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Georgia Onion

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2006 GEORGIA ONION RESEARCH - EXTENSION REPORT

(Summary Report of 2006 Data)

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THE 2006 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 2006, growers in Georgia harvested over 10,500 acres of onions with an on farm value in excess of $82 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 that covered data gathered during 1992. As editor throughout the history of the Onion Research-Extension Report it has been an honor and a privilege to serve in this capacity.

Bryan W. Maw

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VIDALIA ONION VARIETY TRIAL 2005-2006

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Introduction

Onion variety trials have become an important program at the University of Georgia to assess a wide variety of onion characteristics. This has included yield, graded yield, disease resistance, maturity class, flavor characteristics and taste. These trials have been used in part to select varieties for inclusion on the Georgia Department of Agriculture's official list of approved varieties. The Department has relied primarily on flavor characteristics and maturity class.

Materials and Methods

There were 42 entries in the variety trial in the 2005-06 season. Seed were sown on 19 Sept. 2005 in high density plant beds with approximately 60 seed per linear foot. Transplants were grown following University of Georgia Cooperative Extension Service recommendations (Boyhan et al., 2001).

Onion transplants were pulled on 30th November, 2005 and reset to their final spacing with an in-row spacing of 5.5 in. and between-row spacing of 12 in. Four such rows were planted on beds or panels formed on 6-ft. centers. Dry bulb onions were grown according to UGA Cooperative Extension Service recommendations (Boyhan et al., 2001).

The experimental unit or plot size was 30 ft. long with approximately 262 plants. There was a 5 ft. between-plot, in-row alley between each experimental unit. The experimental design was a randomized complete block design with four replications. For seedstems, doubles, and disease incidence the entire 30 ft. plot was evaluated. Twenty-five ft. of each plot was harvested for yield data. Varieties were harvested as they matured on 10th, 17th, 25th April, 2006 along with 1st and 4th May, 2006. Plants were harvested by hand pulling and field curing for two days. Total or field yield was recorded for each plot before transporting to the shed where they were heat cured at 95 deg. F. for 24 hrs. Onions were then graded into mediums (≥2 in. and <3 in.) and jumbos (≥3 in.).

Onions were evaluated for doubles and seedstems on 30th March, 2006 and a select number of varieties were evaluated for center rot on 26th April, 2006. A ten bulb sample from each experimental unit was tested for pyruvate and soluble solids according to (Randle and Bussard, 1993).

The height and width of five bulbs from each experimental unit were measured and averaged to determine the height/width ratio. In addition, five bulbs from each plot was cut open perpendicular to the growing axis and the number of centers counted. This data was averaged before analysis.

Count data for seedstems and doubles were transformed with square root plus 0.5 before analyses and means and least significant differences (LSD) were back transformed to their original units. The coefficient of variation (CV) and Fisher's Protected LSD (p=0.05) with Bonferroni adjustment for five comparisons was computed for each dataset.

Results and Discussion

The 42 entries in the trial represent 11 different onion seed companies. The number of doubles averaged from about 1-38 (Table 1). This contrasts to the 2004-05 season where doubles ranged from 0-118. The five varieties with the highest number of doubles were 'Sapelo Sweet', 'WI-129', 'WI-131', 'Georgia Boy', and 'Granex Yellow PRR'. Twenty-seven of the entries averaged less than 10 doubles per plot. The average number of seedstems ranged from approximately 0-15 with only 'Granex Yellow PRR' having average number of seedstems in double digits.

These entries can be separated into three maturity classes of early, mid-season and late-season varieties. Early season entries were harvested on 10th and 17th April, 2006, while mid-season varieties were harvested on 25th April and 1st May, 2006. Finally, late season entries were harvested on 4th May, 2006. Late season varieties have been plagued with bacterial diseases putatively identified as sour skin and slippery skin. This is reflected in the percent marketable onions with the early and mid-season varieties averaging 69% and 73% respectively, while the late season varieties averaged only 48%.

Among the 21 varieties that were evaluated for center-rot the incidence range averaged 5.3 -30.5. The lowest incidence occurred with 'Mr. Buck', 'Miss Megan', 'Georgia Boy', and 'Yel. Granex 114101'. Overall the incidence of center rot was much higher in 2006 compared to 2005.

Overall yields were good in 2006 with an total yield average of 1,082 50-lb bags/acre compared with only 893 50-lb bags/acre in 2005. The total yield range was 536 - 1,279 50-lb bags/acre. On the low end was 'XP-Red', which for some reason had a poor stand in the plots resulting in low yields. The highest yielding entry for total yield was DY 606 at 1,279 50-lb bags/acre, which was not statistically different from the next 25 entries in descending order for total yield. Jumbo yields ranged from 242 - 955 50-lb bags/acre with the highest yield from Yellow Granex 129101, which did not differ from the next 28 in descending order for jumbo yields. Medium yield was very low for all of the entries, which probably reflects the overall excellent yields.

Pyruvate ranged from 2.8 - 6.3 um/gfw with an average of 4.5 um/gfw which was higher than for 2005 where onions averaged 3.8 um/gfw (Table 2). The lowest entry this year was DY 72766 with 2.8 um/gfw, which did not differ from the next 8 lowest entries for pyruvate. Sugar content ranged from 7.8-11.6% with Ohoopee Sweet having the highest sugar content.

The bulb height/width ratio ranged from 0.62 for Granex Yellow PRR to 1.00 for Yel. Granex 126101. Varieties with height/width ratios closer to one are better for processing into onion rings. Although there were no entries with height/width ratios over one, such varieties would be considered unacceptable for the Vidalia onion industry. The number of centers was also evaluated in this trial and ranged from 1.0 - 2.1. Varieties that average one or near one for centers are also considered better candidates for processing into onion rings.

CVs had relatively low percentages and were typical of a field experiment.

Summary and Conclusions

In conclusion, this year was good for onions, having optimum conditions for high yields and low disease.

References

Boyhan, G.E., D.M. Granberry and W.T. Kelley. 2001. Onion Production Guide. Univ. of Ga. Bul. No. 1198.

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

Table 1. Evaluation of Vidalia onion varieties for doubles, seedstems, disease, and yield.

				Counted on					
				3/30/06		4/26/06			
				Doubles	Seedstems	Center-Rot (Pantoea)	Field Yield	Jumbos	Mediums
No.	Entry	Company	Harvest Date	(No./plot)	(No./plot)	(No./plot)	(50 lb bag/acre)	(50 lb bag/acre)	(50 lb bag/acre)
1	FS 2005	Solar Seed	04/10/06	16.3	0.5		976	744	28
2	FS 2011	Solar Seed	04/17/06	13.1	4.4		1192	945	11
3	Sapelo Sweet	D. Palmer Seed	04/25/06	38.2	2.7		1004	741	22
4	Georgia Boy	D. Palmer Seed	05/01/06	32.4	0.6	7.1	1149	827	7
5	Ohoopee Sweet	D. Palmer Seed	05/01/06	5.7	0.0	9.7	1000	665	9
6	Mr. Buck	D. Palmer Seed	05/01/06	3.7	0.4	5.3	1014	835	8
7	Miss Megan (DPS 1290)	D. Palmer Seed	05/04/06	5.1	0.6	6.8	1090	625	6
8	Yel. Granex 15082	Dessert Seed	04/25/06	6.1	3.2		1078	817	6
9	Yel. Granex 108101	Dessert Seed	05/04/06	2.8	1.9	12.2	1090	837	4
10	Yel. Granex 15094	Dessert Seed	05/04/06	6.3	9.7	28.2	1137	686	4
11	Yel. Granex 105101	Dessert Seed	05/01/06	3.7	3.6	22.0	1073	922	4
12	Yel. Granex 126101	Dessert Seed	05/01/06	2.5	4.7	14.7	1028	612	3
13	Yel. Granex 129101	Dessert Seed	05/01/06	3.1	2.4	13.5	1141	955	4
14	Yel. Granex 114101	Dessert Seed	05/01/06	5.4	2.5	8.9	1131	738	4
15	Yel. Granex 15085	Dessert Seed	04/25/06	2.1	2.6		916	815	4
16	Caramelo (SRO 1000)	Nunhems	05/01/06	5.8	0.2	16.8	1051	792	6
17	Sweet Vidalia	Nunhems	04/25/06	18.2	9.1		1253	868	3
18	Sweet Caroline (SXO 1001)	Nunhems	05/04/06	3.2	0.2	18.9	1215	353	1
19	Nirvana	Nunhems	04/25/06	3.5	0.0		1268	883	1
20	HSX-61304	Hortag Seed	05/04/06	3.2	1.2	22.0	954	342	7
21	Sweet Jasper (XON-202Y)	Sakata Seed	05/04/06	5.4	3.2	18.8	1228	559	1

22	Ponderosa (XON 303Y)	Sakata Seed	05/01/06	7.3	0.6		1063	558	3
23	XON-403Y	Sakata Seed	05/01/06	12.5	1.5	19.4	1208	768	3
24	XON-203Y	Sakata Seed	04/25/06	9.9	1.6		1146	873	1
25	XON-204Y	Sakata Seed	04/25/06	4.5	1.8		1046	767	3
26	WI-129	Wannamaker	04/17/06	36.5	1.0		1216	711	6
27	WI-131	Wannamaker	04/17/06	32.8	3.3		1163	765	17
28	DY 606	Shaddy	04/17/06	13.4	0.4		1279	643	2
29	DY 72766	Shaddy	04/10/06	16.0	3.4		1051	824	18
30	SSC 1535 F1	Shamrock	04/17/06	24.8	0.8		918	559	17
31	Honeycomb (SSC 6372)	Shamrock	04/17/06	12.1	2.5		814	507	42
32	Honeybee (SSC 33076)	Shamrock	04/10/06	21.1	2.1		1155	878	7
33	Sugar Belle	Shamrock	04/25/06	10.7	1.4		995	694	1
34	J 3001	Bejo Seed	04/25/06	2.6	2.0		1104	784	1
35	J 3002	Bejo Seed	05/04/06	1.7	0.0	30.5	1055	242	1
36	Granex Yellow PRR	Seminis	05/01/06	29.6	14.9	29.3	1037	738	12
37	XP 07542007	Seminis	04/25/06	9.3	0.7		976	705	5
38	Pegasus	Seminis	05/04/06	3.1	4.1	30.4	1110	396	1
39	Granex 33	Seminis	05/04/06	8.1	1.6	23.2	1147	413	1
40	Century	Seminis	05/04/06	2.0	1.1	23.1	1259	375	3
41	Savannah Sweet	Seminis	05/01/06	1.3	0.4	30.3	1162	866	2
42	XP Red	Seminis	05/04/06	1.8	0.0		536	460	26
		Coefficient of Variation		28%	34%	26%	11%	23%	90%
		Fisher's Protected LSD (p=0.05) w/Bonferroni adj.		2.0	0.4	3.7	227	299	13

Table 2. Variety evaluation for pyruvate, sugar, height/width ratio, and bulb centers.

