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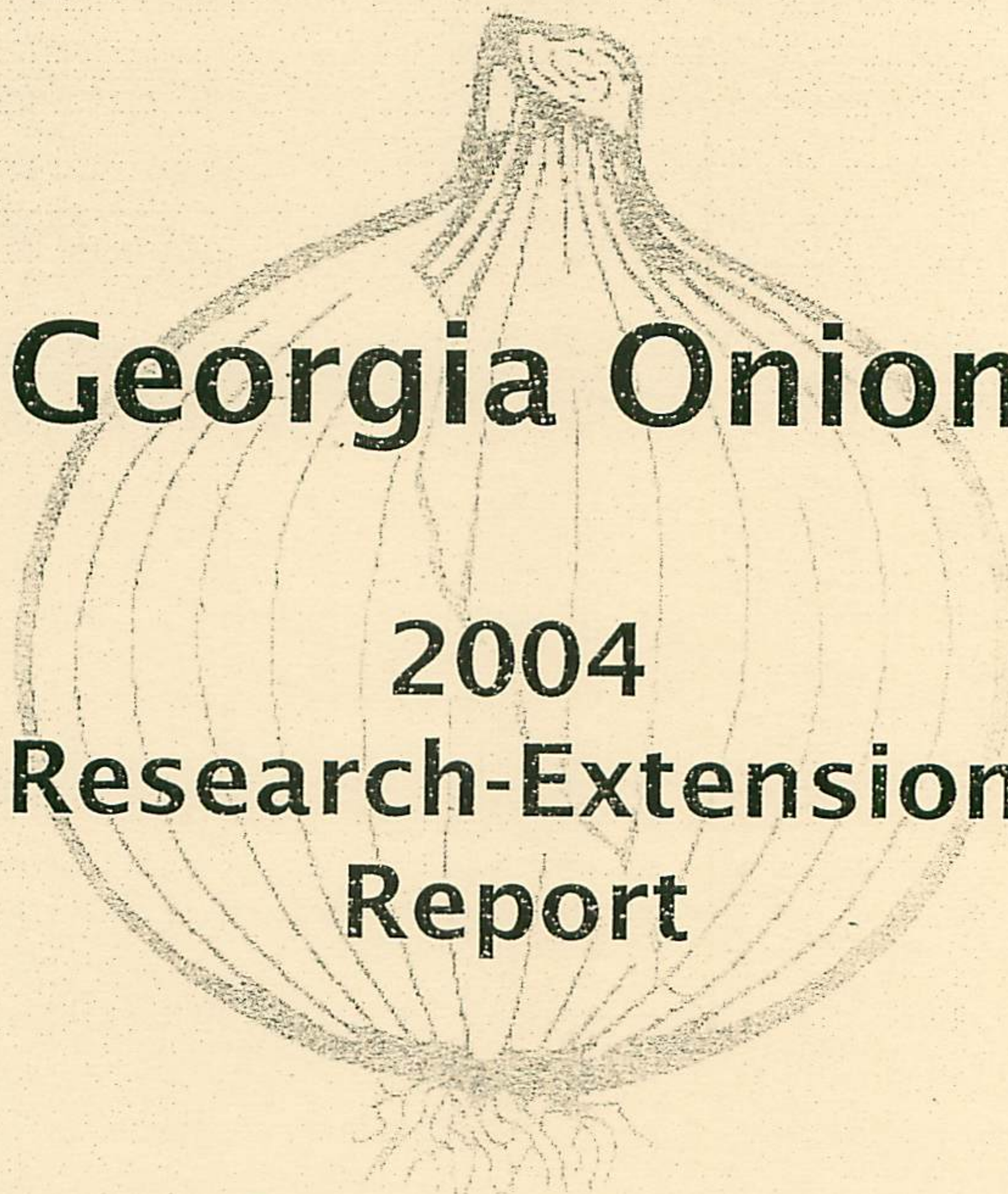

Georgia Onion

2004 Research-Extension Report

U.S. Department of Agriculture Cooperating
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2004 GEORGIA ONION RESEARCH - EXTENSION REPORT

(Summary Report of 2004 Data)

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Production costs supported by
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THE 2004 ONION RESEARCH-EXTENSION REPORT

Georgia's onion industry is primarily based upon the production of sweet onions, so called because of the mild pungency level and moderately high sugar level of varieties grown. Georgia's sweet onion industry is said to have originated on the farm of Moses Coleman, two miles East of Vidalia, more than 60 years ago. Mr. Coleman is given the credit of having observed the mild taste of some onions he had grown. It is reported that he sold a 50 pound bag for as much as $3.50. During 2004, growers in Georgia harvested over 14,500 acres of onions with an on farm value in excess of $88 million.

The University of Georgia and USDA/ARS, through Research and Extension programs, provide information on the production and handling of onions. The Onion Research-Extension Report is an official University of Georgia publication for conveying current information, either in the form of progress reports of research and demonstrations underway or reports of conditions in the field. Since the Onion Research-Extension Report is intended to convey current information, it should not be considered as a final authority containing peer reviewed manuscripts. The Onion Research-Extension Report may serve as a means of accountability to those who have supported the described programs. The Onion Research-Extension Report has been continuously edited and published since the first report, covering data gathered during 1992.

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VIDALIA ONION VARIETY TRIALS 2003-2004

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Introduction

Vidalia onion variety trials continue to be held at the Vidalia Onion and Vegetable Research Center in Lyons, GA. These trials are for the assessment of new and existing onion varieties as to their suitability for Vidalia onion production. Information generated, is used, in part, to make recommendations for the inclusion and exclusion of varieties from the official list of Vidalia onion varieties. Recommendations are forwarded to the Georgia Department of Agriculture, the final authority on the inclusion of varieties to be grown as Vidalia Onions.

Materials and Methods

Thirty-five varieties and 2 observational varieties were entered in this years trial. Seed were sown on September 15, 2003 in a high density planting (30-70 seed per linear foot) with a Monosem vacuum planter. Plants were lifted, 50% of the tops removed, and transplanted to their final spacing on November 17, 2003. Final spacing consisted of 4 rows set on raised beds formed on 6-ft centers. Rows were 12 inches apart with plants set 5.5 inches apart in-row. Fertilization, insect, disease, and weed control followed University of Georgia Cooperative Extension Service recommendations. Onions were irrigated as needed from a portable pipe overhead irrigation system.

The experimental design was a randomized complete block design with 4 replications. Each experimental unit consisted of the particular variety planted on 35 feet of bed. Seedstems and doubles were recorded from the entire 35 foot bed on April 2, 2004. Harvest began on April 5, 2004 and continued until May 10, 2004. There were a total of 6 harvest dates, April 5, 12, 19, 26, May 3 and 10, 2004. Twenty-five feet of each plot were harvested on the dates indicated and left in the field for two days prior to clipping and bagging. Weights were recorded in the field after clipping and bagging. Onions harvested from April 5-19 were heat cured for 48 hours at 95° F. Onions harvested from April 26-May 10 were not subjected to heat curing to minimize problems with warm weather bacterial diseases.

Harvested onions from each plot were graded into jumbo (≥ 3 inches) or medium (≥ 2 inches and < 3 inches) sizes and weighed. Finally, a ten bulb sample of jumbo onions from each experimental unit was combined and analyzed for pyruvate and soluble solids.

Results and Discussion

'XON-303Y' from Sakata Seed had the highest field weight at 1235 50-lb bags per acre (table 1). This was significantly greater than 'Southern Honey' or any variety with a lower field yield. The graded yield (jumbos & mediums) for 'XON-303Y' was only 65% of the field yield.

The highest yielding variety for jumbo yields was 'WI-3115' with 1005 50-lb bags per acre which was significantly better than 72766DY or any other variety with lower jumbo yields. 'WI-3115' had 86% of its field yield marketable.

Seedstems were particularly problematic this year because of cool temperatures in March followed by warmer temperatures. This, coupled with larger plants can trigger flowering. Although ambient environmental conditions are an important factor towards seedstem formation, variety does play a role. Doubles are also affected by the environment, particularly adverse growing conditions that influence the growing point, resulting in more than one bulb. Seedstems ranged from 0-123 per plot with 'Sweet Vidalia' having the largest number of seedstems and 'XON-303Y' having none. For doubles the range was 1-112 per plot. D. Palmer Seed had many of their entries with high numbers of doubles. 'Pegasus', 'Century', 'Exp. Yel. Granex 15094' and 'SRO 1001' all averaged 1 double per plot.

Pyruvate analysis ranged from 3.0-4.6 umol/gfw, somewhat higher than in some years, but within the expected range for Vidalia onions. Soluble solids, the percentage of sugar, ranged from 7.6-10.2, higher than normally seen in onions.

Summary and Conclusions

Overall, the trials went well this year with few problems. Greater than average seedstems and doubles were experienced, resulting from cool weather in March. It is stressed that care should be exercised when interpreting a single year's data.

Table 1. Vidalia Onion Variety Trial 2003-2004.

Entry	Company	Evaluated 4/2/04 Doubles	Evaluated 4/2/04 Seedstems	Harvest Date	Field Weight (50-lb bags/Acre)	Jumbos (50-lb bags/Acre)	Mediums (50-lb bags/Acre)	Pyruvate (um/gfw)	Soluble Solids (%)
XON-303Y	Sakata	4	0	5/10/04	1235	787	10	4.5	7.7
Exp. Yel. Granex 15082	Dessert Seed	4	10	5/10/04	1229	623	7	3.7	8.2
SRO 1001	Sunseeds	1	11	5/10/04	1206	758	8	3.0	8.1
Century	Seminis	1	4	5/10/04	1198	638	4	3.9	8.6
WI-3115	Wannamaker	20	3	4/12/04	1174	1005	8	3.4	8.2
XON-204Y	Sakata	9	21	5/3/04	1164	785	10	4.3	9.2
WI-609	Wannamaker	19	9	4/19/04	1149	677	8	3.0	8.7
Exp. Yel. Granex 15094	Dessert Seed	1	21	5/10/04	1101	485	8	3.7	8.4
DPS 1318	D. Palmer Seed	35	48	5/10/04	1060	536	16	3.5	8.5
Ohoopee Sweet	D. Palmer Seed	91	90	5/10/04	1043	426	26	4.3	8.6
Southern Honey	D. Palmer Seed	112	121	5/10/04	981	417	31	3.4	8.9
Pegasus	Seminis	1	12	5/10/04	979	329	6	4.2	9.0
XON-202Y (99C 5092)	Sakata	3	11	5/10/04	976	426	10	3.8	8.5
XON-203Y (01ZG 5034)	Sakata	5	60	4/26/04	929	683	10	3.6	9.0
Rosali (Red)	Bejo	44	29	5/10/04	923	374	22	3.4	9.1
Granex EM90	Clifton Seed	2	61	5/10/04	918	414	5	4.1	8.1
Exp. Yel. Granex 15085	Dessert Seed	2	109	5/10/04	917	356	8	3.4	7.6
SSC-1600	Shamrock	8	9	4/12/04	916	767	16	4.0	10.0
WI-129	Wannamaker	39	12	4/5/04	908	704	39	3.8	8.4
SSC 1535	Shamrock	8	7	4/12/04	899	781	26	4.2	10.0
606DY	Shaddy	4	4	4/5/04	878	683	21	3.8	8.3
SSC 33076	Shamrock	3	3	4/5/04	858	778	22	3.6	8.5
Sapelo Sweet	D. Palmer Seed	58	45	5/3/04	857	566	21	4.3	8.9
DPSX 1290	D. Palmer Seed	55	108	5/10/04	810	342	15	3.5	8.9
72766DY	Shaddy	20	5	4/5/04	804	742	27	3.6	8.5
Cyclops	Seminis	4	18	5/3/04	801	443	14	3.6	8.6
Mr Buck	D. Palmer Seed	19	52	5/3/04	800	391	19	4.5	8.7

Georgia Boy	D. Palmer Seed	99	91	5/3/04	754	339	42		
Granex 33	Seminis	3	35	5/3/04	734	371	12	4.6	8.8
Exp. Yel. Granex 34140	Dessert Seed	2	55	5/10/04	702	391	19	4.0	7.8
Savannah Sweet	Seminis	12	38	5/3/04	699	391	21	4.3	8.1
Granex Yellow PRR	Seminis	5	38	5/3/04	678	419	19	4.1	9.3
SSC 6371 F1 (Sugar Belle)	Shamrock	5	4	4/19/04	631	463	18	4.3	10.2
SSC 6372 F1	Shamrock	12	97	5/3/04	564	313	8	4.2	10.1
Sweet Vidalia	Sunseeds	24	123	5/3/04	433	199	22	3.5	8.1
	CV	32%	28%		15%	26%	53%	12%	5%
	Fisher's Protected LSD (p=0.05)*	5	8		252	259	16	0.8	0.8
Observational									
Tsubame	Yae Nogei Co.	7	58	4/19/04	1096	747	6		
Nozomi	Yae Nogei Co.	3	5	4/19/04	1185	978	11		

*Bonferonni adjustment for 5 comparisons.

EVALUATION OF GRANO ONION VARIETIES

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Introduction

Onion varieties grown in the Vidalia region are required to be Granex short-day overwintering onions. However, outside the Vidalia region, other types and varieties may be grown, even in south Georgia. Onions of different colors and types, such as the Grano, are attracting interest to be grown without the Vidalia name. An experiment was conducted to evaluate Grano onion varieties to be grown in South Georgia, outside the Vidalia region.

Materials and Methods

On September 15th, 2003, seed was sown using a high density planting (30-70 seed per linear foot) using a Monosem vacuum planter. Plants were lifted, 50% of the tops removed, and transplanted to their final spacing on November 24, 2003. Final spacing consisted of 4 rows set on raised beds formed on 6-ft centers. Rows were 12 inches apart with plants set 5.5 inches apart in-the-row. Fertilization, insect control, disease control and weed control followed University of Georgia Cooperative Extension Service recommendations. The experimental design was a randomized complete block design with 4 replications. Each experimental unit consisted of the particular variety planted on 10 feet of bed. Onions were harvested on May 6 or 13, 2004, based on maturity. Field yield and graded yield were recorded. Graded yield consisted of jumbos (≥ 3 in.) and mediums (≥ 2 in. & < 3 in.).

Results and Discussion

Higher total yield occurred among varieties harvested on the later harvest date with 'EX 07593001' and 'Don Victor' having the highest field yields (table 1). Both of these entries also had the highest yield of jumbos with 'Don Victor' having a higher percentage of marketable yield. 'Sherita' had the poorest overall yield with 32.7 lbs/plot field yield and 17.6 lbs/plot jumbos.

Summary and Conclusions

Several of these varieties would be suitable for production in south Georgia. Grano varieties tend to be a rounder onion then Granex, yet are also prone to having torpedoes (length greater than width). 'Mata Hari' and 'Arizona Sunset' are both red short-day onions. These onions also tend to be later maturing under our production practices (mid-winter transplanting) compared with traditional Granex onions.

Table 1. Yield, harvest date and percentage marketable onions for Grano onion varieties

Entry	Company	Field Yield (lbs/plot)	Jumbos (lbs/plot)	Mediums (lbs/plot)	Harvest Date	Percent Marketable
EX 07593001	Seminis	93.9	62.0	0.4	5/13/04	66%
Don Victor	Sunseed	91.9	76.6	0.2	5/13/04	84%
Nikita	Sunseed	77.1	47.8	0.4	5/13/04	63%
Sweet Magnolia	D. Palmer Seed Co.	75.4	31.4	0.6	5/13/04	42%
Linda Vista	Seminis	75.3	38.4	0.5	5/13/04	52%
Mata Hari	Sunseed	73.8	43.6	0.7	5/13/04	60%
Pumba (DPSX 1029)	D. Palmer Seed Co.	70.5	36.0	0.0	5/13/04	51%
Chula Vista	Seminis	65.5	50.8	0.5	5/13/04	78%
Safari	Sunseed	65.0	54.3	1.2	5/6/04	85%
Sweet Sunrise	Sunseed	63.5	48.7	0.8	5/13/04	78%
Texas Grano 1015Y	Seminis	63.2	39.7	0.1	5/13/04	63%
Prowler	Sunseed	60.7	53.4	2.2	5/6/04	92%
Timon	D. Palmer Seed Co.	60.4	48.1	1.3	5/6/04	82%
Arizona Sunset	D. Palmer Seed Co.	52.2	37.0	2.2	5/6/04	75%
Sherita	D. Palmer Seed Co.	32.7	17.6	4.2	5/6/04	67%
	CV	10%	23%	75%		
	Fisher's Protected LSD ($p \leq 0.05$)	9.3	14.7	1.1		

EVALUATION OF FERTILITY TREATMENTS FOR VIDALIA ONION PRODUCTION

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Introduction

Vidalia onions are an important crop for southeast Georgia, with an estimated farm gate value of $88 million (Georgia Agricultural Statistics Services, 2004). However, not only are the onions of high value, they are expensive to produce. Part of the total cost of production comes from fertilizer coupled with the cost of application. A typical protocol for onion production from transplanting to harvest would involve applying fertilizer six times, resulting in approximately 130-160-130 lbs per acre of N, P, and K with an additional 60 lbs per acre of S.

Recent research suggests that the amount of P and K required by the crop is considerably less than previously thought. With this in mind, the recommended rates for both P and K based on soil testing have been halved compared with previous recommendations. This experiment was designed to validate existing nitrogen fertilizer rates, new recommendations of P and K, and to evaluate a slow-release liquid 30-0-0 fertilizer.

Materials and Methods

Based upon traditional recommendations, the soil test called for 150-40-180-60 lbs/acre of N-P-K-S, which was used as the baseline for planning the experiment. There were 16 treatments in this experiment, arranged in a randomized complete block design with 4 replications. Each experimental unit was a 6 x 20 ft plot, prepared as raised beds on 6 ft centers and planted with 4 rows of onions per bed, 12 in. between-rows and 5.5 in. within the row. Variety Sweet Vidalia was planted on November 25, 2003. Fertilizer was applied on December 8. 2003, January 6 & 26 and February 24, 2004.

