was shown between N treatments. At both locations, US #1 sweetpotato yields were not affected by irrigation (Figure). A similar result was observed with marketable and total yield at SMS. At EVSRC, a significant yield increase was observed with the high-water irrigation rate; however, this was due to an increase in Canner and Cull weights.

The readings of the gypsum blocks showed that soil water tension seldom dropped below 40 kPa. The yield and soil water tension data together suggest that the irrigation schedule followed maintained too low a soil water tension. Because this work was conducted on small plots, excessive water benefited the "dry" treatments more than the "wet" treatments. It is possible that sweetpotato will benefit from irrigation under an irrigation scheduling model that allows a higher maximum soil water tension. Marketable yields for both locations did show a significant difference between the low and high N treatments. Marketable yields averaged 19,520 and 25,000 lb./acre (low N) and 18,960 and 26,000 lb./acre (high N) for EVSRC and SMS, respectively. Before using irrigation scheduling, growers should evaluate the economical benefits of irrigation and start with a small test acreage.



Effect of irrigation on sweetpotato yield at E.V. Smith Research Center.



Effect of irrigation on sweetpotato yield at Sand Mountain Substation.

EVALUATION OF BOTRAN FOR PLANT BED DISEASE CONTROL OF SWEETPOTATOES

Edward Sikora and Jim Pitts

This experiment was conduct at the Chilton Area Horticultural Substation in Clanton, Alabama, during the summer of 1997. The test was conducted to evaluate the effectiveness of a low rate of Botran for controlling plant bed diseases as compared to its standard recommended use rate. The test consisted of four treatments, replicated five times, in a randomized complete block design. Each replication consisted of 10 roots of the sweetpotato 'Beauregaurd' which were placed into a bucket and covered with weathered (three-years-old) sawdust. Treatments are as outlined below. After 68 weeks, the percent sprouted tubers and the number of sprouts/tuber were determined.

The treatment consisting of the high rate (3.75 lb.) of Botran resulted in the highest number of sprouts per healthy tuber and the highest number of sprouts overall. Both Botran treatments produced a higher number of sprouted tubers (due to a lower incidence of tuber rot disease) than the Mertect treatment and the untreated control.

EFFECT OF BOTRAN AND MERTECT ON DISEASE DEVELOPMENT

Treatment/rate	Application method	Pct. sprouted tubers[1]	Avg no. sprouts on healthy tuber	Total no. sprouts[2] (50 tubers)
1. Botran 75 WP 3.75 lb/14 gallons of water/1000 sq. ft.	Bed spray[3]	90.0	10.1	458
2. Botran 75 WP 1.25 lb/14 gallons of water/1000 sq. ft.	Bed Spray	92.0	7.4	343
3. Mertect 8 oz/7.5 gallons of water	Seed dip	84.0	8.0	338
4. Untreated control	—	80.0	7.5	302

[1]Based on total number of sprouts from tubers that sprouted (non-diseased)
[2]Total number of sprouts from the 50 tubers bedded over all replications.
[3] Suspension sprayed over sweetpotatoes before covering them with sawdust.

EVALUATION OF FUNGICIDES FOR CONTROL OF EARLY BLIGHT ON TOMATO

Edward Sikora, Arnold Caylor, Mahefa Andrianifahanana, and Derenda Hagemore

In 1998, a variety of fungicides were evaluated for their ability to control early blight on tomato. This experiment was conducted at the North Alabama Horticultural Substation in Cullman, Alabama. The products Penncozeb 75 DF, Vondoflo 4F, Quadris and Cuprofix were evaluated alone or in various combinations at different time intervals with the more established compounds, Kocide 2000 and Bravo Weatherstik. The tomato cultivar 'Sun Leaper' was used in the trial. Disease severity was determined July 7, 14, 21, and 28, 1998. Tomatoes were harvested weekly and total yield was determined (data not available at printing).

Early blight pressure was high based on the amount of disease observed in the unsprayed control plots (93.8% on 7/28). More early blight was observed on the unsprayed control compared to the fungicide treatments on all rating dates. Two treatments, (1) Penncozeb plus Kocide early followed by Quadris alternated with Penncozeb for the remainder of the season, and (2) Penncozeb plus Bravo Weatherstik full season, provided the best control of early blight among all the treatments tested. Differences were most obvious on the July 28 rating date.