No.	Entry	Company	Pyruvate (umoles/gfw)	Sugar (%)	Height/Width Ratio	Centers (No./bulb)
1	FS 2005	Solar Seed	2.9	8.6	0.84	1.3
2	FS 2011	Solar Seed	3.3	7.8	0.80	1.6
3	Sapelo Sweet	D. Palmer Seed	4.9	9.7	0.74	1.2
4	Georgia Boy	D. Palmer Seed	5.1	9.9	0.75	1.4
5	Ohoopee Sweet	D. Palmer Seed	6.3	11.6	0.84	2.0
6	Mr. Buck	D. Palmer Seed	5.2	9.7	0.73	2.1
7	Miss Megan (DPS 1290)	D. Palmer Seed	4.9	9.5	0.74	1.6
8	Yel. Granex 15082	Dessert Seed	5.7	9.0	0.67	1.0
9	Yel. Granex 108101	Dessert Seed	5.0	9.7	0.70	1.6
10	Yel. Granex 15094	Dessert Seed	4.7	9.3	0.68	1.3
11	Yel. Granex 105101	Dessert Seed	4.5	9.4	0.65	1.4
12	Yel. Granex 126101	Dessert Seed	4.5	9.2	1.00	1.7
13	Yel. Granex 129101	Dessert Seed	4.4	8.7	0.69	1.2
14	Yel. Granex 114101	Dessert Seed	5.0	8.7	0.77	1.3
15	Yel. Granex 15085	Dessert Seed	4.2	8.5	0.71	1.1
16	Caramelo (SRO 1000)	Nunhems	4.4	9.1	0.66	1.3
17	Sweet Vidalia	Nunhems	4.9	9.5	0.66	1.2
18	Sweet Caroline (SXO 1001)	Nunhems	4.3	9.4	0.63	1.1
19	Nirvana	Nunhems	4.6	9.5	0.77	1.0
20	HSX-61304	Hortag Seed	5.4	9.5	0.66	2.0
21	Sweet Jasper (XON-202Y)	Sakata Seed	4.0	10.5	0.69	2.0
22	Ponderosa (XON 303Y)	Sakata Seed	6.0	8.5	0.79	1.4
23	XON-403Y	Sakata Seed	4.8	8.4	0.77	1.6
24	XON-203Y	Sakata Seed	4.2	8.5	0.72	1.4

25	XON-204Y	Sakata Seed	4.9	9.2	0.77	1.8
26	WI-129	Wannamaker	3.0	8.6	0.84	1.3
27	WI-131	Wannamaker	3.2	7.9	0.85	1.3
28	DY 606	Shaddy	3.0	7.8	0.85	1.1
29	DY 72766	Shaddy	2.8	8.7	0.79	1.2
30	SSC 1535 F1	Shamrock	3.5	9.7	0.64	1.3
31	Honeycomb (SSC 6372)	Shamrock	3.5	9.7	0.72	1.2
32	Honeybee (SSC 33076)	Shamrock	3.8	8.6	0.76	1.0
33	Sugar Belle	Shamrock	5.4	9.2	0.67	1.6
34	J 3001	Bejo Seed	4.9	8.8	0.72	1.3
35	J 3002	Bejo Seed	4.7	9.6	0.66	1.7
36	Granex Yellow PRR	Seminis	5.1	9.7	0.62	1.8
37	XP 07542007	Seminis	4.6	9.5	0.73	1.1
38	Pegasus	Seminis	4.6	9.5	0.65	1.5
39	Granex 33	Seminis	5.2	9.9	0.69	1.9
40	Century	Seminis	3.8	9.4	0.68	1.4
41	Savannah Sweet	Seminis	4.9	8.3	0.73	2.1
42	XP Red	Seminis	5.2	11.5	0.78	1.3
		Coefficient of Variation	15%	8%	6%	21%
		Fisher's Protected LSD (p=0.05) w/Bonferroni adj.	1.2	1.4	0.08	0.5

CONTROLLED ATMOSPHERE STORAGE AND BULB CHARACTERISTICS OF VARIETY TRIAL ONIONS 2004-2005

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Introduction

Every year onion variety trials are conducted to assess new and existing varieties for their suitability in the Vidalia onion growing region of Southeastern Georgia. Part of that assessment involves their suitability for storage under controlled atmosphere (CA) conditions. In addition, the height/width ratios and number of centers are recorded for these varieties. Such characteristics are important for the processing industry, which requires rounder onions with single centers for maximum onion ring production.

This study was part of the 2005 variety trial to report information on onion storability and suitability for the onion ring market.

Materials and Methods

Approximately 50 lbs of onions from each experimental unit or plot from the 2004 - 2005 variety trial was transported to Vidalia Onion Research Laboratory in Tifton, Ga. to be stored under CA conditions of 3% O_2, 5% CO_2, 34 deg. F., and 70% relative humidity. Onions were placed under these conditions as they matured. CA initiation dates were 3rd, 10th, 18th, 25th of May, 2005. Onions were removed from storage on 3rd October, 2005.

Onions were evaluated for weight loss (primarily water loss) during storage and percent marketability. In addition, onions were held for two weeks under ambient conditions (approx. 75 deg. F.) after removal from CA storage and re-evaluated for weight loss, compared with the pre-storage weight, taking into account the post-storage weight and percent marketability. For five bulbs from each experimental unit a height and width measurement was taken to determine the height/width ratio. Bulbs were then cut perpendicularly to the growing axis and the number of centers was counted.

Data were subjected to an analysis of variance and the Fisher's Protected Least Significant Difference (LSD) calculated (p=0.05), taking the Bonferroni adjustment for five comparisons. The coefficient of variation (CV) was calculated for each dataset.

Results and Discussion

Weight loss in CA storage ranged from 3.3% for Serengeti to 13.6% for HSX-61304 F_1 (Table 1). Seventeen of the entries lost 5% or less in storage. The percent marketable onions after 4.5 months of storage ranged from 44-95%. There were 23 varieties that had 70% or better marketable onions after removal from storage. The average for all the varieties was 69% marketable, which would be considered good. There were, however, several entries that had less than 60% marketable onions upon removal from storage and included Var. No. 15082, WI-609, FS 2011, WI-3115, Sugar Belle, Century, SSC-1600, and HSX-61304 F_1. Several of these varieties would be considered early maturing and so are unlikely to be stored under CA conditions.

Varieties were held at ambient conditions for two weeks after removal from CA storage and re-evaluated. The weight loss among these bulbs ranged 0.6% to 3.4%. Varieties with less than 1% weight loss during these two weeks included EX 07542007, EX 07542008, Georgia Boy, Mr. Buck, WI-102, Var. No. 15082, XON 303Y, and Var. No. 105101. The percentage marketability after two weeks, based on pre-storage weights, was also noted. This ranged from 9% for HSX-61304 F_1 to 65% for Sweet Vidalia and Serengeti. An additional third to two thirds of onions were lost among the varieties in this trial during this two week period. This rapid loss in marketability among onions removed from CA storage has been seen in past studies. Grocery stores and consumers should be counseled to keep these onions under refrigeration as much as possible after removal from CA storage to prevent rapid loss.

The onion height/width ratio and number of centers is important for buyers of onions destined for onion rings. More rings can be generated from an onion that is nearly round with a single center. Onions that have a low height/width ratio and/or more than one center will yield fewer onion rings. The height/width ratio among these varieties ranged from 0.5 for SSC-1600 to 1.1 for Ohoopee Sweet (Table 1). Varieties with a height/width ratio greater than one would be considered unsuitable as a Vidalia onion. It should be noted that a single year's data is not sufficient to make a complete assessment of a particular variety. Several varieties had height/width ratios at or near one including HSX-18201 F_1, Serengeti, Gobi, 1200, XON 303Y, and Var. No. 34140. The number of centers among these varieties ranged from 1.0 to 2.7 (Table 1). Along with SSC-1600 with 2.7 centers, there were 11 entries that averaged 2.0 or more centers per bulb. With the exception of weight loss after two weeks at ambient temperatures all the CVs were within an acceptable range for an experiment of this type.

Table 1. Evaluation of onion variety storability and bulb characteristics, 2005.