Table 1 lists the treatments, dates of application, fertilizer rates, and total amount of nitrogen, phosphorus, potassium, and sulfur applied per acre. Treatments 10 and 11 list the actual equivalent amounts applied per acre for the respective products (table 1). Nitrogen and potassium applications were split into three equal applications and sulfur was applied in two equal applications unless otherwise noted.

Treatments 1-9 represented different rates of nitrogen from 0-300 lbs/acre. Treatment 10 represented a traditional fertilizer application, applying 147N-169P-150K-90S with 5-10-15 (9% S), diammonium phosphate (DAP, 18-46-0), and $CaNO_3$ (15.5-0-0). Treatment 11 applies 140N-80P-80K-96S with 10-10-10 (12% S) and $CaNO_3$.

Treatments 12-14 represented applications of a slow release 30-0-0 liquid fertilizer at different dates of application. Treatment 15 represented 150 lbs/acre nitrogen with no phosphorus or potassium. Finally, treatment 16 represented 150N-100P-90K-60S.

Onions from this experiment were harvested on May 4, 2004 and were weighed in the field after the tops and roots were removed. These onions were then graded into size classes of jumbo (≥3 in.) or mediums (≥2 and <3 in.).

Results and Discussion

Field yields ranged from just over 20 lbs/plot to almost 100 lbs/plot among treatments 1-9 (figure 1). The highest yield of 99.8 lbs/plot for the 200 lbs/acre nitrogen rate did not differ from the yield of 125 lbs/acre rate, confirming previous research that rates of 125-150 lbs/acre nitrogen should be sufficient to produce onions from transplants. Jumbo yields did not show a significant loss from the highest yield (150 lbs/acre N) until treatment 3 with 50 lbs/acre nitrogen.

Treatments 10 and 11 received a fertilizer application on December 8, 2003, within 2 weeks of transplanting, while all other treatments did not receive their first fertilizer application until January 6, 2004. The onions of these two treatments appeared healthier during December and into January than the onions of treatments 1-9, which may partly explain the higher yields of treatment 11, although treatment 10 did not perform any better than other treatments which received adequate nitrogen.

Liquigreen 30-0-0 responded well in comparison with other treatments. Treatment 14, having applications on the first and third application dates, had a field yield of 123.4 lbs/acre, which was significantly better than the other Liquigreen treatments suggesting that splitting the application may be helpful.

Applying only nitrogen (treatment 15) did not change the results compared with treatments 10, 12, 13, or 16, but treatment 15 was lower in yield, than treatments 11 or 14 . Previous research has hown that phosphorus and potassium applications don't have much influence on onion yield compared with nitrogen. These results are mirrored in the jumbo yields as well.

Summary and Conclusions

Based upon previous research and reinforced in this experiment, phosphorus and potassium are not as important as nitrogen in onion production. Slow release fertilizers such as Liquigreen and Meister (previous experiments) may offer an alternative for growers by allowing the number of applications to be only 1 or 2 compared with multiple applications. This experiment and previous research has led to changes in soil test recommendations in which the phosphorus and potassium recommendations have been halved.

References

Georgia Agricultural Statistics Service, 2004. Onions-Spring season by States, 2003 and 2004. GASS, Georgia Farm Report, Vol 04(09):3.

Table 1. Experimental treatments, date of application, rate, and amount of N, P, K, S applied.

Number	Treatment	Application Date	Application Rate (lbs/acre)	N-P-K-S per acre
1	0 N	1/6/04	40 lbs P, 60 lbs K, 30 lbs S	0N-40P-180K-60S
		1/26/04	60 lbs K, 30 lbs S	
		2/24/04	60 lbs K	
2	25 N	1/6/04	8.3 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	25N-40P-180K-60S
		1/26/04	8.3 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	8.3 lbs N, 60 lbs K	
3	50 N	1/6/04	16.7 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	50N-40P-180K-60S
		1/26/04	16.7 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	16.7 lbs N, 60 lbs K	
4	75 N	1/6/04	25 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	75N-40P-180K-60S
		1/26/04	25 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	25 lbs N, 60 lbs K	
5	100 N	1/6/04	33.3 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	100N-40P-180K-60S
		1/26/04	33.3 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	33.3 lbs N, 60 lbs K	
6	125 N	1/6/04	41.7 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	125N-40P-180K-60S
		1/26/04	41.7 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	41.7 lbs N, 60 lbs K	
7	150 N	1/6/04	50 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	150N-40P-180K-60S
		1/26/04	50 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	50 lbs N, 60 lbs K	
8	200 N	1/6/04	66.7 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	200N-40P-180K-60S
		1/26/04	66.7 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	66.7 lbs N, 60 lbs K	
9	300 N	1/6/04	100 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	300N-40P-180K-60S
		1/26/04	100 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	100 lbs N, 60 lbs K	
10*	Old Standard	12/8/03	400 lbs 5-10-15 (9% S) & 150 lbs DAP	147N-169P-150K-90S
		1/6/04	400 lbs 5-10-15 (9% S)	
		1/26/04	200 lbs 5-10-15	
		2/24/04	450 lbs $CaNO_3$	

11*	New Standard	12/8/03	400 lbs 10-10-10 (12%S)	140N-80P-80K-96S
		1/6/04	400 lbs 10-10-10 (12%S)	
		1/26/04	225 lbs $CaNO_3$	
		2/24/04	225 lbs $CaNO_3$	
12	Liquid 30-0-0 (1 application)	1/6/04	150 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	150N-40P-180K-60S
		1/26/04	60 lbs K, 30 lbs S	
		2/24/04	60 lbs K	
13	Liquid 30-0-0 (2 applications)	1/6/04	75 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	150N-40P-180K-60S
		1/26/04	75 lbs N, 60 lbs K, 30 lbs S	
		2/24/04	60 lbs K	
14	Liquid 30-0-0 (2 applications.)	1/6/04	75 lbs N, 40 lbs P, 60 lbs K, 30 lbs S	150N-40P-180K-60S
		1/26/04	60 lbs K, 30 lbs S	
		2/24/04	75 lbs N, 60 lbs K	
15	150 N no P or K	1/6/04	50 lbs N, 30 lbs S	150N-0P-0K-60S
		1/26/04	50 lbs N, 30 lbs S	
		2/24/04	50 lb N	
16	High P, Low K	1/6/04	50 lbs N, 100 lbs P, 30 lbs K, 30 lbs S	150N-100P-90K-60S
		1/26/04	50 lbs N, 30 lbs K, 30 lbs S	
		2/24/04	50 lbs N, 30 lbs K	

*Application rates are actual equivalent amounts per acre of the respective product.

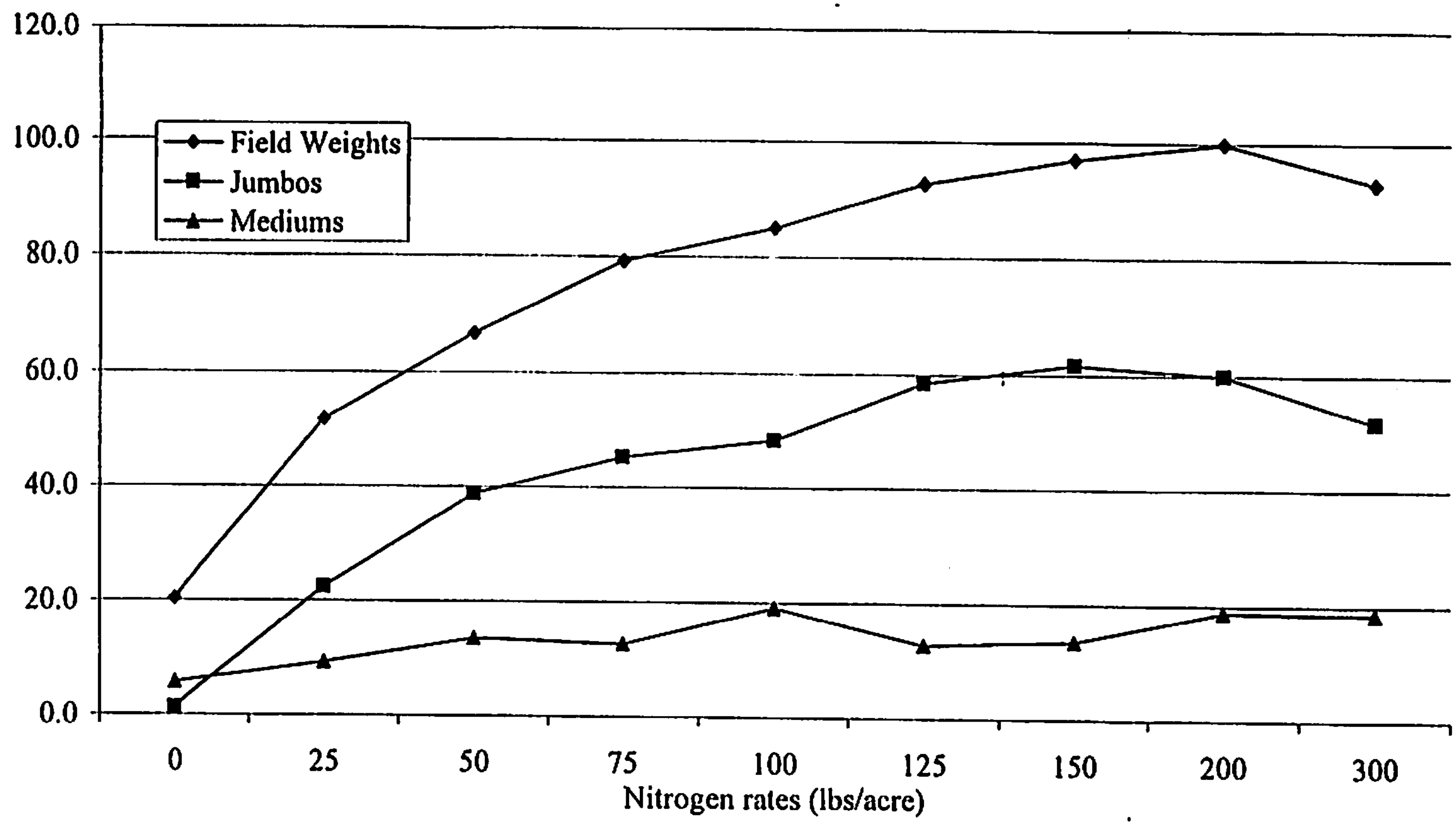

Figure 1. Effect of nitrogen rates among treatments 1-9 for field weights, jumbos, and mediums.

Table 2. Field yield, jumbos, and mediums for treatments 10-16.

Number	Treatment	Field Yield (lbs/plot)	Jumbos (lbs/plot)	Mediums (lbs/plot)
10	Old Standard	94.6	51.0	7.7
11	New Standard (10-10-10 & $CaNO_3$)	128.1	83.1	10.6
12	Liquigreen (30-0-0) 1 appl.	105.9	59.7	19.2
13	Liquigreen (30-0-0) 2 appl.	104.6	67.2	15.2
14	Liquigreen (30-0-0) 2 appl.	123.4	83.5	14.7
15	150 N (no P or K)	98.7	55.9	18.0
16	High P, Low K	101.0	55.0	17.6
	CV	13%	25%	27%
	Fisher's Protected LSD (p=0.05)	17.0	19.0	5.4

EVALUATION OF FERTILIZATION OF DIRECT SEEDED VIDALIA ONIONS

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Introduction

Approximately 25 years ago both the direct seeding and transplanting of Vidalia onions were about equally used (Dave Pickenpaugh, Incotec, Inc., personal communication). Then in the early '1980s, two years of single digit freezes resulted in greater damage to direct seeded onions compared with transplanted onions. As a result, the industry quickly adopting transplanting as the primary means of production. Yet, a review of the historical low temperatures for this region show those two low temperature events to be the only such events in the past 75 years.

Research over the last several years has shown that the direct seeding Vidalia onions can be accomplished by using a planting date around October 15th, using coated seed and using a good planter for insuring singulation. However, the exact quantity of fertilizer to use and the timing of application are still unknown.

Current Vidalia onion production uses about 100-130 lbs/acre of nitrogen for transplant production and 125-150 lbs/acre for dry bulb onion production after transplanting. In Texas, it is recommended that approximately 150 lbs/acre of nitrogen are applied from seeding to harvest. Texan recommendations call for an application of 25-40 lbs/acre nitrogen prior to seeding along with all the recommended phosphorus and potassium. After seeding it is recommended to apply equal amounts of nitrogen every 3 weeks, up to 45 days prior to harvest. An experiment was undertaken to investigate the amount, type and timing of fertilizer for direct seeded Vidalia onions.

Materials and Methods

This experiment was arranged in a randomized complete block design with varieties 'Savannah Sweet' and 'Granex Yellow PRR' in eight treatments. All plots had 800 lbs/acre of 5-10-15 with 9% sulfur applied preplant incorporated. This resulted in 40-80-120-72 lbs/acre of N-P-K-S. Weed, disease and insect control followed University of Georgia Cooperative Extension Service recommendations.

Treatments are listed in table 1. Intermittent treatments had no fertilizer applied during December and January compared with the continuous treatments. The standard treatment included materials and applications common to the Vidalia region. This included 5-10-15, $CaNO_3$, and di-ammonium phosphate (DAP, 18-46-0).

Seedstem numbers were recorded on April 22, 2004 and onions were harvested on May 11, 2004. Weights were recorded in the field after tops and roots were removed. Onions were then graded into jumbos (≥3 in.) and mediums (≥2 in. and <3 in.). The rationale for the chosen treatments were to determine an optimum fertility regimen for Vidalia onions. Since we use approximately 130 lbs/acre nitrogen to produce transplants and another 150 lbs/acre to produce dry bulb onions, it was felt the 150 lbs/acre recommended by Texas may be too little for the Vidalia area, therefore the 195 lbs/acre nitrogen rate was included. In the past, seedstems have been a particular problem with direct seeded onions, especially when the onions were seeded in September. The intermittent fertilizer application was an attempt to slow growth during the winter so that plants would be smaller in the spring reducing the chance of high seedstem numbers.

DAP in the has been a commonly applied fertilizer, being applied particularly during cooler winter months. Although most cultivated soils in southeast Georgia are high in phosphorus, there is a response to DAP application with evidence of top growth. 10-10-10 with 12% sulfur, 5-10-15, and $CaNO_3$ are all commonly used fertilizers.

Results and Discussion

There were no differences between the yields for any of the treatments listed suggesting that onion could be produced from seed in the Vidalia area with 150 lbs/acre nitrogen, which is similar to recommendations for Texas onions. The 2004 season generally had a high number of seedstems because of cool weather in March and this is reflected in all the treatments, but there were no differences between treatments indicating that reduced fertilizer applications mid-winter do not have an effect upon reducing the number of seedstems.

Summary and Conclusions

In conclusion, the results of this study are encouraging in that they indicate 150 lbs/acre nitrogen with all phosphorus and potassium applied preplant are adequate for direct seeded onion production and fertilizer timing is not critical for controlling seedstems. This experiment will be repeated to further validate these results.

Table 1. Treatment list with application date and material.

Number	Treatment	Date	Amount/acre & material
1	Texas (continuous) 195 lbs N	11/18/03	25 lbs N ($CaNO_3$)
		12/8/03	25 lbs N ($CaNO_3$)
		1/6/03	25 lbs N ($CaNO_3$)
		2/2/04	27 lbs N ($CaNO_3$)
		2/23/04	27 lbs N ($CaNO_3$)
		3/15/04	26 lbs N ($CaNO_3$)
2	Texas (intermittent) 150 lbs N	11/18/03	25 lbs N ($CaNO_3$)
		2/2/04	28 lbs N ($CaNO_3$)
		2/23/04	28 lbs N ($CaNO_3$)
		3/15/04	29 lbs N ($CaNO_3$)
3	Texas (intermittent) 195 lbs N	11/18/03	40 lbs N ($CaNO_3$)
		2/2/04	38 lbs N ($CaNO_3$)
		2/23/04	38 lbs N ($CaNO_3$)
		3/15/04	39 lbs N ($CaNO_3$)
4	Standard 150 lbs N	11/18/03	25 lbs N (DAP)
		2/2/04	43 lbs N (5-10-15)
		2/23/04	42 lbs N ($CaNO_3$)
5	DAP 150 lbs N	11/18/03	25 lbs N (DAP)
		12/8/03	25 lbs N (DAP)
		2/2/04	20 lbs N (DAP)
		2/23/04	20 lbs N (DAP)
		3/15/04	20 lbs N (DAP)
6	10-10-10 (intermittent) 195 lbs N	11/18/03	40 lbs N (10-10-10)
		2/2/04	38 lbs N (10-10-10)
		2/23/04	38 lbs N (10-10-10)
		3/15/04	39 lbs N (10-10-10)
7	10-10-10 (intermittent) 150 lbs N	11/18/03	25 lbs N (10-10-10)
		2/2/04	28 lbs N (10-10-10)
		2/23/04	28 lbs N (10-10-10)
		3/15/04	29 lbs N (10-10-10)
8	10-10-10 (continuous) 150 lbs N	11/18/03	25 lbs N (10-10-10)
		12/8/03	25 lbs N (10-10-10)
		1/6/03	25 lbs N (10-10-10)
		2/2/04	12 lbs N (10-10-10)
		2/23/04	12 lbs N (10-10-10)
		3/15/04	11 lbs N (10-10-10)

Table 2. Treatment field yield, jumbos, mediums, and seedstems.