FUNGICIDE EVALUATION TRIAL; WEEKLY DISEASE (EARLY BLIGHT) SEVERITY RATINGS				
Treatment	% Early blight			
(rate/acre)	7/7	7/14	7/21	7/28
Unsprayed control	7.8	34.0	65.4	93.8
Vondoflo 4F 3 pt/A + Kocide 2000 2 lb/A[1] followed by Vondoflo 4F 4.5 pt/A**	1.4	7.6	13.8	32.8
Penncozeb 75 DF 2 lb/A + Kocide 2000 2 lb/A* followed by Penncozeb 75 DF 2 lb/A[2]	1.2	7.0	13.2	30.6
Cuprofix 6 lb/A	1.2	7.0	13.6	28.0
Cuprofix 4 lb/A	1.2	6.6	12.2	29.8
Penncozeb 75 DF 2 lb/A + Bravo Weatherstik 1.5 pt/A	1.2	5.0	7.8	13.2
Penncozeb 75 DF 2 lb/A + Kocide 2000 2 lb/A[1] followed by Quadris 6 oz/A alternated with Penncozeb 75 DF 3 lb/A[2]	1.0	3.6	5.6	9.8

[1]Applied the first three weeks only.
[2]Applied over the remainder of season.
All treatments applied on seven- to10-day intervals.

TOMATO IPM PROGRAM A SUCCESS IN ALABAMA IN 1998

Edward Sikora, Geoff Zehnder, Joseph Kemble, Mahefa Andrianifahanana, and Michael Patterson

In 1998, the Alabama Tomato IPM Program was successfully demonstrated for the second consecutive year through large scale on-farm demonstrations with five cooperating growers in Geneva county. A one-acre tomato field was set aside by each grower for the purpose of comparing the Alabama Tomato IPM Program with their standard calendar-based pest program and general production practices. The IPM program consisted of a twice-a-week insect/disease scouting program combined with TOM-CAST (a weather-based fungicide spray program). The TOM-CAST program was provided by the Agricultural Weather Information Service (AWIS) which is a private weather provider located in Auburn, Alabama.

The most significant disease problems to develop in 1998 were tomato spotted wilt virus (TSWV) and the fungal disease southern blight. Thrips, vectors of TSWV, and fruit worms were the most damaging insect pests.

There were no apparent differences in tomato yield, disease severity, or insect pressure between the IPM and the calendar-based pest program field sections. All the growers involved in the project claimed they saved money on production costs by reducing pesticide applications when following the IPM program. On average, growers made four fewer fungicide applications when following the TOM-CAST weather-based fungicide spray program. The reduction in fungicide use was as much as 46 percent in one grower's IPM section. On average, growers following the recommendations of the IPM field scout made 10 fewer insecticide applications compared to their standard, calendar-based spray program. Two growers reduced insecticide usage by over 70% by following Auburn's IPM guidelines.

A research component of the grant evaluated the efficacy of flame cultivation, mechanical cultivation, mulching, and various combinations of these practices in okra, pepper, sweet corn, and tomato production systems in Alabama. Most treatments worked well with okra, pepper, and sweet corn, but preliminary results indicate that flame cultivation in a tomato production system may not be feasible due to the growth habit of the crop.

A handbook outlining the IPM program is currently being developed and will be made available to all interested parties in 1999.

EVALUATION OF PENNCOZEB FOR CONTROL OF SEPTORIA LEAF SPOT ON TOMATO

Edward Sikora, Arnold Caylor, and Derenda Hagemore

This experiment was conducted at the North Alabama Horticultural Substation in Cullman, Alabama, in fall, 1997. Penncozeb 75WP was evaluated in a tank-mix with Kocide 2000 or Bravo 720, and in an alternating spray program with Bravo 720. Cuprofix was also included in the test along with an unsprayed control treatment. Fungicide applications were made at seven to 10 day intervals beginning three days after transplanting. Disease severity ratings were taken on September 26, October 2, October 13, October 21, and October 27, 1997. Harvest data were not available due to an early frost.

Septoria leaf spot was the most common problem in the test plot. Low levels of early blight occurred but only on the control treatment. Significantly more Septoria leaf spot was observed on the unsprayed control treatment at all rating periods compared to the fungicide-treated plots. The Penncozeb + Kocide tank-mix and the Cuprofix had significantly less disease than the Bravo + Penncozeb tank-mix on the last rating date (10/27).