No.	Entry	Source	After 4.5 months of CA storage: Weight Loss (%)	After 4.5 months of CA storage: Marketable	2 weeks after removal from storage: Weight loss (%)	2 weeks after removal from storage: Marketable	Height/Width Ratio	Number of Centers
1	FS 2005	Florida Seed	5.1	65	1.1	34	0.8	1.7
[redacted]	FS 2011	Florida Seed	4.7	57	1.2	25	0.8	1.8
3	33076	Shamrock Seed Co.	5.2	64	1.3	35	0.7	1.7
[redacted]	SSC-1535	Shamrock Seed Co.	5.0	62	1.9	24	0.6	1.7
5	SSC-1600	Shamrock Seed Co.	5.8	46	1.6	22	0.5	2.7
[redacted]	Sugar Belle (SSC 6371 F_1)	Shamrock Seed Co.	6.3	47	2.0	17	0.6	1.7
7	SSC 6372 F_1	Shamrock Seed Co.	4.3	70	1.2	43	0.7	1.7
[redacted]	XON 303Y	Sakata Seed	5.6	63	0.9	29	0.9	1.5
9	XON-403Y	Sakata Seed	5.5	62	1.8	28	0.8	2.4
[redacted]	XON-204Y	Sakata Seed	3.9	75	1.4	42	0.8	1.9
11	XON-202Y	Sakata Seed	8.7	66	2.4	22	0.7	2.2
[redacted]	Var. No. 15094	Dessert Seed LLC	6.1	76	2.3	34	0.7	1.3
13	Var. No. 108101	Dessert Seed LLC	6.5	61	1.0	19	0.8	1.9
[redacted]	Var. No. 15082	Dessert Seed LLC	7.9	59	0.9	33	0.8	2.0
15	Var. No. 34140	Dessert Seed LLC	6.7	74	1.8	41	0.9	2.1
[redacted]	Var. No. 15085	Dessert Seed LLC	6.1	73	3.1	30	0.7	1.1
17	Var. No. 128101	Dessert Seed LLC	6.0	73	2.3	37	0.6	1.6
[redacted]	Var. No. 114101	Dessert Seed LLC	10.4	63	2.5	19	0.7	2.0
19	Var. No. 105101	Dessert Seed LLC	5.5	95	0.9	59	0.7	1.5
[redacted]	WI-102	Wannamaker Seeds	4.9	74	0.8	35	0.7	1.5
21	WI-129	Wannamaker Seeds	5.3	68	1.4	35	0.7	1.4
[redacted]	WI-131	Wannamaker Seeds	4.2	66	1.8	28	0.8	1.7
23	WI-609	Wannamaker Seeds	4.9	57	1.4	24	0.7	1.6
[redacted]	WI-3115	Wannamaker Seeds	5.7	52	3.4	24	0.8	1.5
25	EX 07542008	Seminis	7.6	83	0.6	57	0.8	1.1
[redacted]	EX 07542007	Seminis	4.4	81	0.6	53	0.7	1.2
27	Granex 33	Seminis	6.6	63	1.5	29	0.8	1.9
[redacted]	Candy	Seminis	3.8	61	1.4	27	0.8	1.6
29	Pegasus	Seminis	9.2	65	2.2	23	0.7	1.6
[redacted]	Granex Yellow PRR	Seminis	7.2	71	1.8	32	0.7	2.2
31	Century	Seminis	7.7	47	1.9	13	0.7	1.6

[redacted]	Savannah Sweet	Seminis	6.5	68	1.7	27	0.8	1.8
33	HSX-18201 F-1	Hortag Seed	6.6	73	1.7	28	1.0	1.5
[redacted]	HSX-19406 F-1	Hortag Seed	8.1	65	1.7	18	0.7	1.8
35	HSX-61304 F-1	Hortag Seed	13.6	44	1.6	9	0.8	1.6
[redacted]	Georgia Boy	D. Palmer Seed	5.8	85	0.7	59	0.7	2.2
37	DPS 1290	D. Palmer Seed	6.9	68	2.3	24	0.7	1.8
[redacted]	Ohoopee Sweet	D. Palmer Seed	4.4	83	1.2	57	1.1	2.4
39	Mr. Buck	D. Palmer Seed	4.2	87	0.8	62	0.7	2.4
[redacted]	Southern Belle	D. Palmer Seed	4.2	78	1.5	58	0.8	1.9
41	Sweet Advantage	D. Palmer Seed	4.2	72	1.8	48	0.7	1.6
[redacted]	Sapelo Sweet	D. Palmer Seed	5.4	77	2.0	38	0.8	1.9
43	SR1001	Nunhems	6.7	66	1.7	34	0.7	1.4
[redacted]	Sweet Melody	Nunhems	4.5	88	1.5	61	0.7	1.7
45	Nirvana	Nunhems	4.0	74	1.5	48	0.7	2.0
[redacted]	Sweet Vidalia	Nunhems	4.5	92	1.4	65	0.7	2.0
47	1200	Nunhems	6.6	68	2.9	35	0.9	1.0
[redacted]	Serengeti 1202	Nunhems	3.3	85	1.1	65	1.0	1.1
49	Gobi 1201	Nunhems	5.8	83	1.6	55	1.0	1.1
		CV	26%	18%	71%	35%	14%	23%
		Fisher's Protected LSD (p=0.05)	2.8	23	NS	23	0.2	0.7

EVALUATION OF FERTILITY PROGRAMS FOR VIDALIA ONIONS

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Introduction

Vidalia onions are a high value, long season crop therefore fertilization practices are critical. Because of the value of the crop there is a great deal of flexibility in how onions can be fertilized. Growers can use a variety of products even more expensive products, if they offer some advantage over less expensive materials. Growers also have flexibility in the number of applications and the type of application (dry versus liquid materials). Having said this, however, growers should not overuse fertilizers that add cost and can contaminate the environment.

Fertility research has been underway for several years and based on these results soil test recommendations have been changed. We have lowered our overall recommendation for both phosphorus and potassium. For example, with a soil test of medium P and K levels, our recommendations on Coastal Plain soils now call for 125-150 lbs/acre N, 90 lbs/acre P, and 90 lbs/acre K. This compared to the past where we would have recommended 125-150 lbs/acre N, 160 lbs/acre P, and 180 lbs/acre K.

Fertility work continues primarily evaluating new products particularly slow release materials that are now available to the industry. These experiments were conducted to evaluate several new products offered to the industry along with more standard materials for fertilizer application.

Materials and Methods

Two different experiments were conducted in the 2005-06 season. The experimental unit or plot was four rows of onions planted on a bed prepared 6-ft on-centers with 12 in. between-row and 5.5 in. in-row spacing. There was a 5 ft. in-row alley between each plot. Each plot was 20 ft. long and the experiment was arranged in a randomized complete block design with four replications. Sweet Vidalia plants were transplanted to their final spacing on 29 Nov. 2005 for the first experiment. For the second experiment, Georgia Boy plants were transplanted on 15 Dec. 2005. In the first experiment there were 12 treatments, which evaluated Nitamin 30L (Georgia-Pacific, Atlanta, GA), Nitamin 24% Granular (Georgia-Pacific, Atlanta, GA), JMAXX (Agrotain Inter. LLC, St. Louis, MO), and Nature Safe (Cold Spring, KY) (Table 1). Table 1 lists the 12 treatments, materials applied, the total N-P-K-S applied and date of application.

In the second experiment there were eight treatments as listed in Table 2. Products included in this experiment were TurfPro and activated Humus 14 (Organic Products, Claxton, GA). In addition, the HM series and Es-Cal-8, which are proprietary products of Helena Chemical (Collierville, TN) were also tested. Table 2 lists the experiment 2 treatments, materials applied, total N-P-K-S, and date of application.

Leaf samples from each experimental unit of both experiments were collected on 20th March, 2006 and analyzed for N, P, K, Ca, Mg, and S. Onions were harvested from experiment 1 on 24th April, 2006 and allowed to field dry for owo days before clipping and recording total yield. They were then transported to the shed to be heat cured at 100 °F for 24 hrs. They were then graded into jumbo (≥3 in.) and mediums (≥2 in. and <3 in.). Onions from experiment 2 were harvested on 1st May, 2006 and allowed to field dry for two days prior to clipping and recording total yield. Onions were then heat cured for 24 h prior to grading into jumbos and mediums. Coefficient of variation and Fisher's protected least significant difference (LSD) at the 5% level were calculated for each parameter.

Results and Discussion

In the first experiment the greatest total yield was for treatment 12 with 200 lb/acre N, which was significantly greater than treatment 11, Nature Safe 9-0-9, treatments 6 or 7 Nitamin 24% granular, and treatments 1 and 2 with Nitamin 30L (Table 3). The highest jumbo yield in experiment 1 was with treatment 3 (Nitamin 30L + $Ca(NO_3)_2$, 150 lbs/acre N), which was significantly greater than any of the Nitamin 24% treatments or Nitamin 30L treatments. In addition, treatment 3 was better than the JMAXX or Nature Safe programs for jumbo yields. The percentage of marketable (jumbo+mediums/total) yields ranged from 56 to 84% with an average of 72% with 9 of the 12 treatments having marketable yields above 70%.

There was no difference for leaf tissue P, K, Ca, or Mg in the first experiment (data not shown). There were differences, however, for N and S. The highest leaf tissue N was with treatment 9, which was significantly greater than treatments 4, 6, 7, 8, and 11. None of the treatments had leaf tissue nitrogen below the sufficiency range of 2.0-3.0% (Maynard and Hochmuth, 1997). Leaf tissue S ranged from 0.47 to 0.77% with treatment 12 (200 lb/acre N) having the highest leaf tissue S, which was significantly greater than treatments 4, 7, 8, 9, and 11. None of the leaf tissue samples were below the recommended range of 0.2-0.6% for S (Maynard and Hochmuth, 1997).

In the second experiment , the highest total yield was with treatment 5, which did not differ from any treatment that had at least 150 lb/acre N (Table 4). Treatments 2, 4 and 7 had no appreciable amount of fertilizer and this is reflected in their yields. This pattern is reflected in the jumbo yields as well.

There were no differences between treatments for leaf tissue K or Ca (data not shown). Leaf tissue N showed significant differences between treatments with treatment 5 having the greatest concentration with 3.31%. The leaf N concentration was similar to total and jumbo yield data in that treatments without an appreciable amount of fertilizer also had low levels of leaf tissue N. Treatments 4 and 7 had leaf tissue N levels below the sufficiency range (2.0-3.0%).

Phosphorus levels also correlated with yield, but it was treatments with little fertilizer and low yields that had the highest leaf tissue P concentrations (Table 4.). Treatments 4 and 7 had the highest leaf tissue P levels. None of the treatments had P levels below sufficiency range of 0.2-0.5% (Maynard and Hochmuth, 1997).

Leaf tissue Mg ranged from 0.23 to 0.29 with significant differences between treatments (Table 4). There was not, however, any apparent correlation with treatment fertilizer level or yield. All of these values wer e within the sufficiency range for Mg at 0.15-0.30% (Maynard and Hochmuth, 1997).

Leaf tissue S also showed a treatment effect with a range of values from 0.48 to 0.89%. All of these are within or above the sufficiency range for S of 0.4-0.6% (Maynard and Hochmuth, 1997). In general normally fertilized treatments such as treatments 1, 3, and 5 had relatively high leaf tissue S, with the exception of treatment 6 which had acceptable fertility levels and yield, but lower leaf tissue S at 0.57%. This may be due to the fact that S containing fertilizer was last applied with treatment 6 on 15 Dec. 2005, whereas the other treatments had the last S fertilizer applied on 17 Jan 2006.