Number	Treatment	Field Yield (lbs/plot)	Jumbos (lbs/plot)	Medium (lbs/plot)	Seedstems (No./plot)
1	Texas (continuous) 195 lbs N	109.7	101.1	5.3	10
2	Texas (intermittent) 150 lbs N	156.8	110.0	5.8	14
3	Texas (intermittent) 195 lbs N	138.7	108.4	5.1	16
4	Standard	165.3	115.6	7.3	7
5	DAP 150 lbs N	140.7	104.7	7.5	14
6	10-10-10 (intermittent) 195 lbs N	142.2	114.9	4.8	21
7	10-10-10 (intermittent) 150 lbs N	147.0	115.3	4.7	29
8	10-10-10 (continuous) 150 lbs N	144.8	115.4	4.5	10
	CV	26%	11%	37%	40%
	Fisher's Protected LSD ($p \leq 0.05$)	NS	NS	NS	NS

TRANSPLANT DATE EFFECT ON YIELD OF VIDALIA ONIONS

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Introduction

Onion production in the Vidalia growing region primarily relies on a transplanted crop. Onion seed is sown in mid-to-late September in high density plantings. Transplants are then taken to their final spacing beginning around 8 weeks later. Because of weather conditions, the availability of labor and other logistical problems, transplanting can extend over a long period, well after the first of the year. An experiment was designed to determine the effect of date of transplanting upon onion yield.

Materials and Methods

Onion seed of variety Sweet Vidalia was sown on September 15, 2003 in high density plantings. University of Georgia Cooperative Extension Service recommendations for transplant production were followed. Transplanting began on November 5, 2003 and continued approximately every 2 weeks until March 15, 2004 for a total of 10 planting dates. The experiment was arranged in a randomized complete block design with 4 replications. Onions transplanted on the first 5 planting dates were harvested on April 28, 2004. Onions transplanted on January 20 to March 2, 2004 were harvested on May 11, 2004. Onions transplanted on March 15, 2004 were not harvested.

Results and Discussion

The highest field yield occurred with onions transplanted on 11/24/03, which did not differ from onions transplanted on 12/22/03 or 1/20/04, but interestingly did differ from onions transplanted on 12/8/03 and 1/5/04 (table 1).

Onions transplanted on 11/5/03 had field yields significantly lower than onions transplanted on 11/24/03. This probably represents transplants that are somewhat immature for optimum yield having been grown for only 7 weeks prior to transplanting.

All onions transplanted after 1/20/04 had significantly lower field yields compared with the highest yields. This suggests that onions can be transplanted up to the end of January with a reasonable expectation of producing economic yields. These results are borne out with jumbo yields following a similar pattern to field yields. Mediums showed an increase in yield with later harvests as would be expected since they did not have sufficient time to develop.

Table 1. Field yield, jumbos, and mediums for various transplant dates.

Transplanting Date	Field Yield (lbs/plot)	Jumbos (lbs/plot)	Mediums (lbs/plot)
11/5/03	71.1	48.6	1.6
11/24/03	98.1	70.8	4.6
12/8/03	66.4	42.3	9.5
12/22/03	83.7	57.0	6.7
1/5/04	51.7	20.6	14.9
1/20/04	95.0	57.8	9.4
2/2/04	69.1	26.0	15.5
2/19/04	45.9	10.3	16.4
3/2/04	29.2	0.6	14.6
3/15/04		No Harvest	
CV	17%	24%	28%
Fisher's LSD ($p \leq 0.05$)	16.9	13.1	4.3

THE EFFECT OF ONION TRANSPLANT SIZE ON SEEDSTEMS

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Introduction

Vidalia onion production is a labor intensive undertaking which normally involves the production of field grown transplants in high-density plantings. These are transplanted mid-winter to their final spacing. Fifty percent of the tops are removed prior to transplanting to reduce transplant shock and to encourage a more uniform stand. There can be a tremendous difference in transplant diameter ranging from 0.25 inch or less to 1.0 inch with some swelling of the base.

Normally transplants are harvested, bundled, tops removed and reset with no thought given to transplant size. A study was undertaken to assess differences in transplant size and its effect upon yield and upon seedstems of onions.

Materials and Methods

In the 2002-2003 season 'Granex 33' onion transplants were visually graded into 3 size classes, small, medium and large, Small onion transplants had a stem diameter of approximately 1/8-3/8 inch. Medium onion transplants had a stem diameter of approximately 3/8-5/8 inch, and large onion transplants had a stem diameter of approximately 5/8 inch or larger, often with noticeable swelling of the base. These onions were transplanted on December 18, 2002 onto raised beds formed with 6 ft between bed centers. Four rows of onions were transplanted onto these beds with a 12 inch between-row spacing and a 5.5 inch in-row spacing. Onions were grown following University of Georgia Cooperative Extension Service recommendations for fertility, disease, insect, and weed control. The experiment was arranged in a randomized complete block design of 4 replications.

Individual plots consisted of 5 ft of bed as described above. Seedstem counts were made on April 25, 2003 and onions were harvested on May 19, 2003. Harvested onions were weighed immediately in the field after tops and roots had been removed. They were also graded into two size classes, jumbos (≥3 inches) and mediums (≥2 inches and <3 inches). In the 2003-2004 season, the experiment was arranged as in the previous season. Plot size was larger at 10 ft and variety 'Sweet Vidalia' was used. Onions were transplanted on December 3, 2003. Seedstems were counted on April 22, 2004 and onions were harvested and graded as described above on May 11, 2004.

Results and Discussion

The results of the study are listed in table 1. In both 2003 and 2004 the larger the transplant size the greater the number of seedstems. In 2003 there were no differences in harvest yield, jumbos or mediums between the treatments. In 2004, the large and medium sized transplants had a significantly greater harvest yield compared with the small transplants. In addition, the yield of medium onions was greater from the large transplants compared with the yield from the small or medium sized transplants.

Summary and Conclusions

Based upon this study, transplant size appears to have an effect upon seedstem formation. Seedstem formation can be particularly problematic in some years. Usually years with cool weather in March followed by warm weather results in significant numbers of seedstems. The effect of transplant size on yield however is inconclusive. It is unclear if growers will find grading transplants a cost effective method of controlling seedstems or whether a practical method of grading large numbers of transplants is possible.

Table 1. Graded transplant effect on yield and number of transplants

Graded Size	Harvest Yield (lbs/plot)	Jumbos (lbs/plot)	Mediums (lbs/plot)	Seedstems (No.)
	2003			
Small	17.1	6.6	7.0	4
Medium	18.9	9.3	7.4	14
Large	17.7	7.9	6.5	19
P>F	0.835	0.313	0.777	0.039
	2004			
Small	45.0	36.4	1.0	2
Medium	63.2	45.4	1.3	6
Large	64.1	39.3	3.0	22
P>F	0.002	0.137	0.030	0.000

EVALUATION OF POULTRY LITTER AS A FERTILIZER FOR ORGANIC ONION PRODUCTION

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Introduction

Organic Vidalia onion production is a new undertaking for Georgia growers with very little information about production being available. The market demand for organic Vidalia onions has resulted in several growers attempting to produce this crop under the USDA guidelines for certified organic production. An experiment was conducted to determine the optimum level of poultry litter for dry bulb onion production.

Materials and Methods

Beds were prepared as for conventional production with a clean cultivation. Approximately 4-6 inches of compost was rototilled into the site prior to final bed preparation. Organically produced transplants of 'EM 90' were transplanted on December 3, 2003 onto raised beds prepared on 6 ft centers. Beds were planted with 4 rows each 12 in. apart with a 5.5 in. in-row spacing. Each plot was 20 ft long. Treatments consisted of 2, 4, or 8 tons/acre poultry litter, one half being applied on January 20, 2004 and the second half being applied on March 9, 2004. The experiment was arranged in a randomized complete block experiment with 3 replications. No pesticides were applied and weeds were controlled by hand weeding when necessary. Onions were harvested on May 6, 2004 and allowed to field dry until May 11, 2004 at which time the tops and roots were removed and the onions weighed. They were then graded into jumbos (≥3 in.) and mediums (≥ 2 in. and < 3 in.).

Results and Discussion

There were no statistical differences among the yield parameters tested. This was due to a high degree of variability across replications. However, the data suggests that future studies should concentrate on poultry litter rates of 4 tons/acre and higher in order to produce economic yields.

Table 1. Rates of poultry litter effect on onion yield.

Treatments (tons/acre)	Field Yield (lbs/plot)	Jumbos (lbs/plot)	Mediums (lbs/plot)
2	26.2	4.7	4.7
4	51.6	17.1	17.1
8	49.0	17.1	17.1
CV	44%	52%	80%

EVALUATION OF ORGANIC MULCH FOR WEED CONTROL IN ORGANIC VIDALIA ONION PRODUCTION

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Introduction

Organic Vidalia onion production has several challenges not the least of which is weed control. Onions are poor competitors with weeds and require a relatively weed free bed in order to produce adequate yield and size. Growers that have begun to organically produce Vidalia onions have quickly learned that weed control is important. Most growers of organic onions rely on black plastic mulch to control weeds. Under USDA guidelines, black plastic mulch is allowed in certified organic production. There are, however, some growers that would prefer to use a natural material to eliminate the problems associated with the disposal of the plastic film, quite apart from the fact that organic materials eventually add organic matter to the soil. An experiment was designed to evaluate several natural mulches for the control of weeds in onions.

Materials and Methods

Beds at the Vidalia Onion and Vegetable Research Center, Lyons, Ga. were prepared as for conventional production with clean cultivation. Approximately 4-6 inches of compost was rototilled into the site prior to final bed preparation. Organically produced transplants of 'EM 90' were transplanted on December 3, 2003 onto raised beds prepared on 6 ft centers. Beds were planted with 4 rows 12 in. apart with a 5.5 in. in-row spacing. Each plot was 20 ft long.

The 4 different treatments included bare ground (no mulch) and mulch of pine straw, Bermuda hay and wheat straw. The bare ground treatment was kept weed free by hand weeding as needed. The experiment was arranged in a randomized complete block design (RCBD) with 4 replications. The mulch treatments were applied immediately after transplanting. Additional mulch was applied once in mid-February.

Plant stand and weed control were assessed on February 23, 2004 by rating each plot. Plant stand was rated on a 1-5 scale with 1 indicating an excellent stand (few missing plants) and 5 indicating a poor or non-existent stand. Weed control was also rated on a 1-5 scale with 1 indicating excellent weed control and 5 indicating poor weed control.

Onions were harvested on May 6, 2004 and allowed to field dry until May 11, 2004, at which time they were weighed after tops and roots had been removed. These onions were then graded into jumbos (≥ 3 in.) and mediums (≥ 2 in. and < 3 in.).

A second on-farm experiment was conducted in Screven Co., Ga with 5 treatments of mulch including bare ground, compost, oat straw, Bermuda hay and pine straw. The experiment was prepared and arranged as described above in a random complete block design. Onions were harvested on May 17, 2004. Bulbs had their tops and roots removed. They were then weighed and counted.

Results and Discussion

Field yield was highest for the bare ground treatment at 40.4 lbs/plot, but it did not significantly differ from that for pine straw (table 1). The bare ground treatment also had a significantly higher yield of mediums compared with the other treatments. Wheat straw and Bermuda hay yielded the poorest.

Plant stand rating was best with the bare ground while there were no differences among the treatments for the weed rating. Both wheat straw and Bermuda hay are known to have adverse effects on seed germination and plant growth. This makes both of these materials an effective mulch, however, these effects also tended to reduce onion plant stand and consequently onion yield.

Although it is not reflected here, past work has also shown that wheat straw tends to have wheat seed as a contaminate. This seed is unaffected by the wheat straw, readily germinates under favorable spring conditions, and becomes a weed problem in the wheat straw plots. Of the different mulch tested in this experiment, pine straw seemed to have the most promise. It did not appear to reduce stand as much as wheat straw and Bermuda hay.

In the Screven Co. experiment, the highest yields were on bare ground and with compost (table 2). There was a significantly lower yield and number of bulbs with oat straw and Bermuda hay than for other types of mulch. Pine straw was intermediate in yield. Allelopathic effects of oat straw and Bermuda hay were the cause of reduced stand and yield. Compost had a positive effect on yield probably due to mineralization resulting in greater nutrient availability.

Onion populations are usually high with 80,000 plants/acre or more and our plots reflected these high plant populations. Consequently, it was difficult to place organic mulch, such as Bermuda hay, wheat & oat straw and pine straw, around the base of the plants. Instead the mulch often lay on top of the plants, settling around the plants in a few days. This probably aggravated the allelopathic effects of the wheat & oat straw and Bermuda hay, reducing onion plant stand.

Summary and Conclusion

In conclusion, because of the high plant density of onions and their poor competitive nature with weeds, it is not recommended that organic mulches be used for weed control. Plastic mulch appears to be the best method for weed control in organic onion production.

Table 1. Effect of mulch type on yield, plant stand, and weed control.

Mulch Type	Field Yield (lbs/plot)	Jumbos (lbs/plot)	Mediums (lbs/plot)	Plant Stand[z]	Weed Rating[y]
Bare ground	40.4	8.6	7.1	1.0	1.8
Pine Straw	26.5	3.5	2.4	1.9	2.2
Wheat Straw	8.2	0.0	0.3	3.9	3.2
Bermuda Hay	19.5	3.9	1.5	3.2	2.2
CV	41%	114%	86%	17%	27%
Fishers Protected LSD ($p \leq 0.05$)	15.6	NS	3.9	0.2	NS

[z]Plant Stand Rating: 1-Excellent, 5-Poor to non-existent.

[y]Weed Rating: 1-Excellent control, 5-Poor control.

Table 2. Evaluation of mulch type on onion yield, Screven Co.

Mulch Type	Yield (lbs/plot)	Number/plot
Bare ground	12.6	49
Compost	16.0	47
Oat Straw	1.6	7
Bermuda Hay	2.2	12
Pine Straw	8.7	36
CV	60%	40%
Fisher's Protected LSD ($p \leq 0.05$)	7.6	18

EVALUATION OF POULTRY LITTER APPLICATION FOR ORGANIC VIDALIA ONION TRANSPLANT PRODUCTION

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Introduction

There has been a growing interest in recent years in the production of organically grown Vidalia onions. This interest has been fueled by market demand. Organically producing onions has been problematic on several fronts.

Onion production in the Vidalia region usually begins with the production of transplants in high density plantings that are then transplanted to their final spacing 8-10 weeks later. Onion seed are very small with little reserve. Nutrients must be available both early and continuously for these seedlings to develop sufficient size to be hand transplanted. An experiment was designed to evaluate fresh poultry manure as a source of fertilizer.

Materials and Methods

Beds were prepared as for conventional production with clean cultivation. Approximately 4-6 inches of compost was rototilled into the site prior to final bed preparation. Immediately after final bed preparations, seed of variety EM90 were sown on September 17, 2003 with a Monosem vacuum planter set to sow at the highest density. Each plot was 10 ft long and consisted of 4 rows sown with 12 in. between rows. Six treatments that consisted of 0, 2, 4, 6, 8, and 10 tons/acre rate of poultry litter was applied to the plots in a randomized complete block design of 4 replications.

Treatment applications were split-applied with one-half the material applied on September 22, 2003 and one-half applied on October 23, 2003. Treatments were evaluated on December 3, 2003 by harvesting a random sample from each plot. Five plants from this sample were measured for plant length from the basal plate to the leaf tip and plant diameter was measured at the widest point. In addition, 20 plants were randomly selected and weighed.

Results and Discussion

Plants grown at the 10 tons/acre rate resulted in a weight of 144.4 gm per 20 plants which did not differ from either the 6 or 8 ton/acre rates. There were also no differences in plant length or diameter for the 10 ton/acre rate compared with the 6 or 8 ton/acre rate. This indicates that a 6 tons/acre rate of poultry litter should be sufficient to produce organically grown onion transplants. Figure 1 shows conventionally produced transplants next to organically produced transplants with no detectable difference in the plants.

Table 1. Effect of poultry litter on onion transplant production.

Treatments Poultry Litter (Tons/acre)	Plant Weight (gms/20 plants)	Plant Length (inches)	Plant Diameter (mm)
0	34.0	8.1	6.1
2	53.9	10.8	6.3
4	74.7	11.3	7.6
6	116.1	13.5	8.7
8	127.9	14.2	8.7
10	144.4	16.1	10.1
CV	32%	14%	15%
LSD ($p \leq 0.05$)	44.9	2.7	1.8

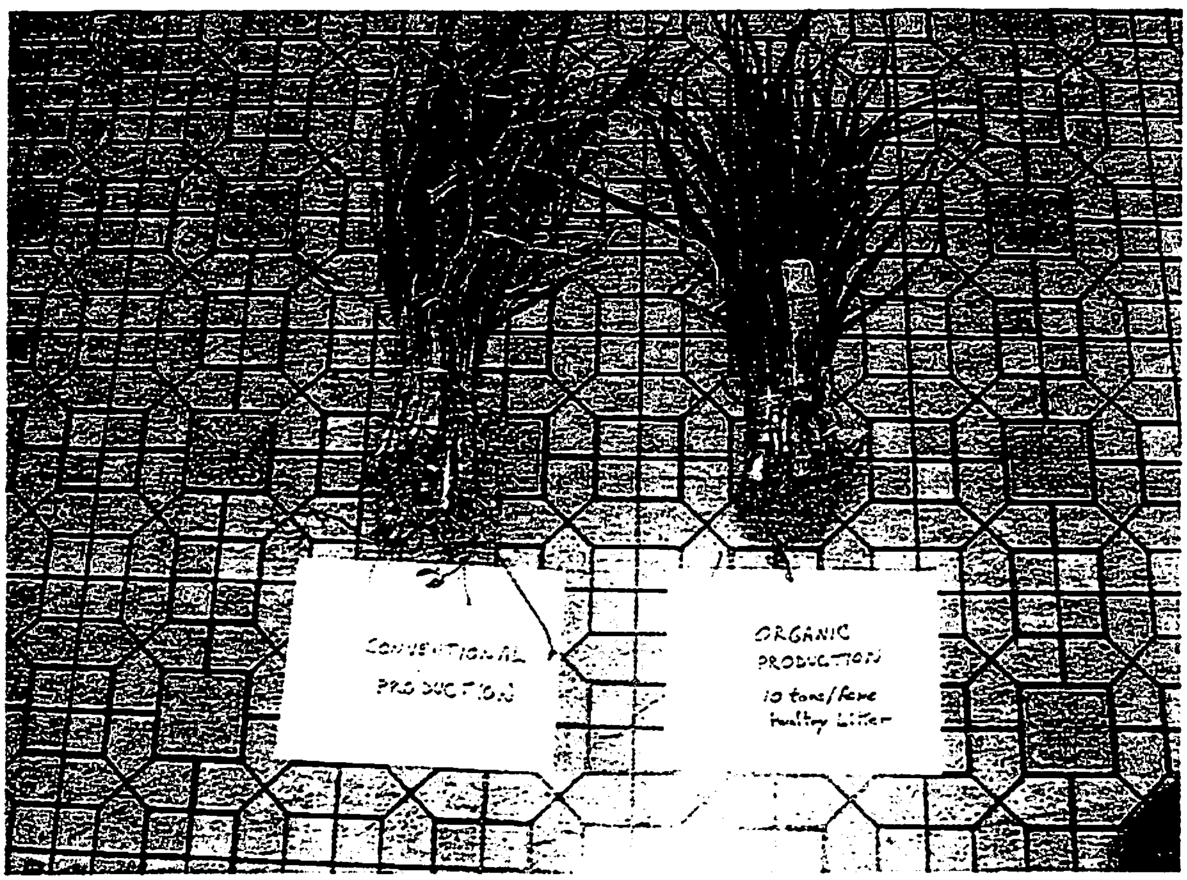

Figure 1. Conventionally produced onions (left) and organically produced (right).