PENNCOZEB - TOMATO EVALUATION TRIAL; WEEKLY DISEASE SEVERITY RATINGS, CULLMAN, AL, 1997

Treatment[1]	Rate/acre	Disease (Septoria leaf spot) severity rating			
		10/2	10/9	10/20	10/27
1. Penncozeb 75DF + Kocide 2000	2 lb 2 lb	0. 0b	3.0b	4.5b	5.7c
2. Bravo 720 + Penncozeb 75DF	0.75 pt 1.0 lb	**applied until fruit set**			
then Bravo 720 + Penncozeb 75DF	1.5 pt 2.0 lb	0.0b	4.0b	8.2b	11.7b
3. Bravo 720 alternated with Penncozeb 75DF	2 pt 2 lb	**applied until fruit set**			
then Bravo 720 alternated with Penncozeb 75DF	3 pt 3 lb	0.2b	3.5b	6.2b	7.5bc
4. Cuprofix	6 lb	0.5b	1.7b	3.7b	5.5c
5. Unsprayed control	——	9.5a	22.0a	39.7a	46.7a

[1]Means followed by the same letter are not significantly different.

Responses of Field-Grown Tomatoes to Nitrogen Sources

Beth Guertal and Joe Kemble

The effect of different nitrogen (N) sources on crop growth and production has long been a topic of interest among scientists. Reasons for selecting a certain N form may be environmental, such as using positively-charged ammonium forms to reduce leaching losses; may be economic, when a cheaper form of N is selected; or may be quality/quantity issues, when one form of N produces a better crop than another form.

Often, the source of fertilizer N becomes a nitrate (NO_3^-) versus ammonium (NH_4^+) issue. Often, greenhouse or hydroponic studies reveal that many plants are sensitive to ammonium, and ammonium toxicity may be observed. However, in field studies the impact of NH_4^+-N nutrition on vegetable crop growth and yield is less clear. Thus, the objective of this study was to examine the effect of N source (nitrate versus ammonium) on field-grown, drip-fertigated stake tomato production yield and quality.

The two-year experiment was located at the E.V. Smith Horticultural Research Unit, near Shorter, Alabama on a Norfolk fine sandy loam. Tomatoes ('Mountain Pride') were grown on six-inch raised beds covered with black plastic polyethylene mulch with drip irrigation installed. Six-week-old transplant were planted into single rows of 25-foot long plots with a within row spacing of 24 inches.

Nitrogen sources were treatments, each repeated four times. Selected N sources were: (1) calcium nitrate ($Ca(NO_3)2$ - 16-0-0 (N-P-K), (2) urea ($CO(NH_2)_2$ - 45-0-0), (3) ammonium nitrate (NH4NO3 - 34-0-0), (4) urea-ammonium nitrate solution (UAN - 32-0-0), and (5) potassium nitrate (KNO_3 - 13-0-39). A total of 180 lb. N/acre was applied with each N source, with 25% (45 lb. N) applied as a preplant/pre-mulch broadcast treatment and the remaining N applied as 10 weekly applications of 13.5 lb. N/acre. Weekly N applications, beginning one week after transplanting, were applied through drip irrigation system. If an N source also supplied K (e.g., KNO_3) or Ca, the amount of that nutrient applied in the N treatment was also applied to the other N source treatments.

Plant height and stem diameter were affected by N source. In 1995 and 1996 tomato plants that received N as UAN were shorter with smaller stem diameters (1996) at all sampling dates. There were few other differences in plant size or stem diameter due to N source. In both years, there were few significant differences in leaf-N concentration due to N source. In the first sampling of 1995, tomato leaves from plots receiving UAN had a higher N concentration than those receiving KNO_3. Whole plants from UAN treatments were shortest at this time, so volume of plant tissue may be the cause of this higher N concentration. In this limited study (one site, two years) yield and quality of field stake tomatoes grown on raised beds with drip irrigation was only slightly affected by the type of N source applied through the drip irrigation line (Table). Although plants grown in UAN were shorter and had reduced early yield (1996 only) than plants receiving other N sources, total yield of tomato was not affected by the UAN treatment. There were few differences in yield and quality of unmarketable fruit due to N source. In this study, it appears that any of the N sources $Ca(NO_3)_2$, UAN, Urea, KNO_3, or NH_4NO_3 would make suitable N sources for tomato production when total marketable yield is a primary concern.

Marketable and Non-marketable Tomato Yield as Affected by N Source and Harvest Date in 1996.