Summary and Conclusions

Some of these slow release products such as Nitamin 30L, 24% N, and JMAXX should work well in an onion fertility program. None could be recommended as a single application product, but they could be used in a program with fewer applications. The Nature Safe product (9-0-9) since it is an organic fertilizer requires mineralization before the nutrients are available to the crop, consequently it must be used at higher rates to mirror conventional fertilizer performance. Finally, several products both proprietary and based on humic acid were evaluated and none of these showed much promise in these trials.

Reference

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

Table 1. Treatments in onion fertility experiment 1.

No.	Treatment	Material	Applied (lbs/acre N-P-K-S)	Application Date
1	Nitamin 30L program: 150 lbs/acre		150N-40P-100K-25S	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		Nitamin 30L	65 lbs N	1/17/06
		0-0-60, $CaSO_4$	40 lbs K, 25 lbs S	1/19/06
		Nitamin 30L	65 lbs N	2/23/06
2	Nitamin 30L program: 115 lbs/acre		115N-40P-100K-25S	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		Nitamin 30L	47 lbs N	1/17/06
		0-0-60, $CaSO_4$	40 lbs K, 25 lbs S	1/19/06
		Nitamin 30L	48 lbs N	2/23/06
3	Nitamin 30L + CaNO3 150 lbs/acre		150N-40P-100K-25S	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		Nitamin 30L	40 lbs N	1/17/06
		$CaNO_3$	25 lbs N	1/17/06
		0-0-60, $CaSO_4$	40 lbs K, 25 lbs S	1/19/06
		Nitamin 30L	65 lbs N	2/23/06
		$CaNO_3$	25 lbs N	2/23/06
4	Nitamin 30L + CaNO3 115 lbs/acre		115N-40P-100K-25S	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		Nitamin 30L	29 lbs N	1/17/06
		$Ca(NO_3)_2$	19 lbs N	1/17/06
		0-0-60, $CaSO_4$	40 lbs K, 25 lbs S	1/19/06
		Nitamin 30L	29 lbs N	2/23/06
			19 lbs N	2/23/06
5	Nitamin 24% N Gran. 150 lbs/acre		150N-40P-100K-25S	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		Nitamin 24-0-0	30 lbs N	12/7/06
		Nitamin 24-0-0	70 lbs N	1/17/06
		0-0-60, $CaSO_4$	40 lbs K, 25 lbs S	1/19/06
		$Ca(NO_3)_2$	30 lbs N	2/23/06
6	Nitamin 24% N Gran. 115 lbs/acre		115N-40P-100K-25S	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		Nitamin 24-0-0	30 lbs N	12/7/06
		Nitamin 24-0-0	40 lbs N	1/17/06
		0-0-60, $CaSO_4$	40 lbs K, 25 lbs S	1/19/06
		$Ca(NO_3)_2$	25 lbs N	2/23/06
7	Nitamin 24% N Gran. 150 lbs/acre		150N-40P-100K-25S	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		Nitamin 24-0-0	100 lbs N	1/17/06
		0-0-60, $CaSO_4$	40 lbs K, 25 lbs S	1/19/06
		$Ca(NO_3)_2$	30 lbs N	2/23/06
8	JMAXX Program		126N-88P-132K-36S-78Ca	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		JMAXX 47-0-0	35 lbs N	12/7/05
		JMAXX 47-0-0	47 lbs N	1/17/06
		6-12-18 (4% S)	24N-48P-72K-16S (400lbs/A)	1/17/06
		CaCl	78 lbs Ca	2/23/06

9	150 lbs/acre		150N-157P-132K-52S	
		5-10-15 (9% S)	20N-40P-60K-36S (400lbs/A)	12/7/05
		DAP (18-46-0)	27N-69P-0K (150lbs/A)	12/7/05
		6-12-18 (4% S)	24N-48P-72K-16S (400lbs/A)	1/17/06
		$Ca(NO_3)_2$	79 lbs N	2/23/06
10	10-10-10, 150 lbs/acre		150N-80P-80K-96S	
		10-10-10 (12% S)	40N-40P-40K-48S	12/7/05
		10-10-10 (12% S)	40N-40P-40K-48S	1/17/06
		$Ca(NO_3)_2$	70 lbs N	2/23/06
11	Nature Safe (9-0-9)		150N-40P-150K-48S	
		10-10-10 (12% S)	40N-40P-40K-48S	12/7/05
		9-0-9	110N-0P-110K	1/17/06
12	Nitrogen 200 lbs/acre		200N-200P-200K-240S	
		10-10-10 (12% S)	40N-40P-40K-48S	12/7/05
		10-10-10 (12% S)	160N-160P-160K-192S	1/17/06

Table 2. Treatments in onion fertility experiment 2

No.	Treatment	Material Applied	Application (lb/acre N-P-K-S)Applied	
1	TurfPro + Fertilizer		150N-80P-80K-96S	
		TurfPro	4 gal/acre	12/15/05
		10-10-10 (12% S)	40N-40P-40K-48S	12/15/05
		10-10-10 (12% S)	40N-40P-40K-48S	1/17/06
		TurfPro	2 gal/acre	2/8/06
		$Ca(NO_3)_2$	70 lbs N	2/23/06
2	TurfPro		Negligible	
		TurfPro	4 gal/acre	12/15/06
		TurfPro	2 gal/acre	2/8/06
3	Activated Humus 14 + Fertilizer		150N-80P-80K-96S	
		Activated Humus 14	174 lbs/acre	12/15/05
		10-10-10 (12% S)	40N-40P-40K-48S	12/15/05
		Activated Humus 14	87 lbs/acre	2/8/06
		10-10-10 (12% S)	40N-40P-40K-48S	1/17/06
		$Ca(NO_3)_2$	70 lbs N	2/23/06
4	Activated Humus 14		Negligible	
		Activated Humus 14	174 lbs/acre	12/15/05
		Activated Humus 14	87 lbs/acre	2/8/06
5	150 lbs/acre		150N-80P-80K-96S	
		10-10-10 (12% S)	40N-40P-40K-48S	12/15/05
		10-10-10 (12% S)	40N-40P-40K-48S	1/17/06
		$Ca(NO_3)_2$	70 lbs N	2/23/06
6	Standard from Megalab (Waters)		160N-40P-160K-48S	
		10-10-10 (12% S)	40N-40P-40K-48S	12/15/05
		$Ca(NO_3)_2$	60 lbs N	1/17/06
		0-0-60	60 lbs K	1/17/06
		$Ca(NO_3)_2$	60 lbs N	2/23/06
		0-0-60	60 lbs K	2/23/06
7	HM Series		Negligible	
		HM9939	2 qt/acre	12/15/06
		HM9938	2 qt/acre	1/3/06
		HM9870	2 qt/acre	1/17/06
		HM9938	2 qt/acre	2/8/06
		MM9870	2 qt/acre	3/23/06
8	Standard + HM + Es-Cal (-15% N)		136N-65P-125K-78S	
		10-10-10 (12% S)	40N-40P-40K-48S	12/15/05
		HM9754A	40 lbs/acre	12/15/05
		10-10-10 (12% S)	25N-25P-25K-30S	1/17/06
		ES-CA-8	1 gal/acre	2/23/06
		$Ca(NO_3)_2$	70 lbs N	2/23/06
		0-0-60	60 lbs K	2/23/06
		ES-CA-8	1 gal/acre	3/23/06

Table 3. Experiment 1 treatments, yield, and leaf tissue analyses.

Number	Treatment	Total Yield	(50-lb bags/acre) Jumbos	Mediums	Marketable (%)
1	Nitamin 30L, 150 lbs/acre	1053	804	11	77%
2	Nitamin 30L, 115 lbs/acre	1053	789	10	76%
3	Nitamin 30L + $Ca(NO_3)_2$, 150 lbs/acre	1109	926	6	84%
4	Nitamin 30L + $Ca(NO_3)_2$, 115 lbs/acre	1124	797	12	72%
5	Nitamin 24% N Gran., 150 lbs/acre	1124	620	8	56%
6	Nitamin 24% N Gran., 115 lbs/acre	878	602	17	71%
7	Nitamin 24% N Gran., 150 lbs/acre	1065	720	7	68%
8	JMAXX Program	1123	774	13	70%
9	150 lbs/acre	1184	849	7	72%
10	10-10-10, 150 lbs/acre	1187	883	7	75%
11	Nature Safe (9-0-9)	810	542	21	69%
12	Nitrogen 200 lbs/acre	1200	924	5	77%
	CV	6%	11%	64%	
	Fisher's Protected LSD (p=0.05)	96	116	9	

Table 4. Experiment 2 treatments, yield, and leaf tissue analyses.

No.	Treatment	Total Yield	(50-lb bags/acre) Jumbos	Mediums	Marketable (%)	(%) Nitrogen	Phosp
1	TurfPro + Fertilizer	1115	895	7	81%	3.17	0.28
2	TurfPro	153	85	26	73%	2.16	0.36
3	Activated Humus 14 + Fertilizer	1119	939	14	85%	3.19	0.26
4	Activated Humus 14	133	53	39	69%	1.73	0.44
5	Standard	1129	684	5	61%	3.31	0.27
6	Standard from Megalab (Waters)	1103	676	30	64%	2.80	0.28
7	HM Series	126	23	57	63%	1.78	0.47
8	Standard + HM + Es-Cal (-15% N)	793	468	15	61%	2.02	0.31
	CV	8%	35%	45%		11%	12%
	Fisher's Protected LSD (p=0.05)	87	247	7		0.41	0.06

VARIETY EVALUATION WITHOUT FUNGICIDES FOR DISEASE INCIDENCE

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Introduction

Disease resistance can be an important variety characteristic for improving yield and quality, while reducing production costs. By using low levels of fungicides the environment can be protected. With this in mind a study has been undertaken for evaluating selected varieties according to disease resistance.