IRRIGATION RATE, NITROGEN FERTILIZATION AND MULCH EFFECTS ON BOLTING AND YIELD OF SWEET ONIONS

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Introduction

In Georgia, sweet onions (*Allium cepa*) are typically grown on bare soil (unmulched) and are irrigated with high-pressure systems such as sprinklers or center-pivots. Drip irrigation alone or in combination with plastic mulch is widely used for vegetable production, particularly for tomatoes and peppers. Vegetable production with drip irrigation often results in reduced water costs and reduced leaching of nutrients and other chemicals. Irrigation and nitrogen may affect onion yield and quality (Batal et al., 1994). In a recent study, it was found that onion yields decreased with increasing soil water potentials (i.e., increasing soil water contents) down to -30 kPa (Díaz-Pérez et al., 2004). This study also showed that the use of wheat straw mulch was associated with reductions in plant growth, leaf nitrogen concentration, and bulb yield.

The objective of this study was to determine the effects of irrigation rate, nitrogen fertilization, and mulch on seed-stem formation (bolting) and on bulb yield.

Materials and Methods

The experiments were conducted during the 2003-04 season at the University of Georgia's Horticulture Farm, at the Coastal Plain Experiment Station, Tifton, Ga. The experimental design was a randomized complete block. The treatments were the combination of two types of mulch (bare soil or wheat straw), two irrigation rates [60% the rate of evapotranspiration (ET), adjusted by the stage of crop development (low); 100% ET (medium); 140% ET (high)], and three rates of nitrogen fertilization [80 lb/acre (low), 160 lb/acre (medium), and 240 lb/acre (high)]. Onion seedlings ('Sweet Vidalia') were transplanted on 11 Dec. 2003. Except for N fertilization and irrigation, onion plants were grown according to the recommendations of the UGA Extension Service. Plants were harvested on 26 May 2004. Onions were hand-harvested and roots and tops were clipped.

Results and Discussion

Bolting: The incidence of bolting plants was lowest at the medium irrigation rate (bolting = 22%) compared with either low irrigation (bolting = 30%) or high irrigation (bolting = 30%) rate. The incidence of bolting was also lower for plants receiving the high N fertilization rate (bolting = 22%), compared with plants at either the low N rate (bolting = 30%) or medium N (bolting = 31%) rate. This reduction in bolting with increasing N rate is consistent with previous studies (Díaz-Pérez et al., 2004).

Yield: The main factors, nitrogen and mulch had a significant effect on yield, while irrigation rate had no effect on yield. Yield was lowest at the low N rate, while there were no yield differences between medium N rate and high N rate. Yield was higher on plants on bare soil than on wheat straw mulch. There was a significant irrigation x mulch interaction. On bare soil, yield tended to decrease with increasing irrigation rate, while on wheat straw, yield changed little with increases in irrigation rate. Increasing irrigation rates are associated with increasing N leaching rates in light (sandy) soils, such as that used in this study. Possibly, yield reductions with increasing irrigation rates in bare soil are due to plant N deficiency because of increased N leaching. High irrigation rates also result in yield reductions due to increased incidences of bulb decay (Díaz-Pérez et al., 2004; Gitaitis et al., 2004).

Summary and conclusions

In conclusion, onion yields were highest at either medium N rate or high N rate. Onion plants on bare soil yielded more than plants growing on wheat straw mulch. Compared with plants on bare soil, onion bolting was higher among plants grown on wheat straw mulch.

Acknowledgements

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References

Batal, K. M., K. Bondari, D. M. Granberry, and B. G. Mullinix. 1994. Effects of source, rate, and frequency of N application on yield, marketable grades and rot incidence of sweet onion (*Allium cepa* L. cv. Granex-33). J. Hort. Sci. 69:1043-1051.

Díaz-Pérez, J.C., W.M. Randle, G.B. Ronald, W. Walcott, D. Giddings, D. Bertrand, H.F. Sanders, and R.D. Gitaitis. 2004. Effects of mulch and irrigation system on sweet onion: I. Bolting, plant growth, and bulb yield and quality. J. Amer. Soc. Hort. Sci. 129:218-224.

Gitaitis, R.D., R.R. Walcott, H.F. Sanders, L. Zolobowska, and J.C. Díaz-Pérez. 2004. Effects of mulch and irrigation system on sweet onion: II. The epidemiology of center rot. J. Amer. Soc. Hort. Sci. 129:225-230.

Table 1. Effect of irrigation rate, nitrogen fertilization rate, and mulch on yield of sweet onion.

Treatment	Yield (lb/acre)	Yield (# bulb/acre)
Irrigation		
60% ET	5,695 a[z]	11,301 a
100% ET	5,087 a	11,447 a
140% ET	4,496 a	9,571 a
Nitrogen		
80 lb/acre	3,652 b	11,253 a
160 lb/acre	5,690 a	10,104 a
240 lb/acre	5,938 a	10,963 a
Mulch		
Bare	6,241 a	14,254 a
Straw	3,246 b	7,292 b
Significance		
Irrigation (I)	0.133	0.093
Nitrogen (N)	<0.01	0.448
I x N	0.338	0.025
Mulch (M)	<0.01	<0.01
I x M	0.057	0.099
N x M	0.183	<0.01
I x N x M	0.601	0.686

[z] Mean separation within columns by LSD $P \leq 0.05$.

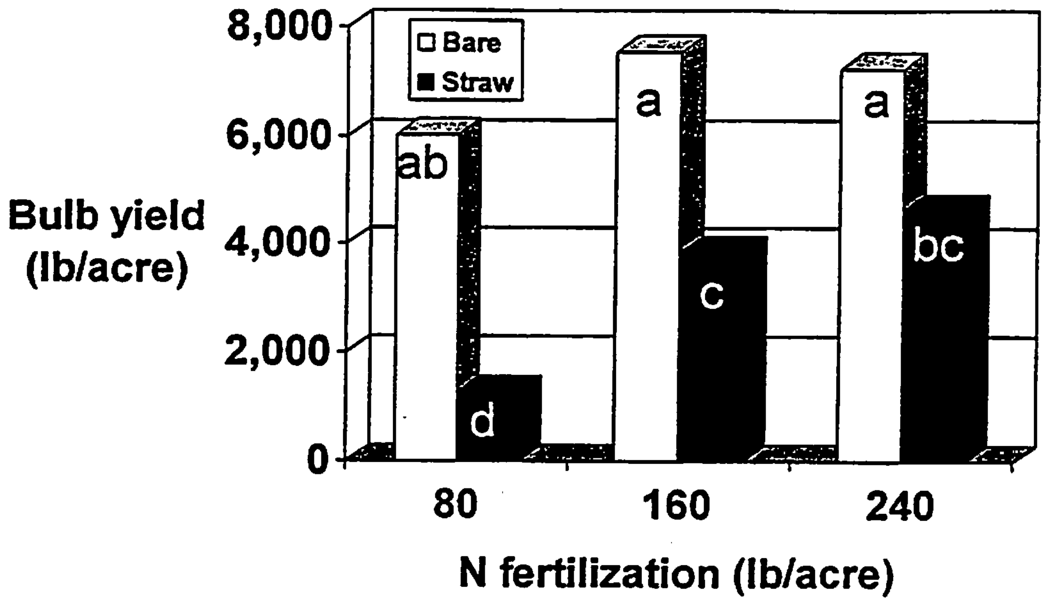

Figure 1. Onion yield as affected by irrigation rate and nitrogen fertilization (LSD P ≤ 0.05).

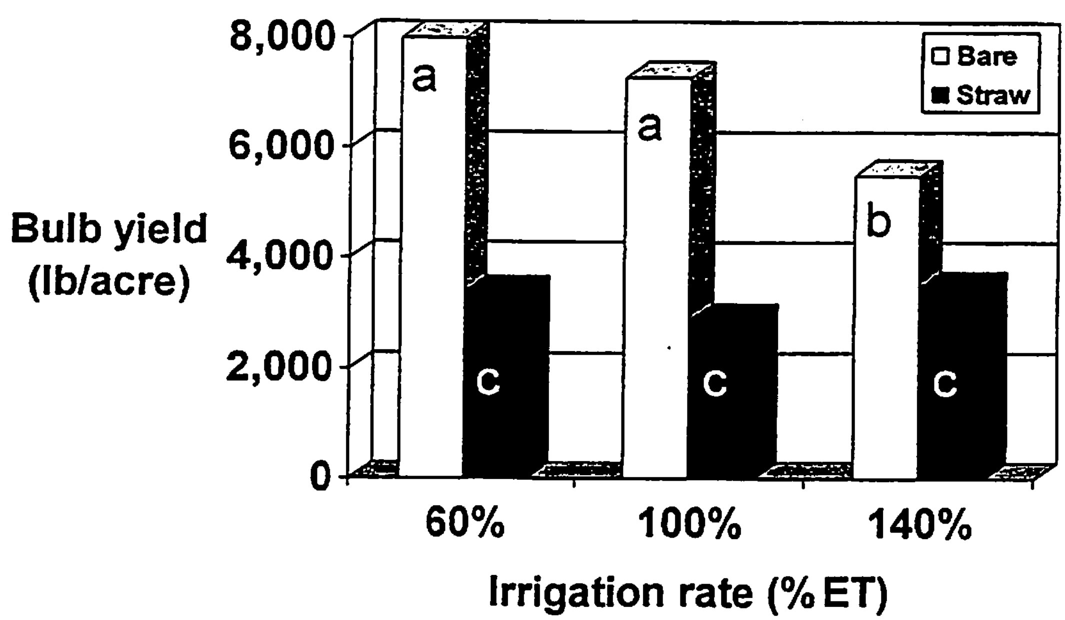

Figure 2. Onion yield as affected by irrigation rate and mulch (LSD P ≤ 0.05).

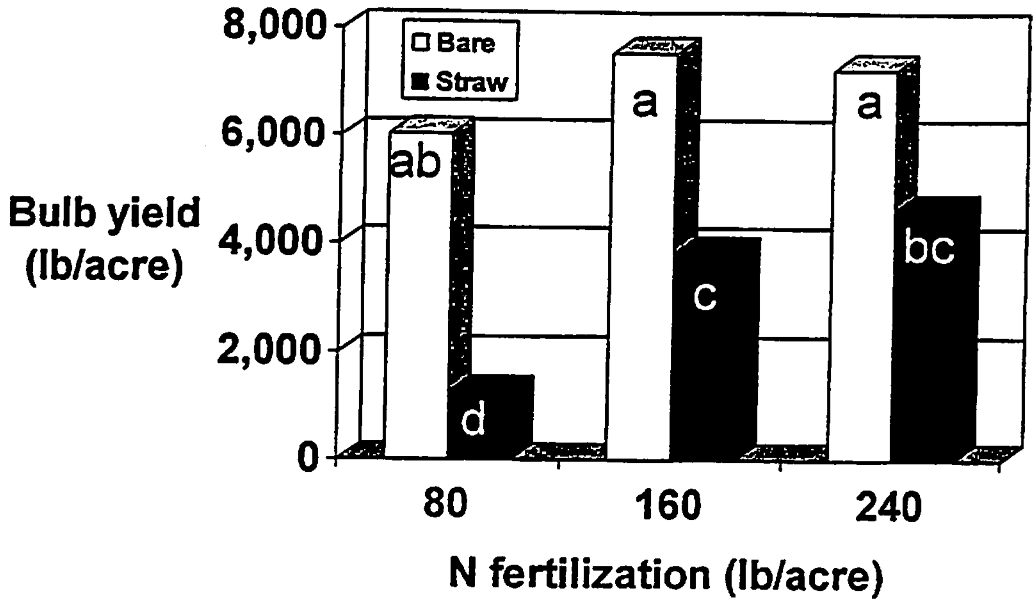

Figure 3. Onion yield as affected by irrigation rate and nitrogen fertilization (LSD P ≤ 0.05).

RESIDUAL HERBICIDE CARRYOVER SIMULATION IN TRANSPLANTED VIDALIA ONIONS

Timothy Grey, Research Weed Scientist
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Introduction

Georgia onion growers often produce multiple crops on their farms, including crops of cotton, peanuts, or soybeans. Although rotation of various crop species is usually beneficial, the potential for herbicide carryover is of concern to Georgia Vidalia onion producers. In cotton, growers often rely on herbicides such as Direx, Staple or Envoke for controlling weed species. In peanuts most Georgia fields are treated with Cadre or Strongarm. In soybean, although Roundup is usually the only herbicide used, some fields are treated with Roundup plus Firstrate for improved morning glory control. All of these residual herbicides can be beneficial for controlling weeds for their respective agronomic crops but they also all pose threats to a following onion crop (table 1).

Materials and methods

A field experiment was conducted at the Vidalia Onion and Vegetable Research Center near Lyons, Ga. in 2003 and 2004. The area was conventionally tilled by moldboard plowing then smoothed with a rotary tiller to form six foot wide beds. This area had not been previously exposed to any of the herbicides evaluated for this experiment. On October 13, 2003, residual herbicides were applied with a CO_2-pressurized backpack sprayer with 15 gallons of water per acre. Treatments included Cadre at 0.77 and 0.385 oz product/acre, Strongarm at 0.225 and 0.113 oz product/acre, Staple at 0.90 and 0.45 oz product/acre, Envoke at 0.25 and 0.125 oz product/acre, Direx at 12.8 and 6.4 oz product/acre, and Firstrate at 0.38 oz product/acre. A nontreated control treatment was included. The intent was to simulate herbicide carryover by using approximately one-half and one-fourth of the labeled rate of each herbicide to their respective crop. All plots were irrigated immediately after herbicide applications to insure soil incorporation.

The experimental design was a randomized complete block with four replications (blocks). Plots consisted of four transplanted onion rows per bed. Each bed was 25 feet long. Onion bulbs were hand transplanted approximately 1 inch deep on November 6, 2003. Additional irrigation was applied as needed and fertilizer was applied based on soil test recommendations for onion production. The entire test was maintained weed-free throughout the growing season by a blanket treatment of Prowl plus Goal.

Onion injury ratings for stunting and bleaching were visually estimated using a scale of 0% (no injury) to 100% (death) during the course of the study and prior to harvest. Yield was determined by hand harvesting all onions from 10 feet of the center two rows of each plot, and recording their number and weight. Cumulative number and yield per acre are reported. Weight per fruit was determined by dividing the total fruit yield by total fruit count.

Results and Discussion

Onion injury, fresh weight, bulbs per acre and average bulb weight were ~~each herbicide~~ dependent (table 2). Injury and average bulb weight variables were telling with respect to onion response.

Cadre injury was 1 and 6% for 0.77 and 0.385 oz/acre, respectively. Data would indicate that transplanted onions have a good tolerance to the peanut herbicide Cadre. In contrast, transplanted onions were extremely sensitive to Strongarm at either rate with injury of 56% or greater at 149 days after application. The number of onion bulbs/acre was not significantly affected by either of these herbicides. However, there was a significant reduction in average bulb weight for Strongarm. This would indicate that Strongarm did not kill transplanted onions but did cause injury that reduced growth for the entire season.

Staple caused severe onion injury with 56 and 86% at 0.45 and 0.90 oz product/acre, respectively. Staple also caused significant reductions in average bulb weight. Envoke injury was variable, but there was significant reduction in the average bulb weight as compared with the nontreated control. In contrast to Staple and Envoke, Direx did not adversely affect onion for any variable.

Firstrate was the most injurious and detrimental herbicide evaluated. Compared with the non-treated control, onion was visually injured 86%, onion fresh weight was reduced 76%, and average bulb weight was reduced 69%.

Summary and Conclusions

This research indicates that there needs to be further evaluation of some of the herbicides used in cotton, peanuts, and soybeans with respect to plant back restrictions for transplanted onions. It appears that Cadre and Direx restrictions could possibly be reduced with further evaluation. In contrast, the onion plant back (rotational) restrictions for Strongarm, Staple, Envoke, and Firstrate must be followed. Not following these guidelines could result in potential crop failure.

Table 1. Onion rotational restrictions.

Herbicide	Rotational restriction
	Months after application
Cadre 70% DG	18
Strongarm 84% DG	30
Staple 85% DF	Do not plant in fall or spring after following applications
Envoke 75 % DF	18
Direx 4L	12
Firstrate 84% DF	30 months and successful bioassy

Table 2. University of Georgia 2003-2004 residual herbicide simulation in transplanted Vidalia onions[a].