N source	Harvest date: Early season	Mid season	Late season	Total
	Marketable Yield (lb./acre)			
$Ca(NO_3)_2$	1,717a[1]	9,846b	1,198b	12,761c
KNO_3	1,296a	17,360a	6,704b	25,360a
NH4NO3	1,198a	16,988a	5,668b	23,854ab
Urea	907a	16,648a	6,802b	24,357ab
UAN	0b	2,397c	12,097a	14,494bc
	Non-marketable Yield (lb./acre)			
$Ca(NO_3)_2$	138a[1] (7.4)[2]	3,336ab (25.3)	850b (41.5)	4,324b (25.3)
KNO_3	275a (17.5)	4,834a (21.8)	2,397ab (26.3)	7,506a (22.8)
NH4NO3	235a (16.4)	3,320ab (16.3)	2,478ab (30.4)	6,033ab (20.2)
Urea	186a (17.0)	3,668ab (18.1)	2,065ab (23.3)	5,919ab (19.6)
UAN	49a (100.0)	955c (28.5)	3,466a (22.3)	4,470b (23.6)

[1]Within each date and quality category, a number followed by the same letter is not significantly different from other numbers in that column with the same letter(s)

[2] Numbers in parentheses are non-marketable yield expressed as a percent of total yield.

NEW HOT SET TOMATO CULTIVARS –OBSERVATIONS FROM THE FIELD

Joe Kemble and Dan Porch

It is likely that in several years, most new tomato cultivars will be hot set hybrids, or called Heat-set, or Heat tolerant hybrids. Most of you are familiar with one of the first commercially available hot set tomatoes 'Solar Set' which originated from the tomato breeding program at the University of Florida.

Why will most of the cultivars be hot set tomatoes? The unique aspect of hot set tomatoes is that they tend to perform well not just under high temperatures and humidity typical in the Southeast in the summer, but also under cool, rainy environments. Symptom of heat stress such as reduced fruit set, misshapen fruit, and blossom-end rot become apparent when day temperatures exceed 86°F and night temperatures exceed 72° F. Hot set tomatoes are better able to handle stressful growing conditions. So, many of the new cultivars such as 'Sun Leaper' set well under more difficult growing conditions.

Many new hot set tomato hybrids are introduced each year. As a grower, make a point to evaluate several of these new cultivars in your operation. Try growing a small plot 30 to 40 plants of each cultivars. If you are growing several crops, evaluate these cultivars with each new crop. In this way, you will get a clear idea of how well each of these new cultivars performs during several growing seasons under your management.

We evaluated several new hot set tomato hybrids during the summer of 1998 on three farms in Blount county. Seed was provided by Asgrow Seed Co., Novartis Seeds, Inc.–Rogers Brand, and the fresh-market tomato breeding program at North Carolina State University. Transplants were set in the field in the beginning of July. Average daily temperatures exceeded 90°F during July and most of August. Below are some observations concerning some of the best performing hybrids.

NC 96378 from N.C. State. NC 96378 produced firm red fruit that are uniform green and the pedicels are jointed. Fruit have a glossy finish with a deep red color. The blossom scars are small and pinpoint. Crown fruit set is above average producing mostly extra large to large sized fruit. Fruit were very uniform in size and shape. Plants were one week earlier than 'Solar Set.' Overall, the foliage cover is good, but not excessive.

NC 97295 from N.C. State. NC 97295 is a plum or Roma type of fresh-market tomato. The pedicels were jointed with uniform green fruit. Fruit shape was consistent and uniform. The fruit developed a deep red color and glossy finish. The fruit were firm with a pinpoint blossom end and very few fruit produced any noticeable nipples on the blossom end. The foliage cover was good and not excessive. The plant set a great deal of fruit and appears to be a heavy producer.

Solar Set from Asgrow Seed Co. Solar Set has been a standard for summer production from Baldwin to Blount County. Solar Set produces jointed pedicels, with uniform green fruit. In this test, the fruit set was good throughout the plant and fruit had smooth blossom scars with good fruit shape. Fruit ranged from extra large to large in size. Canopy cover was adequate but size was not as good as with NC 96378.

Florida 47 from Asgrow Seed Co. Florida 47 is fast becoming the standard in Florida. A few growers in South Alabama have tried it out. Florida 47 produces jointed pedicels, uniform green fruit with a good glossy finish. In this test, the crown set was fair to good. Florida 47 set fruit up throughout the plant. The canopy cover of Florida 47 is heavy compared to Solar Set, but not too excessive.