Materials and Methods

Nine varieties were selected for evaluation in this no-spray trial. Transplants were grown according to University of Georgia Cooperative Extension Service recommendations including the use of fungicides as needed (Boyhan et al., 2001). Onions were transplanted on 30th November, 2005, to their final spacing. Onions were transplanted onto 6ft wide beds with 4 rows on each bed having a 12 in. between row spacing and a 5.5 in. in-row spacing. The experimental plot length was 20 ft. There was a 5 ft space between plots in the bed. The experimental design was a randomized complete block design with four replications. Production practices followed University of Georgia Cooperative Extension Service recommendations, except for the use of fungicide sprays.

Each plot was evaluated on 6th April, 2006, for Botrytis leaf blight (*Botrytis squamosa*) and purple blotch (*Alternaria porri*). Botrytis leaf blight was evaluated on a scale of 1 to 10 with 1 indicating no disease and 10 indicating severe infection. Purple blotch was evaluated by counting the number of lesions on the center two rows of each plot.

The Botrytis leaf blight evaluation was transformed using arcsine square root and the purple blotch evaluation was transformed using the square root plus 0.5 before analyses. Means and least significant differences (LSD) were back transformed to their original units.

As they matured, varieties were harvested by hand and field cured for two days. Total or field yield was recorded for each plot before transporting to the shed where they were heat cured at 95 °F for 24 h. Onions were then graded into mediums (≥2 in. and <3 in.) and jumbos (≥3 in.). The coefficient of variation (CV) and Fisher's Protected LSD (p=0.05) was computed for each measured data set.

Results and Discussion

The highest yielding entry for total or field yield was Georgia Boy with 1,169 50-lb bags per acre, significantly greater than for Pegasus or other lower yielding varieties. The highest yielding entry for jumbos was Savannah Sweet with 1,034 50-lb bags/acre, significantly greater than all other entries except Georgia Boy. Medium yields ranged from 4 to 33 50-lb bags/acre. FS 2005 had the highest yield of medium onions and had the lowest field yield. The percentage of marketable onions ranged from 53 to 91% with four of the entries having greater than 75% marketable onions.

Botrytis leaf blight ratings ranged from 3.2 to 6.2. Three entries with the highest ratings for disease were Savannah Sweet, Pegasus, and Century. Five of the nine entries had disease ratings of 4.0 or below including Ohoopee Sweet, WI-129, Sugar Belle, FS 2005, and Sweet Vidalia.

Purple blotch counts ranged from 15 to 46 among the tested entries. Three entries with the lowest counts were Ohoopee Sweet, FS 2005 and Sugar Belle. The highest count was Savannah Sweet with 46, significantly greater than the next entry, Georgia Boy, with 35.

The Pantoea incidence as recorded in the variety trial is reported here for those entries so evaluated in this study. Savannah Sweet, which had the poorest rating for Botrytis leaf blight and the highest incidence of purple blotch, also had one of the highest incidences of Pantoea. Pegasus also had a relatively high incidence for these three pathogens.

Data transformation was used to insure a dataset met the underlying criteria of an analysis of variance. As a result of the transformation, One of the computed and back transformed LSDs tend to be small. This gives the impression of a greater precision in the experiment than is present. For example, with Botrytis leaf blight the LSD of 0.02 suggests that a real difference exists between FS 2005 (3.9) and Sweet

Vidalia (4.0) and this is unlikely given the nature of visual evaluations. Data would be more meaningful if several years of data were included, particularly if there were years of high disease pressure.

Summer and Conclusions

Overall, 2005-2006 had low levels of disease pressure there having been a mild and dry winter. This is reflected in the high yields and high marketability entries. It is hoped that disease evaluations among tested varieties will continue in future studies.

References

Boyhan, G.E., D.M. Granberry, and W.T. Kelley. 2001. Onion Production Guide. Univ. of Ga. Bul. No. 1198.

Table 1. Variety evaluation for harvest date, yield, graded yield, and disease incidence.

No.	Entry	Source	Harvest Date	Total Yield (50-lb bags/Acre)	Jumbos (50-lb bags/Acre)	Mediums (50-lb bags/Acre)	Marketable (%)	Evaluated 4/6/06: Botrytis Leaf Blight^z	Evaluated 4/6/06: Purple Blotch^y (No.)	Pantoea^x (No./plot)
1	FS 2005	Solar Seed	4/10/06	919	696	33	79%	3.9	17	
2	Georgia Boy	D. Palmer Seed	5/1/06	1169	924	6	80%	4.1	35	7.1
3	Ohoopee Sweet	D. Palmer Seed	5/1/06	1007	633	11	64%	3.2	15	9.7
4	Sweet Vidalia	Nunhems	4/19/06	1029	772	17	77%	4.0	25	
5	WI-129	Wannamaker	4/19/06	1152	719	9	63%	3.6	22	
6	Sugar Belle	Shamrock	4/24/06	1028	697	4	68%	3.7	21	
7	Pegasus	Seminis	5/4/06	1047	678	9	66%	5.0	22	30.4
8	Century	Seminis	5/4/06	1158	613	4	53%	4.5	31	23.1
9	Savannah Sweet	Seminis	5/1/06	1146	1034	5	91%	6.2	46	30.3
			CV	7%	15%	76%		7%	16%	
			Fisher's Protected LSD (p=0.05)	106	160	12		0.02	0.9	

^{z}Botrytis Leaf Blight rating: 1-no disease, 10-heavily diseased.

^{y}Number of lesions per plot for the center 2 rows.

^{x}Pantoea counts are from the variety trial, which were evaluated on 4/26/06.

EVALUATION OF PLANT SPACING AND FERTILITY ON ONION YIELD

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Introduction

Plant spacing may be an important factor affecting plant populations and yield. In many onion producing areas onion plant populations are double those of Georgia providing a corresponding increase in yield. Georgia has a challenging climate for onion production having high rainfall, high humidity and mild winters during the growing season, resulting in higher pressures of disease than in many regions. In Georgia it may be hypothesized that a tighter plant spacing could result in a higher disease pressure. This in turn may be coupled with lower yields and poor onion quality even though the recent introduction of better fungicides than of previous days, could provide some action against disease. The objective of this study was to evaluate plant spacing, fertility and variety on onion yield.

Materials and Methods

In this study there were three varieties of onions, two levels of plant density and two levels of fertility. Onion transplants of WI-131, Sweet Vidalia, and Georgia Boy were produced according to University of Georgia Cooperative Extension Service recommendations and were transplanted on 29th November, 2005. There were both normal and high density plant spacings. There were both normal and high levels of fertility.

Plants were transplanted onto 6ft wide beds. In the normal plant spacing, four rows were planted on these beds with an in-row spacing of 5.5 in. and a between-row spacing of 12 in. In the high density planting seven rows were planted with an in-row spacing of 5.5 in. and a between-row spacing of 6 in. The normal fertility consisted of: 400 lb/acre of 5-10-15 applied on 14th November, 2005; 150 lb/acre 18-46-0 applied on 20th December, 2005; 200 lb/acre of 6-12-18 applied on 6th January, 2006; 200 lb/acre of 6-12-18 applied on 17th January, 2006; 200 lb/acre of 15.5-0-0 applied on 1st February, 2006; and 200 lb/acre of 15.5-0-0 applied on 15th February, 2006. These applications resulted in133-157-132 of N-P-K. The high fertility treatment followed this same program with the addition of 323 lb/acre of 15.5-0-0 being applied on 23rd February, 2006, resulting in 183-157-132 of N-P-K.

These 12 treatments were arranged in a randomized complete block design with four replications. Each experimental plot was 20 ft. long. Plots were separated in the bed by a 5 ft alleyway. Variety WI-131 was harvested on 10th April, 2006, while Sweet Vidalia and Georgia Boy were harvested on 24th April, 2006. Total (field yield) and graded yield were collected for all plots. After the field yield was collected, onions were heat cured for 24 hours before jumbo (≥ 3 in.) and medium (≥2 in and <3 in.) yields were recorded.

Approximately 50 lb of onions from each plot were transported to the Vidalia Onion Laboratory in Tifton, GA, for postharvest storage. Refrigerated storage (34 °F , 70% relative humidity (rh) was initiated on 26th April, 2006, and the onions were removed from storage on 11th July, 2006. The percentage weight loss and percentage of marketable onion yield were recorded and the reason for loss of marketability noted (e.g. disease, regrowth). Onions were then kept under ambient conditions (approximately 75 °F) for two weeks before being evaluated for weight loss (based upon weight after removal from storage) and percentage of marketable (based on pre-storage weight) onions.

Results and Discussion

The highest total yield was with treatment 12, Georgia Boy planted at the high density and with a high fertility (Table 1). The results of this treatment did not differ from any of the other high density treatments except for Georgia Boy with the high density planting and normal fertility. In addition, total yield for treatment 12 was significantly greater than any of the treatments with normal plant spacing.

The greatest jumbo yield was with treatment 4, which had WI-131 planted at the high density with the high fertility. This treatment did not differ from any of the other high density plantings, but was significantly better than any of the normally spaced treatments. Treatment 4 also had the highest amount of medium yields, which did not differ from the other high density plantings except for treatment 11 with Georgia Boy with a normal fertility. Marketability ranged from 62 to 73% even though it does not appear to be affected by any of the treatments in the study.

For each variety, the percentage change of total and jumbo yield for normal spacing and fertility are presented (Table 1). In the case of WI-131, high fertility alone did not affect total yield and only resulted in a 5% increase in jumbo yield. High density spacing of WI-131 whether with normal or high fertility increased yields over the normal spacing and fertility. Increases ranged from 20-43%. For Sweet Vidalia increasing the fertility had no affect on total or jumbo yields. Increasing the plant density with or without additional fertilizer, however, resulted in increased yields of 10-18%. Georgia Boy with the high density spacing showed increases of 16-38% over the normal spacing and fertility. It should be noted for total yield that there would need to be an approximate 19% greater yield over that for the normal spacing and fertility to be statistically significant. For jumbos there would have to be approximately a 23% increase in yield to be statistically significant.