Herbicide	Rate	Late season stunting injury	Onion bulb yield		
	oz produt/acre	149 days after application	Fresh weight	Bulbs	Average bulb weight
		——%——	——lb/acre——	——#/acre——	——oz/bulb——
Cadre 70% DG	0.77	1 c[b]	41,800 a	61,970 ab	11.0 ab
Cadre 70% DG	0.385	6 c	39,860 a	64,610 ab	9.88 ab
Strongarm 84% DG	0.225	73 ab	16,810 c	66,790 a	3.90 d
Strongarm 84% DG	0.113	56 b	19,990 bc	50,820 ab	6.11 cd
Staple 85% DF	0.90	86 a	12,070 c	60,980 ab	3.09 d
Staple 85% DF	0.45	56 b	21,590 bc	60,980 ab	5.57 cd
Envoke 75 % DF	0.25	15 c	40,280 a	68,240 a	9.46 ab
Envoke 75% DF	0.125	26 c	30,350 ab	66,070 a	7.39 bc
Direx 4L	12.8	6 c	42,240 a	67,520 a	10.08 ab
Direx 4L	6.4	0 c	42,860 a	64,610 ab	10.82 ab
Firstrate 84%DF	0.38	86 a	10,000 c	45,740 b	3.54 d
Nontreated		0 c	42,140 a	59,530 ab	11.31 a

[a]Herbicide treatments applied October 13, 2003. Onions transplanted November 6, 2003. A blanket treatment of Prowl plus Goal was applied to the entire test.

[b]Means followed by the same letter in a column do not differ significantly ($P \leq 0.05$, Student-Newman-Keuls).

EVALUATION OF SPRAY PROGRAMS FOR CONTROL OF FOLIAR PATHOGENS OF ONIONS

David Langston, Extension Plant Pathologist

Materials and Methods

Six rows of 'Sweet Vidalia' onions were transplanted to 6-ft beds (panels) on 11 Nov at the Vidalia Onion and Vegetable Research Center located in Lyons, GA. The fertility program for these onions was consistent with University of Georgia Extension Service recommendations. Experimental design consisted of a randomized complete block with six replications. Fungicide/bactericide treatment plots were 20-ft long and were separated on each side by non-treated border panels. Plot ends were separated by a 3-ft bare ground buffer. Fungicides were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 40 gallons per acre at 75 psi using TX-18 hollow cone nozzles. Onions were harvested on 29 April by digging the two center rows of each panel and allowing them to field dry until bagged. Onions were cured at approximately 98° F for 72 hours before weighing on 6 May.

Results and Discussion

The growing season was cool and dry and rainfall was 7.3 in. below the forty eight year average. Purple blotch and botrytis leaf blight were first observed in early March and reached moderate levels by harvest. All spray programs significantly reduced the severity of Botrytis leaf blight on the 19 March rating date when compared with the non-treated check. However, Quadris rotated with Bravo Weatherstik did not significantly suppress purple blotch incidence by that same rating date which is inconsistent with previous reports. Ratings on 29 April indicated that all spray programs significantly suppressed total foliar disease compared with the non-treated plots. No fungicide treatment significantly improved yield over the non-treated control, which is reflective of the low disease severity experienced in 2004 due to the lack of rainfall.

Table 1. Effect of different spray schedules and fungicides on control of foliar diseases of onion.

Treatment (Spray Dates)[1]	Botrytis[2] Leaf Blight	Purple[3] Blotch	Total[4] Disease	Yield[5] lb/plot
Bravo Weather Stik, 1.5 ptA (1 - 14)	1.7 d[6]	4.5 b-d	5.3 b	46.5 a
Bravo Weather Stik, 1.5 ptA (1, 2, 4, 6, 8, 10, 12-14) Rovral, 1.5 pt/A (3, 5, 7, 9, 11)	3.3 b-d	3.3 b-d	3.7 d	50.8 a
Bravo Weather Stik, 1.5 ptA (1, 2, 4, 6, 8, 10, 12-14) Switch, 11.0 oz/A (3, 5, 7, 9, 11)	2.8 cd	3.2 b-d	4.3 b-d	47.3 a
Bravo Weather Stik, 1.5 ptA (1, 2, 4, 6, 8, 10, 12-14) Pristine, 14.5 oz/A (3, 5, 7, 9, 11)	1.8 d	2.8 cd	4.0 b-d	49.1 a
Bravo Weather Stik, 1.5 ptA (2, 4, 6, 8, 10, 12-14) Quadris, 12.4 fl oz/A (1, 3, 5, 7, 9, 11)	3.3 b-d	8.3 a	3.7 d	51.7 a
Bravo Weather Stik, 1.5 ptA (2, 4, 6, 8, 10, 12-14) Quadris, 12.4 fl oz/A (1, 3, 5) Rovral, 1.5 pt/A (7, 9, 11)	2.8 cd	4.0 b-d	3.7 d	48.3 a
7 Bravo Weather Stik, 1.5 ptA (2, 4, 6, 8, 10, 12-14) Quadris, 12.4 fl oz/A (1, 3, 5) Switch, 11.0 oz/A (7, 9, 11)	5.0 b	5.5 b	5.2 bc	47.1 a
Bravo Weather Stik, 1.5 ptA (2, 4, 6, 8, 10, 12-14) Quadris, 12.4 fl oz/A (1, 3, 5) Pristine, 14.5 oz/A (7, 9, 11)	2.2 d	3.3 b-d	4.2 b-d	48.7 a
Bravo Weather Stik, 1.5 ptA (2, 4, 6, 8, 10, 12-14) Cabrio, 12.0 oz/A (1, 3, 5) Pristine, 14.5 oz/A (7, 9, 11)	3.0 cd	5.2 bc	4.0 b-d	50.5 a

Continued on next page......

Table 1. Effect of different spray schedules and fungicides on control of foliar diseases of onion (cont'd)

Treatment (Spray Dates)[1]	Botrytis[2] Leaf Blight	Purple[3] Blotch	Total[4] Disease	Yield[5] lb/plot
Bravo Weather Stik, 1.5 ptA (2, 4, 6, 8, 10, 12-14) Rovral, 1.5 pt/A (1, 3, 5) Quadris, 12.4 fl oz/A (7, 9, 11)	2.7 cd	4.0 b-d	3.2 d	49.3 a
Bravo Weather Stik, 1.5 ptA (2, 4, 6, 8, 10, 12-14) Switch, 11.0 oz/A (1, 3, 5) Quadris, 12.4 fl oz/A (7, 9, 11)	4.3 bc	4.0 b-d	4.5 b-d	51.6 a
Bravo Weather Stik, 1.5 ptA (2, 4, 6, 8, 10, 12-14) Pristine, 14.5 oz/A (1, 3, 5) Quadris, 12.4 fl oz/A (7, 9, 11)	1.8 d	2.5 d	3.8 cd	50.7 a
Bravo Weather Stik, 1.5 ptA (1-6, 8, 10, 13, 14) Pristine, 14.5 oz/A (7, 9, 11, 12)	2.2 d	2.8 cd	4.5 b-d	47.4 a
Bravo Weather Stik, 1.5 ptA (1, 13, 14) Pristine, 14.5 oz/A (2, 4, 6, 8, 10, 12) Rovral, 1.5 pt/A (3, 5, 7, 9, 11)	2.8 cd	3.2 b-d	5.2 bc	54.0 a
Non-treated check	10.8 a	9.3 a	8.0 a	51.9 a

[1]Spray dates: 1=7 Jan, 2=14 Jan, 3=21 Jan, 4=27 Jan, 5=4 Feb, 6=13 Feb, 7=19 Feb, 8=26 Feb, 9=4 Mar, 10=11 Mar, 11=18 Mar, 12=25 Mar, 2 Apr, 14=8 Apr.

[2]Percent leaf area affected by Botrytis leaf blight where 100=100% leaf area diseased and 0=no leaf area diseased on 19 March.

[3]Purple blotch ratings were conducted by counting the number of purple blotch lesions in the two center rows of each plot on 12 April.

[4]Values represent the total severity of all foliar diseases in the two center rows on 29 April where 10=100 diseased and 0= no disease.

[5]Weight of cured onions harvested from the two center rows of each plot.

[6] Means followed by the same letter(s) are not significantly different at according to Fisher's Protected LSD test.

FIRST REPORT OF TOMATO SPOTTED WILT VIRUS AND IRIS YELLOW SPOT VIRUS (FAMILY *BUNYAVIRIDAE*, GENUS *TOSPOVIRUS*), NATURALLY INFECTING VIDALIA ONION (*ALLIUM CEPA* L.) IN GEORGIA

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Introduction

During the seedbed-production phase of the 2003 Vidalia onion growing season, samples with dieback and other unusual symptoms were sent to the Tifton Plant Disease Diagnostic Clinic for identification. These plants were tested for both bacteria and fungi with negative results for both disease agents. These samples were then sent to the Tifton virology lab for further testing to determine if a viral agent could be the cause of the symptoms. The 12-plant clinic sample was screened for a variety of viruses and TSWV and IYSV infections were serologically detected.

Tomato spotted wilt virus (TSWV) has been endemic to Georgia crops for the past decade, but has thus far gone undetected in Vidalia onions. *Iris yellow spot virus* (IYSV), an emerging tospovirus that is potentially a devastating pathogen of onion, has been reported in many locations in the western United States (Du Toit. et al., 2004; Moyer et al. 2003).

Following the discovery of TSWV and IYSV infections in the Vidalia region, specialists and county extension agents from the University of Georgia Cooperative Extension Service immediately began checking to determine where the virus could originate. The first and most obvious place to look was in some of the packing sheds that ship in sweet onions from Peru, where IYSV is known to occur.

Investigations into these packing sheds indicated that live onion thrips (*Thrips tabaci*) were found to be in some of the culled onions in the shed. *T. tabaci* is the known vector for IYSV, but it is somewhat rare in the Vidalia onion growing area of Georgia. Tobacco thrips (*Frankliniella fusca*) and Western flower thrips (*Frankliniella occidentalis*) are the primary vectors for TSWV in this region, and a number of plant species serve as reproductive reservoirs for the vector and/or virus. These two species of thrips are also the predominant species found on onions in the Vidalia area. The role of TSWV as an onion pathogen has yet to be determined. A monitoring system was initiated to determine the extent of IYSV and TSWV in Georgia onions and in weed hosts that are adjacent to fields.

Materials and Methods

Since the initial discovery of the two types of virus in onions, leaf and bulb tissues from 4424 onion samples were screened for TSWV and IYSV by means of a double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) using commercial kits (Agdia Inc. Elkhart, IN). Samples were collected from fifty-three different locations in the Vidalia region during the growing season between November 2003 to March 2004. Tattnall, Evans, and Toombs counties served as the focal point for most of the sampling because of the number of symptomatic plants initially found in those areas and because of the number of packhouses in those counties bringing in onions from Peru.

Plants exhibiting stress, such as tip die back, necrotic lesions, chlorosis or environmental damage were selected. Of these, 306 were positive for TSWV and 396 were positive for IYSV using a positive threshold absorbance of three times the average plus two standard deviations of healthy negative onion controls. Positive serological findings of the onion tissues were verified by immunocapture-reverse transcriptase-polymerase chain reaction (IC-RT-PCR) for TSWV (Jain et al., 1998) and reverse transcriptase-polymerase chain reaction (RT-PCR) for IYSV (Cortês et al., 1998). In both instances, a region of the viral nucleocapsid (N) gene was amplified. The PCR products were analyzed with gel electrophoresis using an ethidium bromide stain in 0.8% agarose. Eighty-six percent (n=263) of the TSWV ELISA positive samples exhibited the expected 774 bp product, and 55 percent (n=217) of the IYSV ELISA positive samples exhibited the expected 962 bp product.

The reduced success of the IYSV verification could be attributed to the age and deteriorated condition of the samples at the time of amplification. Weeds from adjacent fields were also screened for the presence of the viruses. Of 768 weed samples, 61 were positive for IYSV and 37 were positive for TSWV. The combination of these covered more than 20 species of weeds. Weed samples were tested from areas near Berrien County High School as part of a science project and IYSV was detected in 3 weed samples that contained two weed species.

Thrips tabaci were obtained from onion seedbeds and cull piles within the early sampling (n =84) and screened for TSWV by the use of an indirect-ELISA to the non-structural (NSs) protein of TSWV. Of the thrips sampled, 25 were positive in ELISA for TSWV.

Summary and Conclusions

Although IYSV is a serious disease of onion in several countries and in certain areas of the U.S., the disease did not cause severe losses to onion in the Vidalia area in the 2003-2004 season. However, it cannot be ruled out that some of the early season stand losses observed in seedbeds and fields could have been attributed to IYSV infections. The detection of both TSWV and more specifically IYSV in so many weed species and over such a large geographic area, including an area that does not produce Vidalia onions, suggests that IYSV has been in Georgia for some time and is now endemic to the area. This information helps absolve the imported Peruvian onions to some extent, but the presence of the thrips vector in live onion culls may lead to a higher transmission rate of the IYSV than is already here. Therefore thrips in onion culls coming from Peru need to be controlled. The lack of the known thrips vector, *T. tabaci*, may account for the lack of the disease observed in onions at harvest. However, the numbers observed in weed species may indicate that, at least in some instances, the virus may be transmitted by other species of thrips. Certainly more research into the epidemiology of these viruses and the role they have on Vidalia onion production is needed before conclusions can be drawn.

References

Cortês, I. et al. Phytopathology. 88:1276, 1998.

Du Toit, L.J. et al. Plant Dis. 88:222, 2004.

Jain, R.K. et al. Plant Dis. 82:900, 1998.

Moyer, J.W. et al. (Abstr.) Phytopathology 93 (suppl.):S115, 2003.

WARM AIR, LOW HUMIDITY STORAGE OF SWEET ONIONS

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Introduction

The storage of sweet onions continues to be a challenge because the internal moist, sweet flesh is an an ideal host for disease and insects. On the other hand, in order to extend shelf life, sweet onions may be held in an environment having a low temperature, a low level of oxygen and low levels of moisture. If a disease or insect is present in or on the onion when it goes into storage then there is little chance of eliminating that disease or insect while in storage. The disease of insect is likely to spread to other onions in contact in storage.

No single storage condition will inhibit the infestation or development of all pests or unwanted disorders as each has its own set of requirements. *Botrytis* neck rot ceases to sporulate but will continue to grow in Controlled Atmosphere Storage (Purvis and Paulk, 2002). The heat treatment of onions may reduce the growth and spread of *Botrytis allii* in sweet onions, but tissue injury is likely to occur when the onions are exposed to high prolonged temperatures (Purvis and Hakim, 1999). Holding sweet onions in a controlled atmosphere where temperature and oxygen are at a low level may reduce respiration of the onions and growth of pests but the physiological disorder of translucent scale may be aggravated by cold storage and high levels of CO_2 (Purvis and Paulk, 2002). Curing before storage encourages the drying of outer scales providing a barrier for transmission of disease from one onion to another while the onions are in storage, but the temperatures of curing encourage the growth of sour skin on the surface of onions and sour skin may not be detected before the onions go into storage (Maw et al., 1998).

Disease and insects or the effects thereof are carried into storage with the onions. These are acquired during growth, harvesting and post harvest operations. Increasing fertilizer rates on sweet onions increases bulb size and reduces pungency thus allowing sweetness to be a noticeable characteristic. Larger onions, being less pungent, are found to have a shorter shelf life in storage (Purvis, 1998). Insect pests such as thrips are likely to weaken the defenses of an onion plant to infestation during growth and thresholds have been established for infield control using chemicals (Riley and Sparks, 2003). Sanitation at all stages of operation may reduce the likelihood of further infestation (Purvis, 1999) however, it will not take away what is already there and sanitation for one pest may not be sanitation for another. Other diseases such as Black Mold, Blue Mold, Fusarium Basal Plate Rot, Leaf Streak and Pink Root Rot also have their peculiarities and though they may each be regulated by applying inhibiting conditions, such conditions may not necessarily protect the onion from other pests. Then, finally, at the end of all efforts to combat pests and extend shelf life it even appears that sweet onions have a natural rate of decay no matter how stringent the efforts to preserve them (Mullinix et al., 1999).

As a result of the complexity of conditions that may influence the storability of sweet onions, there is a need to know the condition of the onions before they go into storage in order that suitable storage may be provided. Some surface related pests may be handled by simply removing moisture both before and during storage without the need for controlling the gaseous atmosphere.

By removing moisture from air before it is circulated among onions, the water holding capacity of the air is increased and the capacity of the air to remove moisture from the onions is enhanced. Technology, known as heat pipe technology (Advanced Dryer Systems, Gainsville, FL) is now available that increases the condensation of moisture from air as it passes through an air conditioner condenser coil (figure 1). Heat pipes have been a recognized technology since before 1983 when Khanh Dinh founded Heat Pipe Technology, Inc. However, for exchanging heat from a source to a receiver, a primary patent was issued in 1986 (Dinh, 1999). By using the principles of heat transfer that occur as a result of a change of state of a fluid, heat pipes passively remove heat from warm air and transfer it to cool air. Combined with a conventional air conditioner, having cooling coils and a compressor, increased cooling and thus drying of the incoming air is possible as more moisture is condensed from the air than would otherwise be the case with a condenser coil alone. The result is a high capacity dehumidifier. According to searches of the literature, the curing of onions with this technology has not been attempted. Thus a study has been conducted to hold sweet onions in a low humidity environment in natural air while allowing the temperature of the air to find its own level of warmth.

Materials and methods

Sweet onions of cultivar Granex 33 were grown according to recommendations by the Cooperative Extension Service (Boyhan et al. 2001), at the Vidalia Onion and Vegetable Research Farm. Reidsville, Georgia. At optimal maturity they were harvested by hand into open mesh sacks on May 9th, 2003. It was learned from previous years that onions for low humidity, warm air storage have a longer shelf life if they have been properly cured, therefore onions were cured and later sorted. Visibly decaying onions were removed but grades were left mixed as from the field.