Sun Leaper from Novartis Seeds Inc. Sun Leaper produces smooth, glossy fruit with jointed pedicels. The blossom scars were small with fruit that were mostly extra large to large in size. Crown set was very good and continued throughout the plant. Good foliage cover. Overall, fruit size tended to be larger than any other hot-set tomato in this trial.

Suncrest from Novartis Seeds Inc. Suncrest produces jointed pedicels and fruit with green shoulders. The crown set of Suncrest was good but not as good as that of Sun Leaper and Florida 47. The foliage cover was good. The plant type was more vigorous than that of the other hot-set tomatoes above.

FT 6116 from Notaries Seeds Inc. FT 6116 is not yet commercially available but should be in the next few years. This hot-set tomato looked great. Fruit size was mostly extra large to large. Fruit were uniform green and pedicels were jointed. The crown set was above average. The blossom scars were very smooth. Fruit set was consistent throughout the plant. The plant type was similar to that of NC 96378–not too vigorous, but more than adequate.

A Comparison of Dumas-N and Kjeldahl-N for the Diagnosis of N Nutrition in Vegetables

Eric Simonne, Christine Harris, and Harry Mills

Foliar analysis is routinely used to assess the nutritional status of fast-growing vegetable crops and make fertilization recommendations. The nitrogen (N) status of a vegetable crop is one important aspect examined through foliar analysis to determine a crop's nutritional needs. The most common method for interpreting N status in vegetable crops is to compare the results of a N analytical assay to published (Kjeldahl N) sufficiency values. With recent advances in N analyzers, the Dumas method may replace the traditional Kjeldahl method for the routine diagnosis of N in plants. In addition, the protocol used to determine Kjeldahl N (Kn) involves acids and heavy metal catalysts, whereas the Dumas method does not. Kn recovers all the protein N, amino N, and an unknown fraction of nitrate N in the plant. In contrast, Dumas nitrogen (Dn; also referred to as combustion N) recovers all N fractions in the plant including protein, nitrate, and free amino acids. Since these two methods recover different N fractions, substantial numerical differences in N data may be observed between both analytical methods. If Dumas N data is interpreted with the presently used Kn-based thresholds, it is possible that these differences change the diagnostic of the N nutrition of that sample.