There was no difference in weight loss after approximately 2.5 months of refrigerated storage among the different treatments (Table 2). There was a significant difference in marketable onions, with all of the WI-131 onions having significantly lower percentage marketable onions compared with the other treatments. There were treatment differences in weight loss and percentage marketable onions after two weeks at ambient temperatures. The WI-131 had significantly less marketable onions compared with the other treatments.

The differences for WI-131 compared with other treatments may have to do with the approximate two weeks of hold between harvest and refrigerated storage compared with only two days for the other varieties. WI-131 is an early variety and is unlikely to be stored for a long duration. It is more likely to be immediately moved onto the fresh market upon harvest. There was a loss of marketable onions across all treatments while in ambient storage after removal from refrigerated storage. This does not appear to be a treatment effect since the majority of unmarketable onions was found to be infected by Botrytis neck rot.

<u>Summary and Conclusions</u>

In conclusion, the increase in yields are no where near the actual increase in plant population. The high plant density treatments have 75% more plants per plot compared with the normal plant density yet the highest increase in yield was only 38%. Obviously increased plant competition is reducing rather than increasing yield. In other regions of the country where higher plant populations are planted than in the Vidalia region, Larger tractors (with wider wheel spacings) are used along with higher plant densities. These configurations along with less disease and other environmental pressures probably allow for greater yield.

Table 1. Evaluation of variety, spacing, and fertility on onion yield.

Trt. No.	Variety	Spacing[z]	Fertility[y]	Harvest Date	Total Yield	Jumbo	Medium	Marketable	Percent of Normal	
					50-lb bags/acre			(%)	Total Yield	Jumbo
1	WI-131	Normal	Normal	4/10/06	1055	641	17	62%	-	-
2	WI-131	Normal	High	4/10/06	1037	673	13	66%	-2%	5%
3	WI-131	High	Normal	4/10/06	1305	769	66	64%	24%	20%
4	WI-131	High	High	4/10/06	1366	914	78	73%	29%	43%
5	Sweet Vidalia	Normal	Normal	4/24/06	1102	721	4	66%	-	-
6	Sweet Vidalia	Normal	High	4/24/06	1071	692	10	66%	-3%	-4%
7	Sweet Vidalia	High	Normal	4/24/06	1306	800	76	67%	18%	11%
8	Sweet Vidalia	High	High	4/24/06	1290	796	62	67%	17%	10%
9	Georgia Boy	Normal	Normal	4/24/06	1032	678	8	66%	-	-
10	Georgia Boy	Normal	High	4/24/06	1083	734	8	69%	5%	8%
11	Georgia Boy	High	Normal	4/24/06	1197	827	28	72%	16%	22%
12	Georgia Boy	High	High	4/24/06	1420	820	57	62%	38%	21%
				CV	12%	14%	60%			
				Fisher's Protected LSD (p=0.05)	205	157	31			

[z]Normal spacing: 5.5 in. in-row and 12 in. between-row, high spacing: 5.5 in-row and 6 in. between-row.

[y]Normal fertility: 133N-157P-132K, high fertility: 183N-157P-132K.

Table 2. Treatment effect on refrigerated (34 deg. F., 70% RH) onion storability.

					After 2.5 months of refrigerated storage		2 wks. after removal from storage	
No.	Variety	Spacing[z]	Fertility[y]	Harvest Date	Wt. Loss (%)	Marketable	Wt. Loss	Marketable
1	WI-131	Normal	Normal	4/10/06	4.0	6.7	0.0	4.5
2	WI-131	Normal	High	4/10/06	5.0	2.4	0.0	1.6
3	WI-131	High	Normal	4/10/06	5.7	9.6	0.0	7.4
4	WI-131	High	High	4/10/06	4.4	8.9	0.0	7.0
5	Sweet Vidalia	Normal	Normal	4/24/06	4.5	69.5	2.6	24.2
6	Sweet Vidalia	Normal	High	4/24/06	4.6	69.8	2.9	34.0
7	Sweet Vidalia	High	Normal	4/24/06	4.4	81.4	3.0	42.6
8	Sweet Vidalia	High	High	4/24/06	4.5	82.9	2.8	43.4
9	Georgia Boy	Normal	Normal	4/24/06	4.5	82.3	2.3	47.9
10	Georgia Boy	Normal	High	4/24/06	4.8	78.5	1.9	45.6
11	Georgia Boy	High	Normal	4/24/06	4.8	75.6	3.0	44.5
12	Georgia Boy	High	High	4/24/06	4.4	83.3	3.3	56.7
				CV	17%	14%	40%	39%
				Fisher's Protected LSD (p=0.05)	NS	11.2	1.0	16.8

[z]Normal spacing: 5.5 in. in-row and 12 in. between-row, high spacing: 5.5 in-row and 6 in. between-row.

[y]Normal fertility: 133N-157P-132K, high fertility: 183N-157P-132K.

EVALUATION OF ORGANIC FERTILIZERS FOR VIDALIA ONION PRODUCTION

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Introduction

There has been increasing interest in producing Vidalia onions by organic means. In 2005, it was estimated that approximately 50 acres of organic Vidalia onions were produced encouraged by buyers requesting organic Vidalia onions. The National Organic Program which defines organic for certified organic production has a set of rules that growers are required to follow. It is a challenge to produce onions under these guidelines. For example, fertilization is limited to the use of organic products. The use of fresh manure is restricted, as in the case of crops in contact with the soil being restricted to 120 days. For many vegetable crops this precludes the use of such materials, but with onions they are a long season crop and such products can be used, having an impact on production. A study was undertaken to evaluate the benefits on organic onion production of using several rates of poultry litter as well as the benefits of using one of two organic fertilizer products.

Materials and Methods

Untreated seed of variety Savannah Sweet were seeded on 19th September, 2005, in a high density plantbed. These seedlings were grown in accordance with the National Organic Program on certified organic land. Six ton/acre of poultry litter were used to produce these transplants with 3 ton/acre being applied incorporated preplant and 3 ton/acre applied approximately 4 weeks after seeding. Onion seedlings were hand weeded as needed.

Beds for transplanting were prepared by incorporating all of the fertility treatments. Treatments included poultry litter at 0-10 ton/acre in 2 ton/acre increments (Table 1). Organic fertilizer 4-2-3 (Perdue AgriRecycle, Horsham, PA) at 150, 200, and 250 lb/acre nitrogen as well as an organic 13-0-0 (Nature Safe, Cold Spring, KY) applied at 150 lb/acre N. Beds were formed 6wide and covered with black plastic. The bed top was approximately 4 ft across. A pegger was then run over the plastic to form the planting holes (Figure 1), which consisted of four rows 12 in. apart with an in-row spacing of 5.5 in. and between row spacing of 12 in.

Each experimental plot was 20 ft long, with 5 ft between plots in the bed. Onion transplants were removed from the plantbed, had 50% of their tops removed and planted to their final spacing in the holes made by the pegger on 12th December, 2005. Although the plastic offered good weed control, hand weeding was required in wheel tracks and from the holes where the onions were planted. The experiment had a total of 10 treatments with four replications arranged in a randomized complete block design.

Onions were harvested on 19th April, 2006, and allowed to field dry for 24 hours. Total yield was recorded. Onions were then heat cured at 100 °F for 24 hours before being graded into jumbo (≥3 in.) and medium (≥2 and <3 in.) sizes.

Approximately 50 lb of onions from each experimental plot was transported to the Vidalia Onion Research Laboratory in Tifton and stored at 34 °F and 70% relative humidity from 26th April to 12th July, 2006 (approximately 2.5 months). Onions were weighed immediately before and after removal from storage to assess water loss in storage. Onions removed from storage were then separated into marketable and unmarketable onions and those in each category weighed. The cause of unmarketability was noted. Onions were held under ambient conditions (approximately 75 °F) for two weeks and reassessed for water loss and marketability. The percentage of marketability after 2 weeks of ambient condition storage was based on pre-storage weights, while water loss was based on post-storage weights. Data was analyzed for the coefficient of variation and Fisher's protected least significant difference (LSD) at the 5% level of significance.

Results and Discussion

There were no differences in total yield or jumbo yield between the treatments (Table 1). There were differences between the yields of medium grade onions, differences ranging from 2 to 53 50-lb bags/acre. The highest yield of medium onions was with the no poultry litter treatment, significantly higher than all other treatments. The next two highest medium yields were with Perdue 4-2-3 at 150 lb/acre N and poultry litter at 2 ton/acre. After 2.5 months of refrigerated storage there were no differences among the treatments for either weight loss or percentage marketability.

Neither was there any difference in marketability among the treatments after two weeks under ambient condition storage. There were however, differences among treatments for weight loss after two weeks at ambient conditions. Poultry litter at the 0 ton/acre rate had significantly greater weight loss after two weeks under ambient conditions than any of the organic fertilizer treatments as well as poultry litter at 4 and 6 ton/acre. The storage results suggest that treatment effects were not an important factor in storability.

The lack of differences among the treatments for total yield and jumbos is not typical based on previous work (Boyhan et al., 2006). The site had been heavily amended with compost in previous seasons, which may have played a role in the lack of differences. After application of treatments the beds were re-rototilled, which may have resulted in some of the material being dragged from one plot to the next. Finally, there was a great deal of variability within treatment plots across replications, resulting in a high experimental error.

Summary and Conclusions

This experiment marks the first use of black plastic in our organic work. Although the plastic was not part of the experiment, it did a reasonably good job of controlling weeds. The wider bed top (48 in.) compared with the more typical plastic beds (30 in.) allowed us to have a plant population that was more typical of conventional bareground onion production. There was a small area outside the experiment where extra onions were transplanted, half on black plastic and half on bareground both of which were given 6 ton/acre poultry litter preplant incorporated. Based solely on the greenness of the leaves it appeared that black plastic conserved fertility by preventing nutrient leaching compared with the bareground production. It is anticipated that this experiment will be repeated during the 2006-2007 season to gain further understanding of organic onion fertility.

References

Boyhan, G.E., R. Torrance, C. Hopkins, R. Hill, and T. Paulk. 2006. Experiments on organic production of Vidalia onions, p. 61-65. 2005 Georgia Vegetable Research-Extension Report. Coop. Res.-Ext. Publ. No. 5-2006.

Table 1. Evaluation of organic fertilizers for onion production.