The onions were divided into three treatments: low humidity, warm air storage; cold storage; and controlled atmosphere storage. Each treatment had six replications. They were placed into storage according to treatment on May 21st, 2003. They were removed from storage and examined on September 8th, 2003, after 15 weeks of storage.

Low humidity, warm air storage took place in six plywood columns each of volumetric capacity 30.5 x 30.5 x 122 cm (1 x 4 x 4 ft) and each column acted as a replication. Dehumidified air was passed from a plenum supporting the columns up through the base of each column and thus between the onions inside each column, exhausting through the opening in the top of the column. Being in a closed insulated room the exhausted air was continuously cycled through a heat-pump-dehumidifier (BKP 100, Advanced Drier Systems, Gainesville, Florida), built to incorporate the features of heat pipe technology and to maximize commodity drying with a minimum of energy. This was coupled to the plenum by means of a 15 cm (six in.) diameter flexible insulated duct (figure 2). A water trap was added to the condensate outlet pipe to ensure that dehumidified air did not leak from inside the heat-pump, nor exhaust air be taken into the inlet air going into the plenum. The heat-pump-dehumidifier operated throughout the storage period of onions in the columns. Temperature and humidity probes (Campbell Scientific 45C), were coupled to a data logger (Campbell Scientific 21X) and used to record the temperature and relative humidity of air entering and exhausting the onions. The heat-pump-dehumidifier established the circulating air as having a relative humidity of 32 - 40 % (figure 3) and a temperature of 32 - 34 °C (90 - 93 °F) (figure 4), there being a higher temperature and lower relative humidity of air going into the plenum and a lower temperature and higher relative humidity of air exhausting from the onions.

Cold storage took place in an insulated room at the Vidalia Onion Laboratory where the temperature was continuously monitored and maintained at 1 °C (34 °F). The onions were held in plastic perforated baskets to a similar weight and volume per replication as for those onions in low humidity warm air storage.

Controlled Atmosphere storage took place in a 2.44 x 2.44 x 2.44 m (8 x 8 x 8 ft) sealed insulated room at the Vidalia Onion Laboratory where the atmosphere was closely monitored at a prescribed level of 3 % O_2, 5 % CO_2, 92 %N and temperature of 1 °C (34 °F). Once again, onions were held in plastic perforated baskets to a similar weight and volume per replication as for those onions in low humidity, warm air storage.

Onions were examined for pungency and soluble solids according to treatment and replication of treatment both before being placed in storage and on removal from storage in order to establish the change in pungency and soluble solids as a result of storage. Five onions from each replication were cut in half and a core sample taken of each onion in the sample. The pungency was then established according to the procedure by Randle and Bussard, 1993. Soluble solids were read by extracted onion juice being placed on a Brix refractometer (Fisher Scientific, Fairlawn, NJ.).

Onions were weighed according to treatment and replication of treatment before being placed in storage and on removal from storage, in order to establish the change in weight as a result of storage.

Onions were visually examined for disease infestation according to treatment and replication of treatment before being placed in storage and on removal from storage, in order to establish the change in decay as a result of storage.

Results and discussion

Shrinkage by volume: Most of the shrinkage of onions from the low humidity, warm air storage took place as diseased onions dried leaving surrounding onions intact. The amount of shrinkage depended upon the amount of disease present when the onions went into storage. Further contamination was less likely. Occasionally there were undried diseased onions remaining, although not taking up much room. These began to drip when taken out of the low humidity, warm air storage. During 2003 the final volume for onions in low humidity, warm air storage was approximately one third that of onions going into storage. In cold storage, onions, especially diseased onions, became soft and those with disease infected surrounding onions, even though during the time of storage they somewhat maintained their volume of moisture and did not shrink very much. Likewise in CA storage shrinkage by volume was minimal.

Presence of disease: During storage in 2003, the presence of sound onions among the onions coming out of storage under the three treatments (table 1.) varied from an average of 75 % for CA, to 63 % for cold storage, to 27 % for the low-humidity, warm-air storage of the number of onions placed into storage. The disease was identified as being botrytis neck rot with a small experience of sour skin on onions from under cold and CA storage. There was no sour skin to be found on onions from low humidity, warm air storage because being usually found on the surface of an onion, it had been dried by the low humidity of the storage atmosphere. On the other hand, *Botrytis* grew under the warm temperature established by the heat-pump-dehumidifier and being inside the onions was not eliminated by the low humidity of the storage airflow. However, continuous exposure to the airflow encouraged dessication of those parts of diseased onions which were exposed and in some cases lead to the total dessication of an onion. Low humidity, warm air storage proved more suitable for the storage of healthy onions or those with surface diseases than for onions having internal disease. In Table 1, the sum of the percentage numbers of sound and diseased onions does not necessarily provide 100% because not all onions could not be accounted for, especially those under low humidity, warm air storage that had shriveled away.

Pungency and soluble solids: There was no significant (P>0.10) difference between the pungency of onions stored under one treatment as compared with another (table 1). Neither was there any significant (P>0.10) difference between the soluble solids of onions stored under one treatment as compared with those of onions stored under the other treatments. According to Boyhan et al., 2003, the onions going into storage had a pungency of 5.0 umol/ml and soluble solids of 7.7 %. After storage, the values of pungency and soluble solids were less than those pre-storage values. However, more data would need to be taken in order to determine if such a difference was typical of onions in storage or if the differences were significant.

Weight loss: The weight loss of onions under the three treatments (table 1.) varied from an average of 4 % for cold storage, to 6 % for CA storage, to 54 % for the low-humidity, warm air storage of the original weight of onions placed in storage. However, the discrepancy comes from diseased onions under low-humidity, warm-air storage, desiccating over the life of storage thus causing a shrinkage in weight (and also in volume) compared with the weight of onions going into storage. Though the weight loss of onions under cold and CA storage was considerably less than for onions under low-humidity, warm-air storage, the remaining onions included those that were diseased and would be culled upon removal from storage.

Summary and conclusions

* Onions of variety Granex 33 were placed in low humidity, warm air storage for 16 weeks and examined for weight loss, pungency, soluble solids, and disease presence. They were compared with onions held in cold and CA storage.
* There was a greater shrinkage of both weight and volume of onions held in the low humidity, warm air storage as compared with those from cold and CA storage since the diseased onions were desiccated.
* There was no significant (P>0.10) difference between the pungency and soluble solids of onions stored under any of the treatments.
* There was a greater percentage of disease present in the onions from low humidity, warm air storage because the disease, being mostly *Botrytis allii*, was encouraged to grow by the warm temperature of the storage environment. However, those onions that had surface diseases going into storage were found to be either dry and sound or desiccated.
* Onions from cold storage were soft to the touch whereas healthy onions from warm air, low humidity storage were firm.
* Low humidity, warm air storage proved suitable for the storage of healthy onions and those with surface diseases more so than for onions containing internal diseases.

Acknowledgements

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References

Boyhan, G.E., D.M. Granberry and W.T. Kelly. 2001. Onion Production Guide. Cooperative Extension Bulletin 1198, University of Georgia, Tifton, Georgia.

Boyhan, G.E., W.M. Randle, A.V.A.

Resurreccion, A.C. Purvis, R.L. Torrance, R.H. Blackley, G.B. Hardison, M.J. Cook, C.R. Hill and J. T. Paulk. 2003. Vidalia onion variety trials 2002-2003. 2003 Georgia Onion Research-Extension Report, pub No. 3-03, October, pp:1-5.

Dinh, K. 1999. What are heat pipes? http/www.heatpipe.com.

Maw, B.W., A.C. Purvis and B.G. Mullinix. 2002. Enhancing the performance of the CPES sweet onion harvester. Applied Engineering in Agriculture 18(1):23-28.

Maw, B.W. , D.A. Smittle and B.G. Mullinix. 1997. Artificially curing onions. Transactions of ASAE, Vol 13(4):517-520.

Maw, B.W., R. Gitaitis, A. Purvis and D. Sumner. 1998. Curing Vidalia (sweet) onions. 1996-7 Georgia Onion Research-Extension Report, pub No. 3-98, June, pp:20-21.

Mullinix, B.G., B.W. Maw and D. Dales. 1999. Influence of storage conditions on the longevity of sweet onions in 1998. 1998 Georgia Onion Research-Extension Report, pub No. 3-99, June, pp:30-37

Purvis, A.C., J.T. Paulk. 2002. Methods of controlling *Botrytis allii* in CA storage. 2001 Georgia Onion Research-Extension Report, pub No. 3-2002, August, pp:33-35.

Purvis, A.C., J.T. Paulk. 2002. Translucent scale in Vidalia onions. 2002 Georgia Onion Research-Extension Report, pub No. 3-2002, October, pp:65-68.

Purvis, A.C. 1998. Influence of fertilization on pungency and shelf life of two onion cultivars. 1996-7 Georgia Onion Research-Extension Report, pub No. 3-98, June, pp:34-37.

Purvis, A.C. and A. Hakim. 1999. Effect of heat treatment to control *Botrytis* neck rot on the integrity of onion bulb scales. 1998 Georgia Onion Research-Extension Report, pub No. 3-98, June, pp:46-47.

Purvis, A. 1999. Maintenance and clean up of Vidalia onion handling and storage facilities especially CA store rooms. 1998 Georgia Onion Research-Extension Report, pub No. 3-98, June, pp:38-40.

Randle, W.M. and M.L. Bussard. 1993. Streamlining onion pungency analyses. HortScience 28(1):60.

Riley, D.G., and A. Sparks. 2003. Thrips control on onions. 2003 Georgia Onion Research-Extension Report, pub No. 3-2003, October, pp:41-45.

Table 1. Detection of disease on onions

Rep	Onions from storage: Sound (%)	Onions from storage: Diseased (%)	Pungency (umol/ml)	Soluble Solids (%)	Weight Loss (%)
Low humidity, warm air					
1	39	50	3.60	6.4	49
2	32	60	3.26	6.2	50
3	25	66	3.38	6.4	53
4	24	75	3.78	6.6	57
5	18	71	2.93	6.5	58
6	23	61	2.66	6.5	58
Average	27	64	3.26	6.4	54
Cold					
1	66	33	4.93	6.6	4
2	68	31	2.51	6.1	3
3	75	24	3.27	7.1	4
4	64	36	5.23	7.0	7
5	55	43	4.08	7.2	4
6	52	48	3.43	6.8	3
Average	63	36	3.90	6.8	4
Controlled Atmosphere					
1	78	21	3.77	6.0	6
2	77	23	4.22	6.0	6
3	71	25	5.63	7.4	6
Average	75	23	4.54	6.5	6

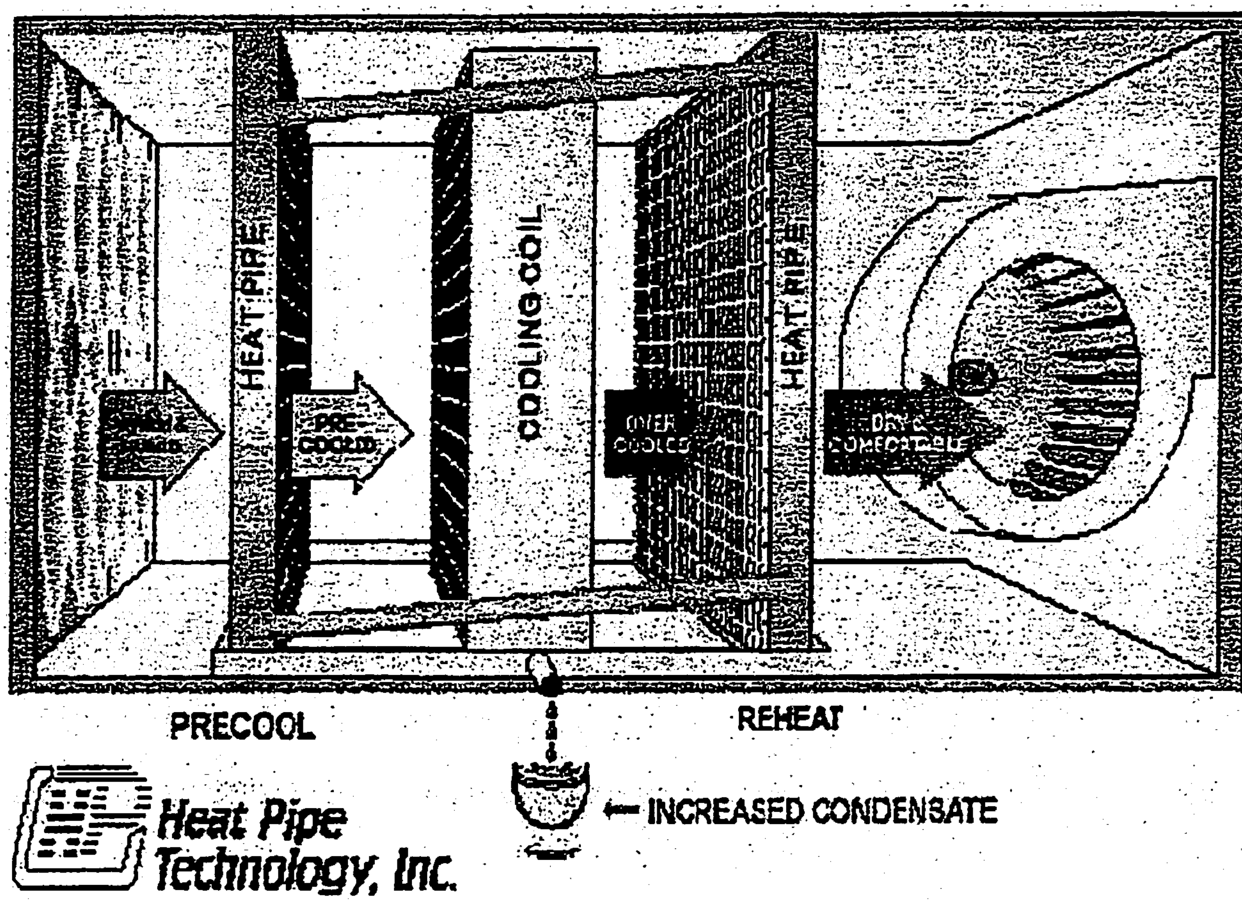


Figure 1. Diagram of the heat-pump-dehumidifier (Dinh, 1999).

Figure 2. Boxes for holding onions under warm-air-low-humidity storage with heat-pump dehumidifier coupled to the plenum by means of a fan assisted air duct.

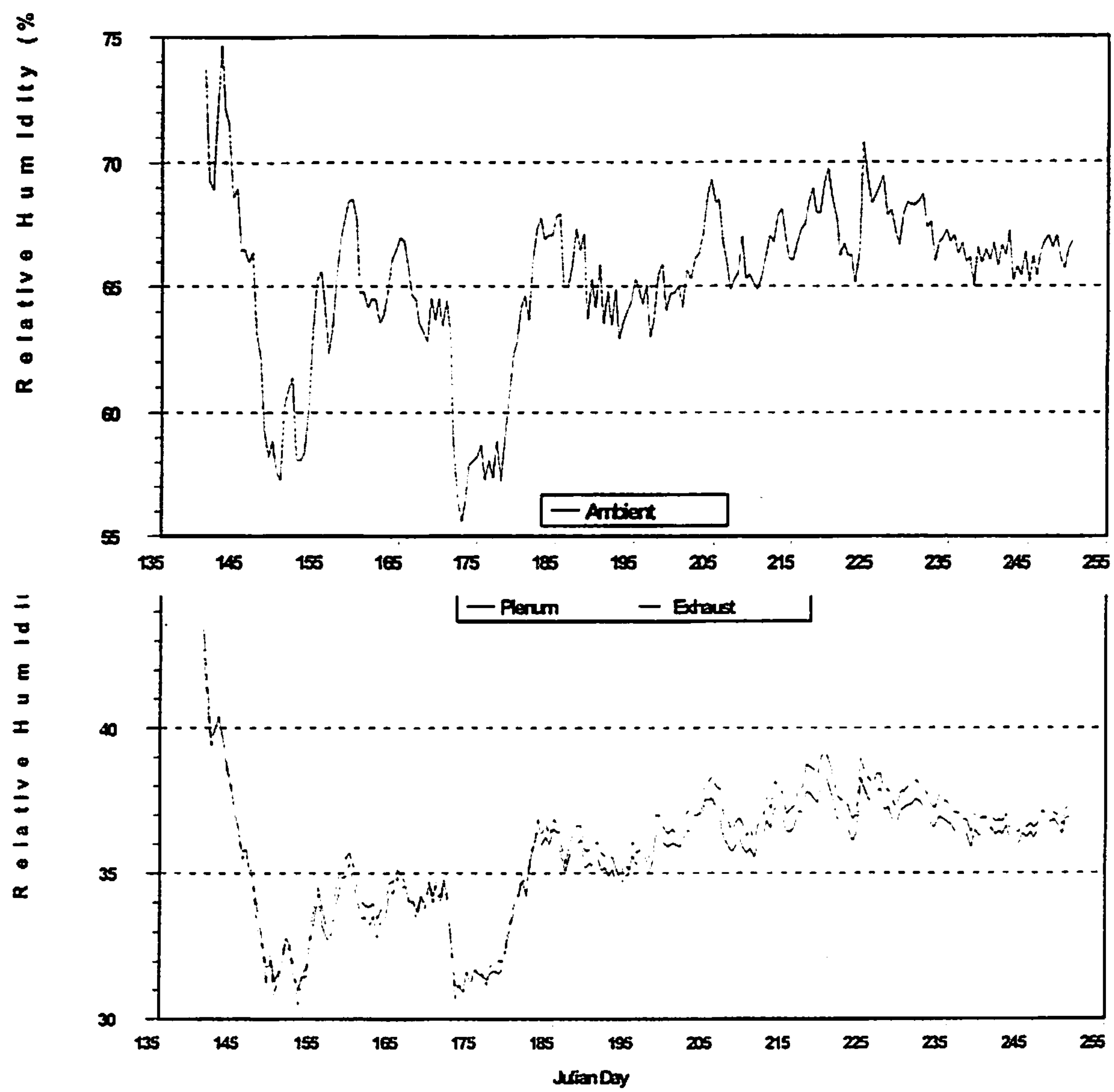


Figure 3. Variation of relative humidity throughout the duration of low humidity, warm air storage.