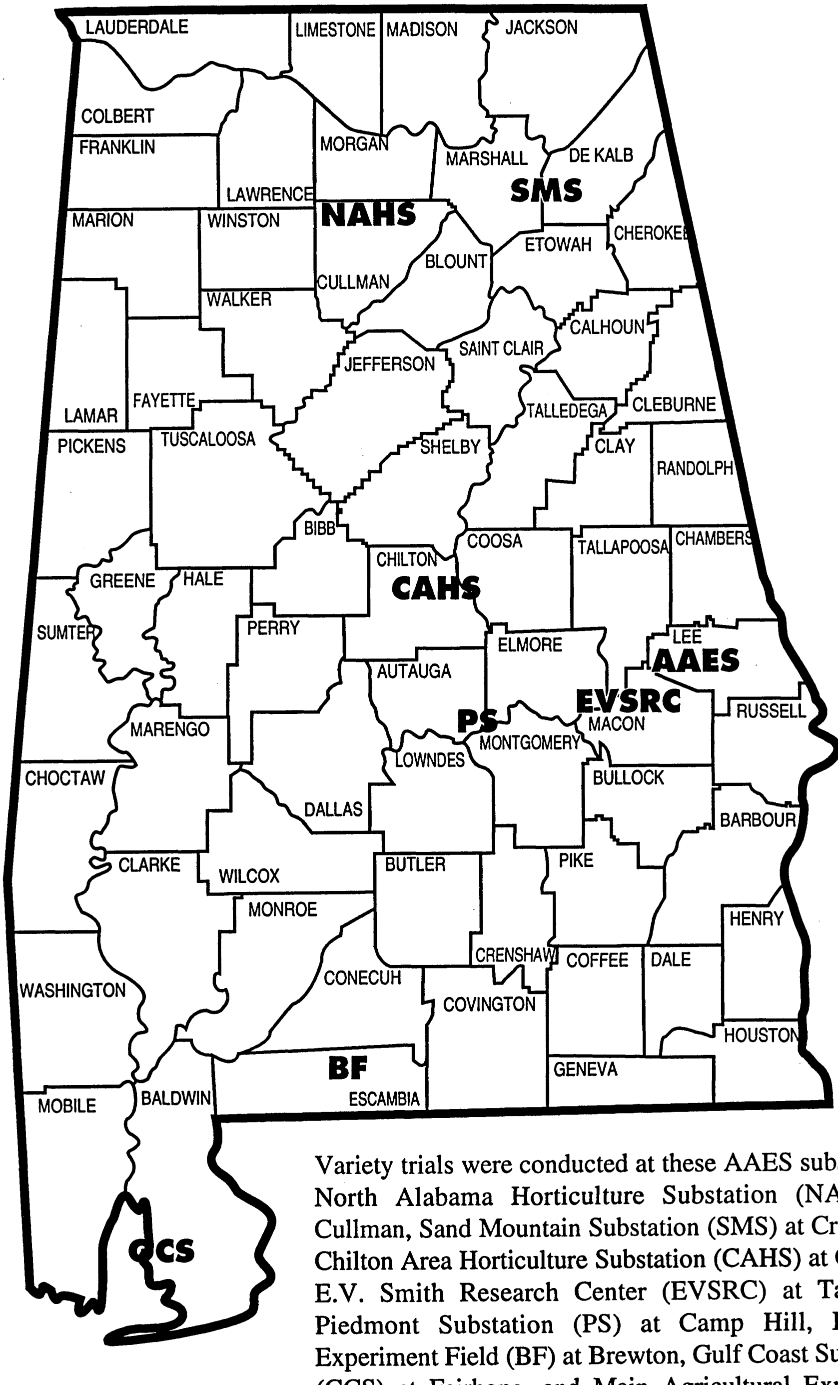
Because developing new threshold values for the interpretation of Dumas N data would be tedious and costly, several attempts have been made to estimate Kjeldahl N from Dn in plants, and then interpret the N nutrition with already published thresholds. Depending on crop type and main N form (nitrate or ammonium) in the fertilizer schedule, the N-NO3 fraction may represent up to 1.2% of the N in tissues of vegetables. Therefore, this study was conducted to (1) determine the Kn:Dn ratio for vegetable crops, and (2) evaluate the effect of the size of the NO_3 fraction on the Kn:Dn ratio.

Leaf samples were taken from vegetable variety trials conducted by the Alabama Agricultural Experiment Station at ten locations scattered throughout Alabama. Collectively, these locations are representative of a wide range of growing conditions and cultural practices. Kn, Dn, and nitrate-N were determined on approximately 130 samples representing most vegetable crops of economical importance in the Southeast (muskmelon, bell pepper, cucumber, eggplant, Irish potato, okra, sweet corn, summer squash, southern pea, sweetpotato, tomato, and watermelon).

Overall, Kn may be estimated from Dn with high confidence as Kn=0.75 Dn. As expected, Dn was numerically greater than or equal to Kn. On average, Kn only represented 75% of Dn. On a limited number of samples, however, Dn was less than Kn. This was attributed to analytical errors. Without any adjustments, the diagnosis of N nutrition using Dn data and Kn-based sufficiency thresholds will result in an over rating of the N nutrition. In such cases, samples may be rated 'excessive' when N level is in the upper part of the sufficiency range. Similarly, samples with N levels slightly below the sufficiency level (and actually within the hidden hunger range) may be diagnosed 'sufficient'.

Nitrate-N was poorly correlated with Kn - Dn or Kn/Dn, thereby suggesting that differences in Kn and Dn values of the same sample are not only due to the recovery rate of the nitrate-N fraction. These results suggest that when NO_3-N is not known (as in most routine samples), Kn may be estimated from Dn as Kn = 0.75 Dn. Growers should be aware of what methodology was used to determine N when reading and interpreting results of foliar analyses.

Location of Participating Research Units



Variety trials were conducted at these AAES substations: North Alabama Horticulture Substation (NAHS) at Cullman, Sand Mountain Substation (SMS) at Crossville, Chilton Area Horticulture Substation (CAHS) at Clanton, E.V. Smith Research Center (EVSRC) at Tallassee, Piedmont Substation (PS) at Camp Hill, Brewton Experiment Field (BF) at Brewton, Gulf Coast Substation (GCS) at Fairhope, and Main Agricultural Experiment Station (AAES) at Auburn. Without the commitment of the substation personnel, results presented in this report would not have been presented in a timely manner.