					After 2.5 months of refrigerated storage		2 wks after removal from storage	
		Total Yield	Jumbos	Mediums	Wt Loss	Marketable	Wt Loss	Marketable
Material	Treatment/acre	(50-lb bags/A)					(%)	
Poultry Litter	0 tons/acre	680	388	53	4.1%	82.9%	2.9%	63.2%
Poultry Litter	2 tons/acre	867	528	32	4.1%	86.6%	2.2%	70.6%
Poultry Litter	4 tons/acre	807	494	5	4.5%	80.1%	1.8%	66.6%
Poultry Litter	6 tons/acre	901	564	23	4.0%	85.1%	1.8%	70.6%
Poultry Litter	8 tons/acre	1084	653	3	4.0%	84.2%	2.4%	69.1%
Poultry Litter	10 tons/acre	817	433	22	3.0%	87.2%	2.1%	78.2%
Perdue 4-2-3	150 lbs N/acre	719	467	35	4.2%	75.9%	1.7%	66.3%
Perdue 4-2-3	200 lbs N/acre	989	628	18	4.1%	77.8%	0.6%	68.5%
Perdue 4-2-3	250 lbs N/acre	933	527	17	4.2%	90.3%	1.0%	76.4%
Nature Safe 13-0-0	150 lbs N/acre	894	455	2	3.7%	80.9%	0.5%	69.1%
	CV	25%	43%	86%	19%	11%	36%	15%
Fisher's Protected LSD (p=0.05)		NS	NS	4	NS	NS	0.9%	NS

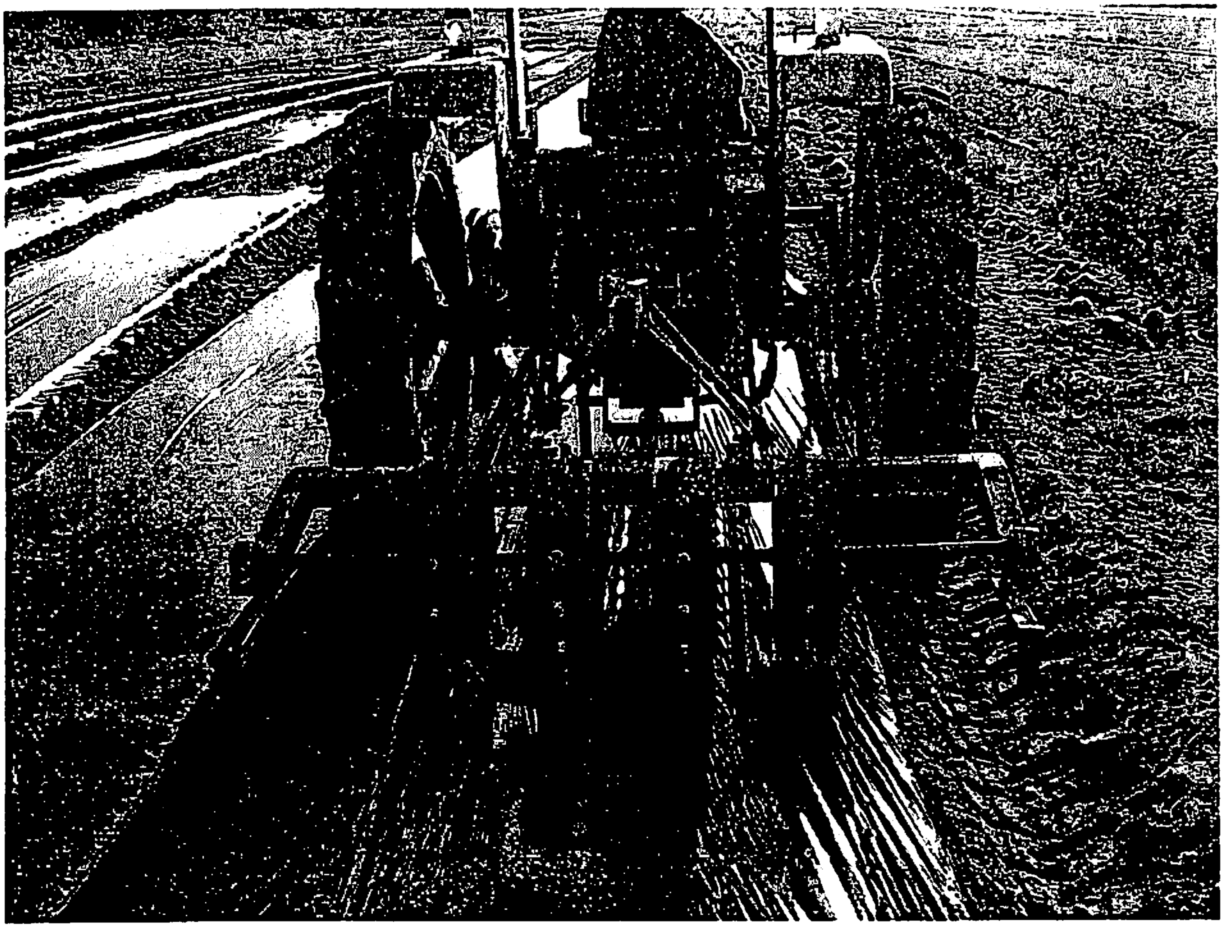

Figure 1. Pegger making holes on black plastic mulch, which has been laid over treatment plots.

EVALUATION OF NON-TRADITIONAL ONION VARIETIES

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Introduction

Georgia is famous for mild, sweet Vidalia onions, which are grown in a defined region of Southeastern Georgia. From time to time there is interest in producing onions outside the Vidalia onion growing region as well as there being an effort to evaluate onions other than Granex yellow types for production in the Vidalia region. Both red and white onions with suitable shape and mildness may have a place in the Vidalia production region.

The traditional Granex yellow onion type produced in Southeastern Georgia is a short-day overwintering onion that has a characteristic shape (slightly flattened) with a mild, sweet flavor. Texas onions by contrast are short-day overwintering Grano type onions. These yellow onions are rounder than Granex, but have many of the other characteristics of granex onion. Other short-day onions are available that are both white and red in color. A study was undertaken to evaluate non-traditional onions for production inside and outside the Vidalia region.

Materials and Methods

Entries 1-14 were sown in high density plantbeds on 21st September, 2005 and entries 15-17 were sown on 26th September, 2005 (Table 1). These transplants were grown according to University of Georgia Cooperative Extension Service recommendations (Boyhan et al., 2001).
Beds were formed with 6-ft centers having four rows of onions transplanted on each bed with 12 in. between the rows and 5.5 in. Within the row. Plantbed onions were transplanted to their final spacing on 13th December, 2005. Each experimental plot was 20 ft. of planted bed. There was a 5 ft. alley between plot plots within a bed. The experimental design was a randomized complete block design with three replications. The field crop onions were grown following University of Georgia Cooperative Extension Service Recommendations (Boyhan et al., 2001).

Onions were harvested when mature on 19th April or 1st May, 2006. Onions were hand pulled and allowed to field cure for at least one day. Field or total yield was then recorded before transporting to the shed for heat curing for 24 h at 100 °F. Onions were then graded into jumbo (≥3 in.) or mediums (≥2 in. and <3 in.). Red onions in this trial were analyzed for pyruvate (Randle and Bussard, 1993).

Approximately 50 lb of onions from each experimental unit were transported to the Vidalia Onion Research Laboratory in Tifton, GA for storage. Onion entries 1, 2, 3, 4, 6, and 7 were stored under refrigerated storage beginning 26th April, 2006 and entries 5, 9-17 beginning 8th May, 2006. The storage conditions were 34 °F and 70% relative humidity (rh). Onions were removed from storage for evaluation on 11th July, 2006. Data on weight loss in storage and percentage marketable onions was collected. In addition, onions were held under ambient conditions (approximately 75 °F) for two week and re-evaluated for weight loss based on post-storage weight and percentage marketability based on pre-storage weight. The coefficient of variation (CV) and Fisher's protected least significant difference (LSD) was calculated for each measured parameter.

Results and Discussion

Seven of the 17 entries harvested on 19th April, 2006, would be considered mid-season onions and included Gobi, Don Victor, Safari, Serengeti, Kristal, Sweet Sunrise, and Kalahari, there being no red onions among the varieties. The remaining 10 entries would be considered late-season varieties.

The greatest total yield was with Ebano, having 1,079 50-lb bags/acre. This did not differ from nine entries with yields above 872 50-lb bags/acre. Jumbo yields ranged from 222 to 804 50-lb bags/acre with XP 07597000 from Seminis having the highest yield. This variety did not differ from the 10 entries with yields above 580 50-lb bags/acre. Overall, medium yields were low with Don Victor and Kristal having the greatest amount of mediums, 25 and 27 50-lb bags/acre, respectively.

The percentage marketable yields ranged from 39% to 79%. The highest percentage marketable yield was with NUN 3005ON. There were a total of five entries with better than 70% marketable onions and along with NUN 3005ON there was XP 07597000, Mata Hari, Kristal, and Mercedes. Overall, the percent age of marketable onions was not high in this trial. Late seasonal bacterial diseases have sometimes been held responsible for poor marketability of those varieties that may be late in maturing or may have been delayed from the optimal harvest date. The red onions in this trial were analyzed for pyruvate, which ranged from 4.5 to 7.8 um/gfw with an average of 6.2 um/gfw. This was higher than in the Vidalia onion trial (see elsewhere in this publication), which ranged from 2.8 to 6.3 um/gfw with an average of 4.5 um/gfw. We have tested red onions in the past that had a suitable mild sweet flavor, but were often misshapen (torpedo shaped).

After 2.5 months of refrigerated storage there were differences in weight loss, but not for percentage marketable onions (Table 2). The lowest percentage weight loss after 2.5 months of storage was Cougar with only 2% loss. This was significantly lower than any other variety. The lowest weight loss after two weeks was with NUN 3001ON, which had only 1.1% loss, significantly lower than Don Victor, Mata Hari, Kristal, Sweet Sunrise, Kalahari, Mercedes, and Ebano. There was no difference in percentage marketable onions after two weeks. It is to be hoped that testing of unusual onion varieties will continue in future years to establish their suitability for use as Vidalia onions.