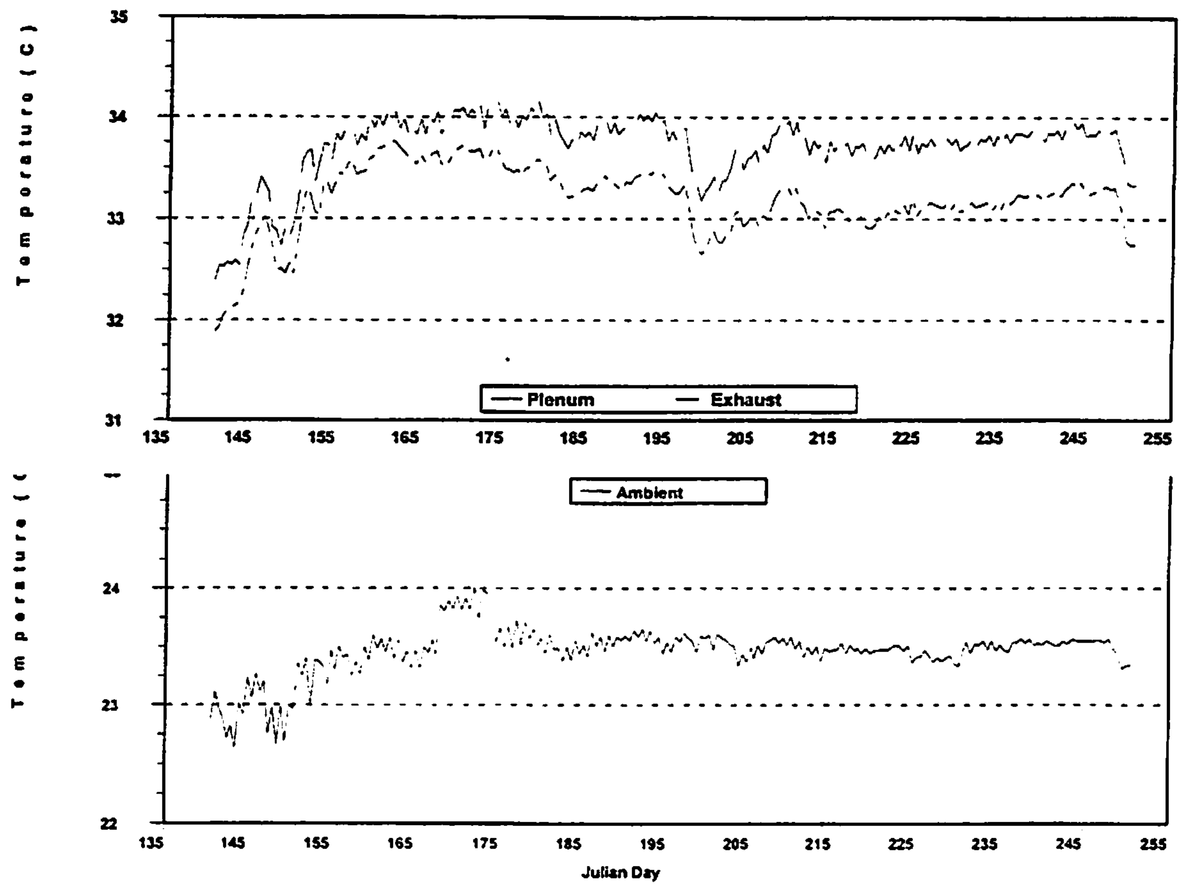


Figure 4. Variation of temperature throughout the duration of low humidity, warm air storage.

CHLORIDE REQUIREMENTS IN ONION: WIDESPREAD MISUNDERSTANDINGS

William (Bill) Randle, Research Horticulturalist

Introduction

In most plants, chloride is an essential, but minor element, thought to be toxic at high concentrations. In conversation with farmers of tobacco on the subject of applying high rates of chloride to fields in the Southern Coastal Plains of Georgia, Southern hospitality may have its limits because tobacco is the poster child for chloride toxicity in the agronomic world, and is extremely sensitive to even moderate levels of chloride. However in contrast sweet onions or Vidalia onions grown in the sandy soils of the coastal plain have a high requirement for chloride. A requirement that is not well known. A conflict of interest thus occurs because many farmers of onions also farm tobacco.

Research conducted at the University of Georgia has shown that onions not only tolerate high chloride levels, but actually require these higher levels to grow and be productive. When chloride was supplied at high levels (up to 500 ppm in nutrient solutions), several studies have shown that chloride, on average, is the 4th most utilized essential element, superceded only by nitrogen, potassium, and phosphorus (figure 1). This result is amazing, considering that chloride is thought to be required by plants in only small doses.

The high chloride requirements of sweet onions comes as a result of their leaf stomate structure. Stomates on the leaf surface regulate the movement of gases in and out of the leaf. Specialized cells called guard cells either swell or deflate, opening or closing a pore thereby allowing gasses to move or not move in and out of the plant. In most plants, potassium ions (+ charged) move in and out of guard cells, and cause stomates to open or close (figure 2). The positively charged potassium ions, however, need to be balanced by a negatively charged ion which is usually malate, formed from the decomposition of starch. Onions do not have starch, therefore they have evolved a different mechanism to counter the influx of positively charged potassium ions, that of using the negatively charged chloride ion. Knowing this, it stands to reason that chloride is needed in high amounts during the production of a sweet onion crop. Unfortunately, the chloride requirement is not widely known. As a matter of fact, some sources claim that onions are a "sensitive" crop to chloride. This is not the case.

Chloride fertilization in onion is overlooked and avoided because of an often misinterpreted association with sodium. Current recommendations for onion production in Oregon, Michigan, New York, Georgia, Texas, and California call for no additional chloride to be added to fertilization regimes. If chloride status in the plant is compromised, poorly functioning guard cells can lead to a number of abnormalities including reduced photosynthesis that may lower yields along with reduced transpiration which may lead to water congestion and increased foliar disease. Recent observations in commercial onion fields suggest that a lower chloride status may cause higher incidences of disease and conversely elevated chloride levels may reduce disease severity. This occurrence has been observed among different types of grasses and potato. A recent claim has been the reduction of the disease *Stemphylium vesicariium* in pears.

Materials and Methods

Soils in Georgia were recently tested for chloride levels prior to planting onions. Most results indicated that Cl was present at less than 6 pounds per acre, which is at the lower limit of detection. In an effort to test the effects of adding chloride to the fertility program, several test areas were established. The effects of adding 20 pounds to the acre of chloride can be seen in figure 3. The onion plants in the front received chloride through the irrigation water and are a darker green than the onions in the back which are lighter in color.

Results and Discussion

Results on the productivity of these two areas are still being compiled. As we begin to learn more about chloride, the recommended rate for chloride fertilization will likely increase.

Summary and Conclusions

Research into the effects of chloride on onion production is just beginning. Preliminary trials indicate that onions would benefit from increased chloride fertility in Georgia. It needs to be determined if chloride levels in the soils of other onion producing areas should be accordingly adjusted.

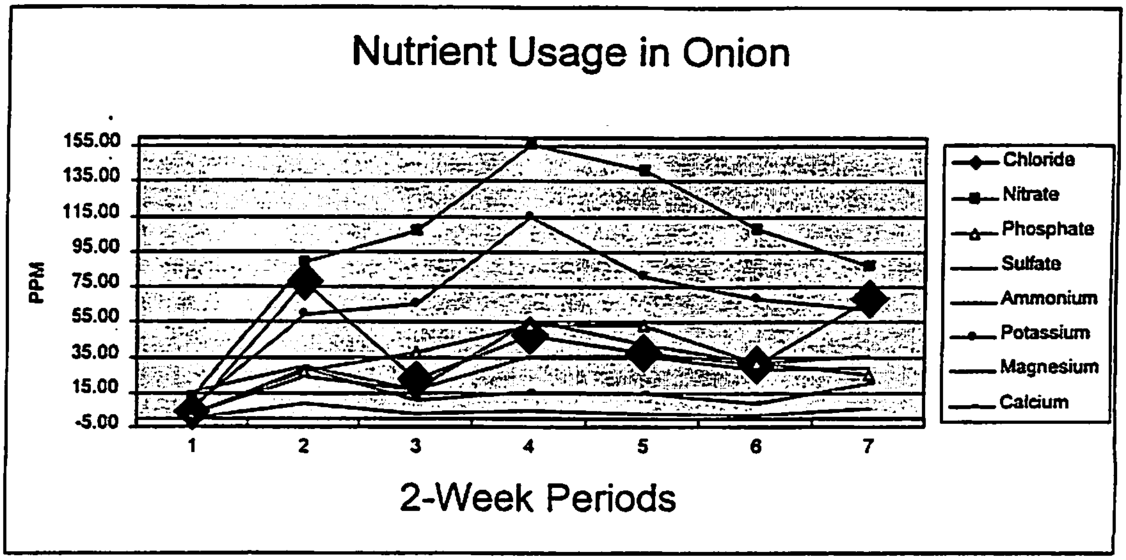


Figure 1. Use patterns for selected nutrients in onion during growth, development and maturation. Chloride has been highlighted.

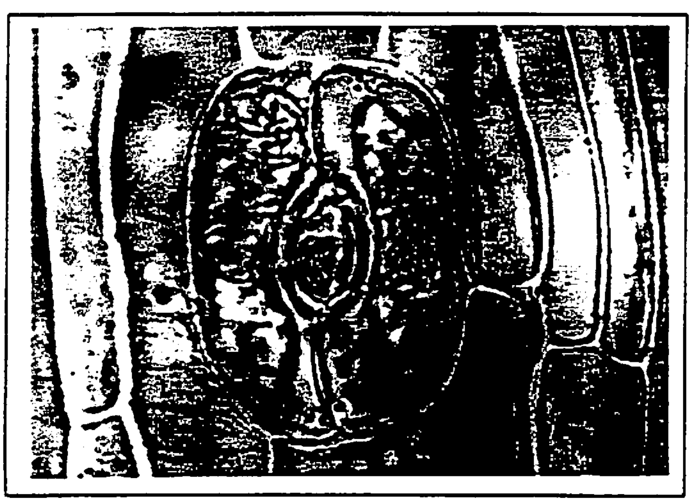


Figure 2. Plant stomates on the leaf composed of kidney shaped guard cells surrounding the circular pore. In onion, potassium and chloride ions control the opening and closing of the pore.

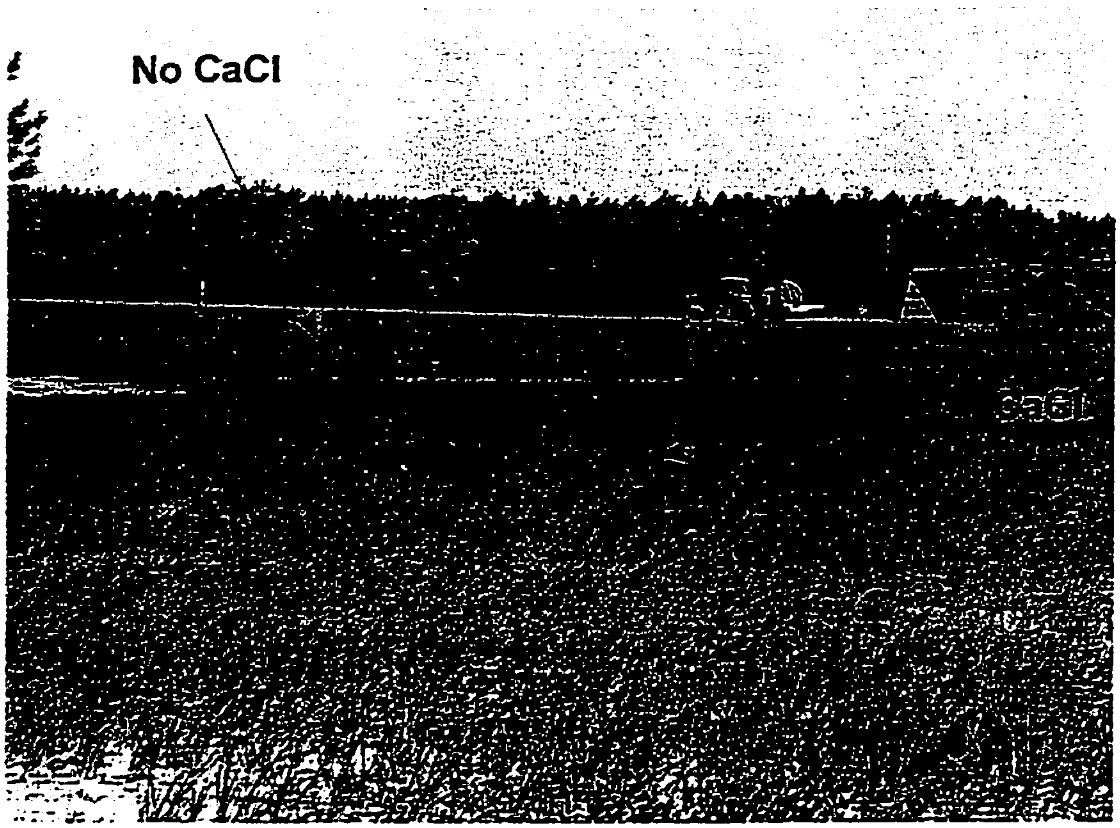


Figure 3. The effects of adding 20 pounds of chloride per acre to onion fields in South Georgia.

REPORT ON THE NEW SITUATION, OF THRIPS THAT VECTOR VIRUSES IN VIDALIA ONIONS

David Riley, Research Entomologist
Alton (Stormy) Sparks, Extension Entomologist

Introduction

During the fall of 2003, onion growers in the Vidalia region near Reidsville, Georgia, encountered unusual disease symptoms in onion seed beds. Samples were taken by the UGA Cooperative Extension Service (David Langston, Reid Torrance and Stormy Sparks) to determine the cause of the symptoms. There was a suspicion that this problem might be associated with onion cull piles in the area, of onions that had originated from Peru, the same region where Ron Gitaitus (CPES-Plant Pathology) had consulted on disease and thrips problems the previous year. Additionally, live *Thrips tabaci* were reported by APHIS on the onions imported from Peru.

Figure 2. Onion seed beds.

Stormy Sparks collected thrips from the imported onions and brought them in alcohol to the Vegetable Entomology Lab at Tifton where he and David Riley keyed out the adult thrips (figure 1) to primarily one species, *Thrips tabaci*, a cosmopolitan pest that occurs in the USA, but that is typically scarce in the Vidalia region in the Winter. David Riley, Stormy Sparks and Reid Torrance collected onions and thrips again on December 9, 2003 from seed beds (figures 2 and 3) and from onion cull piles at a farm located near Reidsville (figures 4 and 5).

Figure 4. Onion cull pile.

Thrips tabaci was detected in high numbers at the cull pile location and plant samples indicated a high frequency of a Tomato spotted wilt virus (TSWV) strain that infects onions as well as an Iris yellow spot virus (IYSV), both of which had not been detected in Georgia before 2003. The Plant Pathology Department at Tifton has since confirmed viruliferous *Thrips tabaci*, but they have also detected the onion-strain of TSWV and IYSV in multiple locations away from onion cull piles in Georgia.

Figure 1. *Thrips tabaci.*

Regardless of how it arrived to Georgia, the onion-strain of TSWV and IYSV viruses are now in the Vidalia area accompanied by elevated numbers of *Thrips tabaci*. The infection is currently established in several Vidalia growing areas. David Riley initiated a thrips species competition study to see if

Figure 3. Symptoms on onion transplants.

Figure 5. Sprouted cull pile.

the "new" strain of *Thrips tabaci* would establish itself along with our other thrips species.

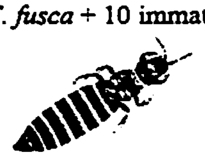
Thrips tabaci has always been a minor species of thrips in the Vidalia onion area, probably a result of the early establishment of *Frankliniella fusca* each Fall. With a possibly new biotype of *T. tabaci* from Peru, a competition study was needed to see if the alleged new biotype would establish itself in the area.

The first objective of the competition study was to measure reproduction of two species of thrips, *Frankliniella fusca* and *Thrips tabaci* (Peruvian strain) on onions both individually and in competition with each other.

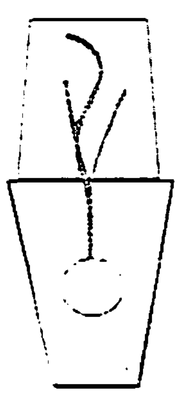
Materials and Methods

Treatments: (each treatment applied to a single onion plant-isolation cage, replicated 6 times):

1. 10 immature *T. tabaci*
2. 10 immature *F. fusca*
3. 10 immature *F. fusca* + 10 immature *T. tabaci*



One onion transplant (Savannah Sweet) "pencil" thickness 3-5 leaf stage was placed in a 1 quart styrofoam cup and sprayed to run-off with 1% Safer Soap solution. It was allowed to dry.



The number of thrips per above treatment were placed on the plant and covered with a quart-cup exclusion cage and the edge sealed with a clay strip. The plant and cup were then placed into a Percival Growth Chamber.

Two replications were placed on each of three shelves in the Percival Growth Chamber having a temperature of 27.5 °C and photoperiod of 12:12. The cups were left undisturbed for 2 weeks, after which time the top cage was removed and the plants and cup inspected for adults.

Adults were removed and placed in a 7 ml vial containing 70% ethanol being labeled by treatment and date. The cages were then closed for another two weeks leaving immature thrips in place to develop. The above procedure was then repeated, again removing adult thrips. The procedure was repeated until all adult thrips had been identified according to species for each inspection date.

Results and Discussion

The data summarized in table 1 indicates that both thrips species reproduced on Vidalia onions when looking at numbers of immature thrips. However, *T. tabaci* produced 72% more adults by the third date. Also, when combined, *T. tabaci* clearly produced more adults than *F. fusca* and, interestingly, there is a reduction in the overall number of immature thrips. This suggests that the mortality of immature thrips is occurring when thrips species are combined on the same onion plant. Given the greater number of resulting *T. tabaci* adults after one generation, the most likely scenario is that *T. tabaci* is interfering with the development of immature stages of *F. fusca*.

Summary and Conclusions

The new strain of *T. tabaci* appears to compete well with *F. fusca* under lab conditions and thus may be able to establish itself in the fall and winter growing season in the Vidalia area. The destruction of cull piles is currently recommended and appears to be carried out in practice. The handling of onion culls will require more attention than has been the case up to now. Additional sampling is needed this coming Winter and Spring to determine the extent of this emerging problem.

Table 1. Thrips species and reproduction by species.

Treatment	*F. fusca* 1st date	*T. tabaci* 1st date	immatures 1st date	*F. fusca* 3rd date	*T. tabaci* 3rd date	immatures 3rd date
1. *T. tabaci*	0.00 b	1.25 a	11.5 a	0.00 b	13.3 a	20.8 a
2. *F. fusca*	1.50 a	0.00 b	5.6 a	7.75 a	0.0 b	21.8 a
3. Both	0.13 b	1.50 a	2.3 a	1.25 b	6.3 ab	4.3 b

* Means in columns followed by the same letter are not significantly different (LSD, P>0.05)

EVALUATION OF PRISTINE FOR THE CONTROL OF PINK ROOT AND BOTRYTIS NECK ROT ON SWEET ONION

Kenneth Seebold, Research Plant Pathologist
David Langston, Extension Plant Pathologist
Bryan Horten, Research Technician

Introduction

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

Materials and methods

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

Fungicide applications were initiated on January 14, 2004 and continued on a 7-day spray schedule until April 1 for a total of 12 applications. All materials were applied with a CO_2-powered backpack sprayer using a 4-nozzle spray boom with 18-inch nozzle spacing. Hollow cone nozzles (TSX-18) were used and the application volume was 40 gallons per acre (GPA). Cuprofix Disperss 20DF was applied bi-weekly at a rate of 3 lb/A to all fungicide treatments to suppress bacterial diseases and all fungicide treatments were tank-mixed with Bravo WeatherStik 720SC at 1.5 pt/A.

The center two rows of each plot were harvested on May 5. Because of high levels of sourskin at harvest, onions were not cured or graded. They were weighed and were then stored for 5 months at 38° F. Following storage, they were removed and evaluated for the presence of BNR.

Results and discussion

Levels of BNR were high in the field at Hort Hill, which has a history of severe soilborne diseases. The fungicide programs employed in this experiment significantly reduced the severity of pink root (PR) on bulbs at the end of the growing season (Table 1). Full season applications of Rovral reduced PR as effectively as the majority of the Pristine programs; however, fewer applications were needed with Pristine to achieve similar levels of disease control. Two applications of Pristine, one at the beginning of the spray program and one at mid-season, were as effective as full-season applications of Pristine for the control of PR. Applications initiated at mid-season were less effective than full season applications of Pristine. No significant difference in yield between any treatment was observed.

Evaluation of onions that had been stored for 5 months for severity of Botrytis neck rot (BNR) showed trends that were similar to those observed for PR. Onions treated full-season with Pristine had a ten-fold reduction in BNR compared with the untreated check or the Rovral spray program (Table 2). Programs with as few as two applications of Pristine, one made at the initiation of the program and one at mid-season, were as effective as full-season applications of Pristine.

Summary and Conclusions

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

Table 1. Severity of pink root and yield (No. 40# box/A) of sweet onions treated with Pristine at the Hort Hill (Tifton), 2004.

Material	Application rate/A	Application timing[a]	PR[b] (0-10)	Yield[c] No. 40# box/A
Untreated Check	–	–	3.5 a	146.9 a
Bravo Weatherstik 720SC	1.5 pt	ABCDFHJL	1.1 bc	88.9 a
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Rovral 480SC	1.5 pt	EGIK		
Pristine 38WG	14.5 oz/A	A-L	0.4 de	119.5 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Pristine 38WG	14.5 oz/A	ACEGIK	0.6 cde	118.4 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Pristine 38WG	14.5 oz/A	ADGJ	0.3 e	112.9 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Pristine 38WG	14.5 oz/A	AEI	0.4 de	109.4 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Pristine 38WG	14.5 oz/A	AFK	0.9 cd	100.4 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Pristine 38WG	14.5 oz/A	AF	0.7 cde	93.3 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Pristine 38WG	14.5 oz/A	A	1.5 b	108.9 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Pristine 38WG	14.5 oz/A	ACE	0.6 cde	84.7 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
Pristine 38WG	14.5 oz/A	GIK	1.0 bc	65.4 a
Bravo Weatherstik 720SC	1.5 pt	A-L		
Cuprofix Disperss 20DF	3 lb	BDFHJL		
		P-value[d]	<0.0001	0.73

[a]Applications made on a 7 day schedule, where A=application 1 and L=application 12.
[b]Severity of pink root (PR) rated on a 0-10 scale where 0=no disease and 10=completely decomposed root system.
[c]Yield determined as the number of 40# boxes harvested per acre (across all grades).
[d]Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test (*P* value listed for each variable).

Table 2. Effect of Pristine on Botrytis neck rot of sweet onions following 5 months in storage at 38° F.

Material	Application rate/A	Application timing[a]	% BNR[b]		% Healthy[c]	
Untreated Check	–	–	43.9	a	49.5	c
Bravo Weatherstik 720SC	1.5 pt	ABCDFHJL	42.9	a	52.4	c
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Rovral 480SC	1.5 pt	EGIK				
Pristine 38WG	14.5 oz/A	A-L	4.7	c	86.2	a
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Pristine 38WG	14.5 oz/A	ACEGIK	5.7	c	85.7	a
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Pristine 38WG	14.5 oz/A	ADGJ	11.2	bc	79.8	a
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Pristine 38WG	14.5 oz/A	AEI	10.1	bc	75.7	ab
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Pristine 38WG	14.5 oz/A	AFK	9.3	c	75.8	ab
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Pristine 38WG	14.5 oz/A	AF	14.6	bc	81.2	a
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Pristine 38WG	14.5 oz/A	A	28.8	ab	60.6	bc
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Pristine 38WG	14.5 oz/A	ACE	4.5	c	79.2	a
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
Pristine 38WG	14.5 oz/A	GIK	5.0	c	78.9	ab
Bravo Weatherstik 720SC	1.5 pt	A-L				
Cuprofix Disperss 20DF	3 lb	BDFHJL				
		P-value[d]	<0.0006		0.0016	

[a]Applications made on a 7 day schedule, where A=application 1 and L=application 12.

[b]Percentage of onions with symptoms of Botrytis neck rot (BNR) after 5 months in storage at 38° F.

[c]Percentage of healthy onions after 5 months in storage at 38° F.

[d]Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test (*P* value listed for each variable).

EFFECT OF THRIPS CONTROL ON CENTER ROT OF ONIONS

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Introduction

Center rot of onion bulbs may be a serious problem for onion production during some years. Recent research has demonstrated that thrips can transmit the bacteria that cause this disease. The actual importance of thrips in movement and severity of the disease is unknown. Field trials were conducted during the 2003-4 production season to evaluate the potential effects of thrips control on center rot of onions.

Materials and Methods

The experiment was conducted in four commercial onion fields in Toombs and Tattnall Counties, with three replications of the treatments in each field. The treatments consisted of weekly insecticide application for thrips control and a non-treated check (although the check did receive producer treatments). Plots were three beds wide (with 4 rows on each bed) and 50 feet long. Insecticide plots were treated with a mix of Lannate (0.9 lb AI/ac) and Warrior (0.03 lb AI/ac). First applications were made on March 3 and were continued through March (application dates: March 3, 10, 17, 24).

Disease counts were conducted on March 30, April 7 and April 15. In one field, ratings were taken only on March 30 as the field quickly matured and was harvested earlier than expected. Disease counts were taken of all plants in the middle of the bed of each plot (>400 plants per plot) by counting the number of onions with obvious symptoms of center rot.

Results and Discussion

The disease incidence in all four locations was low (table 1), exceeding 1 percent in only one field (Toombs 1) which reached an estimated level of about 1.5% based on 400 plants per plot). The low disease pressure precludes any meaningful conclusions from these tests.

Table 1. Number of bulbs per plot with center rot at various locations.

Location	Number of bulbs per plot with center rot					
	March 30		April 7		April 14	
	Treated	Check	Treated	Check	Treated	Check
Reidsville	0	0	—	—	—	—
Near Prison	0	0	0.7	0.0	0.7	0.0
Toombs 1	0	0	1.3	2.7	6.0	6.0
Toombs 2	0	0	0.0	0.3	0.0	0.3

THRIPS SEASONAL ABUNDANCE AND SPECIES COMPOSITION ON ONIONS

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Introduction

Early in the 2003-2004 production season, a problem became apparent in onion transplant beds that was not easily explained. While the exact culprit has yet to be determined, Iris Yellows Spot Virus (IYSV) has been detected on site and may have contributed to the problem. While the potential impact of (IYSV) in Georgia remains highly debatable, it has proven to be a severe problem in other onion production regions. The vector of this virus is thrips, with onion thrips, *Thrips tabaci*, reported to be the primary vector in several regions of the world. In Georgia, onion thrips have been reported to occur, but they typically represent only a small portion of the population. Western flower thrips, *Frankliniella occidentalis*, and the tobacco thrips, *F. fusca* are also to be found. However, Western flower thrips is reported to not vector IYSV and it is not known whether tobacco thrips can vector this virus.

Concurrent with detection of IYSV in the Vidalia onion production region, live onion thrips were also discovered inside cull onions imported from Peru. With the potential introduction of both a new viral disease and its vector into the region, surveys were conducted to evaluate the distribution of both the disease and the vector. This report addresses the results of surveys conducted to evaluate the thrips species composition on onions in the Vidalia production region.

Materials and Methods

Eight fields were selected for thrips sampling. These fields had also previously been selected for virus sampling. In each field, on each sample date, plants were visually examined for thrips. Plants were randomly selected and sampling was conducted for approximately 30 minutes in each field on each date (one person sampling for 30 minutes, or two sampling for 15 minutes). Thrips were aspirated from the plants and placed into alcohol. All thrips collected were examined to determine the stage ofdevelopment (adult or immature) and their species. The majority of thrips collected were adults and only the adult data is presented. Adult thrips were examined under a dissecting scope for preliminary species identification. Subsamples were mounted on slides and examined under a compound microscope for species verification.

In addition to the eight commercial fields, the original cull pile of onions from Peru was periodically monitored for thrips species composition. Six additional commercial fields were sampled once during the production season.

Results and Discussion

Results of the survey are presented in the attached tables. Sampling was attempted prior to the indicated dates, but a limited number of fields were visited and very few thrips were encountered; thus, the survey was delayed until the indicated dates. As usual, thrips populations were low until mid-March then increased through harvest. The eight commercial fields yielded over 95 percent tobacco thrips for most fields and a single onion thrips the entire season. The cull onions from Peru did support an onion thrips population, with 60 percent onion thrips on the last sample date. However, samples collected on the same date at the nearest commercial onion field did not detect any onion thrips.

Summary and Conclusions

The presence of high onion thrips populations on the cull onions from Peru are of concern as they could represent an introduction of a new 'biotype' of onion thrips into Georgia. However, the importance of this is as yet unknown. The lack of onion thrips in the commercial fields, particularly the field closest to the cull pile location, is a promising indicator that onion thrips have not become a more prominent species, at least not at this time. Surveys of thrips species composition will be needed in the future to determine if it changes over time. The detection of onion thrips, and IYSV, on cull onions during the 2004-05 season could either represent an early detection of an emerging problem or the first detection of a minor problem that has been present but undetected for many years. Only time and future surveys will elucidate the correct answer.

Table 1. Thrips counted and identified in various onion fields, 2004.

Location	Number collected on March 3			Number collected on March 17			Number collected on April 7			Percent Tobacco Thrips
	Tobacco	Onion	Other	Tobacco	Onion	Other	Tobacco	Onion	Other	
Toombs South 1	1	0	0	14	0	1	25	0	0	97.6
Toombs South 2	3	0	0	54	0	3	81	0	5	94.5
Toombs Central				33	0	2	56	0	2	95.7
Toombs North	1	0	0	11	0	1	30	0	2	93.3
Tattnall South	0	0	1	9	0	0	77	0	1	97.7
Reidsville 1	2	0	0	10	0	0				100.0
Reidsville 2	0	1	0	24	0	0	87	0	0	99.1
Tattnall North	0	0	1	23	0	1	67	0	0	97.8

Six additional samples collected in commercial fields in Feb., March and April yielded > 90 percent tobacco thrips and no onion thrips.

Table 2. Thrips counted and identified on onion cull pills, 2004.

Location	Number collected on Dec.16, 2003			Number collected on Feb. 3, 2004			Number collected on March 10, 2004			Number collected on April 7, 2004*		
	Tobacco	Onion	Other	Tobacco	Onion	Other	Tobacco	Onion	Other	Tobacco	Onion	Other
Peru culls	0	3	0	3	0	0	2	8	0	25	38	2

Twenty two thrips were collected from the nearest commercial field (about ½ mile northwest) with no onion thrips collected (20 tobacco thrips, 2 other).

EFFICACY OF SELECTED INSECTICIDES AGAINST TOBACCO THRIPS ON ONIONS

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Introduction

A small plot trial was conducted in a commercial onion field in Toombs County, Georgia, to evaluate the efficacy of selected insecticides against thrips. Samples of adults collected prior to treatment and post-treatment indicated that the species composition consisted of almost 100% tobacco thrips, *Frankliniella fusca*.

Materials and Methods

Plot size: 25 feet by 4 rows (one 6 foot bed), with a non-treated bed between plots.

Experimental design: RCB with 4 replications.

Treatments:

- Lannate LV at 0.9 lb AI/ac (3 pints/ac)
- Diazinon AG500 at 0.5 lb AI/ac (1 pint/ac)
- Warrior T at 0.03 lb AI/ac (3.84 oz/ac)
- Mustang Max at 0.025 lb AI/ac (4 oz/ac)
- Assail 70WP at 0.1 lb AI/ac (2.3 oz/ac)
- V-10112 20SG at 60 g AI/ac
- Check

Application methodology:

- CO_2 pressurized backpack sprayer.
- 60 psi.
- 4 nozzles per row (broadcast).

Application date: April 16, 2004.

Thrips monitoring:

All adult thrips were counted on five randomly selected plants in each plot on each sample date. Immature thrips were not counted, but represented a low percentage of the population.

Statistical analysis:

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

Results and Discussion

All insecticide treatments significantly reduced thrips populations at three days after treatment (table 1). Lannate, Assail and both Pyrethroids (Mustang Max and Warrior) provided the greatest reductions at three days after treatment. At 6 days after treatment, thrips had moved back into the Lannate, Diazinon and V-10112 plots, with less than 40% control in these treatments. The two pyrethroid treatments and Assail showed longer residual activity, with the pyrethroid treatments having the lowest numerical densities at 6 days after treatment.

Table 1. Thrips densities in small plot efficacy trial in onions, Toombs County, Georgia, 2004.

Treatment	Thrips per Plant	
	3 DAT	6 DAT
Check	11.50 a	11.60 a
Diazinon	6.95 b	10.55 a
Lannate	1.55 d	7.80 b
V-10112	3.80 c	7.10 b
Assail	1.05 d	3.75 c
Mustang Max	1.60 d	2.20 cd
Warrior	1.50 d	1.20 d

EXPERIENCES WITH A FOOD PRODUCT X-RAY INSPECTION SYSTEM FOR CLASSIFYING ONIONS

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Introduction

Maintaining product quality is critical for success in fresh fruit and vegetable marketing. Some onion packing houses are considering the addition of x-ray inspection systems to their existing optical inspection systems. The x-ray systems enable detection of voids that are likely to be associated with the presence of various bacterial or fungal rots in onions.

Materials and Methods

A series of tests were conducted at the University of Georgia Vegetable and Vidalia Onion research and education center in Lyons, Georgia with a rented Smith-Heimann EaglePak® Xray inspection machine. In 2001, two 100 onion batches of medium sized onions and 100 jumbo onions were inspected by machine, and then halved for a visual internal evaluation.

Results and Discussion

In each series of tests, the accuracy rate was greater than 93% and the false positives were less than 6%. In 2002, two batches, each of 100 onions, were run on a similar machine as in 2001. Additionally, in 2002 and 2004 multiple onions with slight to severe defects were each passed through the inspection machine 50 times respectively, with orientation not controlled to ascertain consistency in defect detection. The machine passed onions with no to slight defect presence (based on subsequent internal visual evaluation of onion halves) nearly 100% of the time. Onions with severe defects were rejected 100% of the time.

In 2004, a Center Rot disease study showed that 80% of the fruit that had passed a routine surface visual inspection, was detected to have the disease, as was later confirmed by dissecting the onions for internal examination. False positives were in the 10% to 15% range.

Summary and Conclusions

The machine detected diseased fruit that passed human visual inspection (HVI) and (in 2004) individual tactile grading. These accuracy and false positive rates are close to the 90% and 10% levels generally accepted for these respective statistics. With an appropriate addition of multiple lanes, commercially viable rates of machine examination are possible.