References

Boyhan, G.E., D.M. Granberry, and W.T. Kelley. 2001. Onion Production Guide Univ. of Ga. Bul. No. 1198.

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

Table 1. Source, harvest date, bulb color, yield, and pungency of non-traditional short-day onions.

No.	Entry	Company	Harvest Date	Bulb Color	Total Yield	Jumbos	Mediums	Marketable	Pungency
					(50-lb bags/acre)			(%)	(um/ml
1	Gobi	Nunhems	4/19/06	Yellow	812	369	5	46%	
2	Don Victor	Nunhems	4/19/06	Yellow	636	222	25	39%	
3	Safari	Nunhems	4/19/06	Yellow	972	654	8	68%	
4	Serengeti (1202)	Nunhems	4/19/06	Yellow	708	314	7	45%	
5	Mata Hari	Nunhems	5/1/06	Red	847	618	14	75%	6.1
6	Kristal	Nunhems	4/19/06	White	855	605	27	74%	
7	Sweet Sunrise	Nunhems	4/19/06	Yellow	812	405	10	51%	
8	Kalahari (1200)	Nunhems	4/19/06	Yellow	835	442	10	54%	
9	NUN 3005ON	Nunhems	5/1/06	Red	879	682	14	79%	4.5
10	NUN 3006ON	Nunhems	5/1/06	Red	1038	714	4	69%	6.6
11	NUN 3004ON	Nunhems	5/1/06	Red	1059	676	4	64%	6.7
12	NUN 3001ON	Nunhems	5/1/06	Red	1057	552	4	53%	7.8
13	XP 07597000	Seminis	5/1/06	Red	1044	804	6	78%	5.5
14	Mercedes	Seminis	5/1/06	Yellow	947	687	4	73%	
15	Ebano	Seminis	5/1/06	Yellow	1079	527	1	49%	
16	Linda Vista	Seminis	5/1/06	Yellow	1045	643	5	62%	
17	Cougar	Seminis	5/1/06	Yellow	1004	697	1	69%	
				CV	14%	24%	73%		7%
			Fisher's Protected LSD (p=0.05)		207	224	11		0.8

Table 2. Treatment effect on refrigerated (34 deg. F, 70% RH) storage of non-traditional onions.

No.	Entry	Company	Harvest Date	Bulb Color	After 2.5 months of refrigerated storage Wt. Loss (%)	After 2.5 months of refrigerated storage Marketable	2 weeks after removal from storage Wt. Loss	2 weeks after removal from storage Marketable
1	Gobi	Nunhems	4/19/06	Yellow	3.8	76.0	1.8	74.6
2	Don Victor	Nunhems	4/19/06	Yellow	4.8	78.7	2.7	76.7
3	Safari	Nunhems	4/19/06	Yellow	3.2	83.4	2.1	81.6
4	Serengeti (1202)	Nunhems	4/19/06	Yellow	3.2	88.0	1.8	86.4
5	Mata Hari	Nunhems	5/1/06	Red	3.5	84.4	2.7	82.2
6	Kristal	Nunhems	4/19/06	White	3.5	85.5	3.0	82.9
7	Sweet Sunrise	Nunhems	4/19/06	Yellow	3.5	72.7	3.2	70.3
8	Kalahari (1200)	Nunhems	4/19/06	Yellow	3.6	81.3	3.1	78.8
9	NUN 3005ON	Nunhems	5/1/06	Red	3.1	90.2	1.3	89.0
10	NUN 3006ON	Nunhems	5/1/06	Red	2.3	89.7	1.7	88.2
11	NUN 3004ON	Nunhems	5/1/06	Red	3.7	88.0	1.5	86.5
12	NUN 3001ON	Nunhems	5/1/06	Red	3.6	90.6	1.1	89.6
13	XP 07597000	Seminis	5/1/06	Red	3.1	73.2	2.1	71.7
14	Mercedes	Seminis	5/1/06	Yellow	3.1	84.0	3.0	81.5
15	Ebano	Seminis	5/1/06	Yellow	3.6	84.6	3.4	81.7
16	Linda Vista	Seminis	5/1/06	Yellow	2.7	82.6	1.8	81.2
17	Cougar	Seminis	5/1/06	Yellow	2.0	90.7	2.2	88.7
				CV	19%	10%	33%	10%
				Fisher's Protected LSD (p=0.05)	1.0	NS	1.2	NS

SEEDED ONION RESPONSE TO DUAL MAGNUM, OUTLOOK, AND PROWL H_2O

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Introduction

Weed control options in seeded onion production are more limited than in transplanted onion production. The ability to use residual herbicides can greatly increase the grower's ability to maintain a weed-free field from planting until harvest. Seeded onions are more sensitive to these residual herbicides than their transplanted counterparts. The objective of this experiment was to determine the tolerance of seeded onions to the three residual herbicides Dual Magnum, Outlook, and Prowl H_2O.

Materials and Methods.

Variety Century onion was seeded on 17th October, 2005, at the Vidalia Onion and Vegetable Research Farm in Reidsville, GA, in a loamy sand soil with pH 5.9 and organic matter of 0.47%. Beds were 6 feet wide with 4 rows of onions spaced 15 inches apart on the bed having a 3 inch in-row spacing. Treatments included Dual Magnum at 0.5 and 1 pt/acre, Outlook at 0.5 and 1 pt/acre, and Prowl H_2O at 1 and 2 pt/acre each applied preemergence, 1-leaf onion stage and the 6-leaf onion stage. Preemergence, 1-leaf, and 6-leaf applications were made on 17th October, 2005, 4th, November, 2005 and 26th January, 2006, respectively. Treatments were applied broadcast using a CO_2 pressurized hand held boom with a spray swath width of 6 feet and nozzle spacing of 18 inches calibrated to deliver 14.8 gal/acre at 3 mile/h using TeeJet 11002 drift guard nozzles at an operating pressure of 24 psi. Data collected was visual onion injury ratings taken where 0 = no crop injury and 100 = complete crop death.

Results and Discussion

No treatment caused injury to onions when applied at the 6-leaf onion stage (data not shown). All preemergence applications caused severe injury (Table 1). Dual Magnum caused 82 % to 86 % injury, Outlook caused 62 % to 73 % injury and Prowl H_2O caused 98 % to 99 % injury when rated 9 weeks after application. Dual Magnum, Outlook, and Prowl H_2O applied at the 1-leaf onion stage caused 4 % to 8% injury 6 weeks after application. Injury was still noted 12 weeks after application for the high rates of all three herbicides applied at the 1-leaf stage.

Summary and Conclusions

Our data shows severe injury and stand loss of seeded onion s with pre-emergence applications of these three residual herbicides. While seeded onion shows tolerance to applications of Dual Magnum, Outlook, and Prowl H_2O when applied at the 6-leaf onion stage more research needs to be done to determine the tolerance of onions to an application of these herbicides at the 1-leaf stage.

Table 1. Visual onion injury from preemergence and 1-leaf applications of Dual Magnum, Outlook, and Prowl H_2O.[a]

Treatment	Rate	Onion Injury			
		11-22-05[b]	*12-20-05*[c]	*1-8-06*[d]	*1-26-06*[e]
	pt/A	%			
Preemergence application					
Dual Magnum	0.5	96 a	82 b	86 bc	68 c
	1	88 b	86 b	91 b	79 b
Outlook	0.5	81 c	62 d	72 d	51 d
	1	90 b	73 c	82 c	61 cd
Prowl H_2O	1	99 a	98 a	99 a	85 b
	2	99 a	99 a	99 a	100 a
1-leaf application					
Dual Magnum	0.5	0 d	6 e	8 ef	4 e
	1	0 d	8 e	15 e	16 e
Outlook	0.5	0 d	4 e	5 f	0 e
	1	0 d	8 e	8 ef	11 e
Prowl H_2O	1	0 d	4 e	4 f	0 e
	2	0 d	4 e	6 ef	2 e
Non-treated Control		0 d	0 e	0 f	0 e

[a] Visual ratings based on 0 = no injury and 100 = complete crop death. 6-leaf applications did not cause any visual injury and are not included.
[b] Visual ratings taken 5 and 2 weeks after preemergence and 1-leaf applications, respectively.
[c] Visual ratings taken 9 and 6 weeks after preemergence and 1-leaf applications, respectively.
[d] Visual ratings taken 12 and 9 weeks after preemergence and 1-leaf applications, respectively.
[e] Visual ratings taken 15 and 12 weeks after preemergence and 1-leaf applications, respectively.

PATHOLOGICAL ACTIVITY DURING THE 2005-2006 ONION SEASON

David Langston Jr., Extension Plant Pathologist

Introduction

The 2005-2006 onion growing season was similar to that of the two previous years, by being both cool and dry. The fungicide tests conducted at the Vidalia Onion and Vegetable Research Farm did not experience severe epidemics from foliar diseases, either fungal or bacterial.

Results and Discussion

Although some differences in disease were noted between treatments, no yield differences were observed. Generally, treatments receiving more sprays showed less disease compared with treatments receiving fewer or no sprays. However, lower levels of disease could not be correlated with higher yields. This discovery is common when disease pressures are low at the beginning of the season and moderate at later times in the season when bulbs are developed.

The generally low disease pressure for the year was echoed across the Vidalia onion growing region as indicated by there being only a few samples diagnosed as having foliar pathogens. The loom of a threat of losses from Iris Yellow Spot Virus (IYSV) and Tomato Spotted Wilt Virus (TSWV) came to no avail. No losses of yield or quality could be directly attributed to the presence or absence of these two viral diseases. Center rot caused by the bacteria *Pantoea ananatis*, was observed in some areas and continued to be a threat even later in the season. As always, sour skin (caused by *Burkholdarea cepacia*) caused losses to onions left in the field during the warm temperatures of late April and early May.

Summary and Conclusions

The Cooperative Extension Plant Pathology program will again investigate reduced fungicide spray programs for the 2006-2007 season. Data has shown that reduced spray schedules would have saved growers money these past years when conditions were not favorable for diseases either to occur or develop. A year of high disease pressure is needed to complete the study of evaluating the benefits of weather based fungicide spray schedules on onions in Georgia.

OZONATION OF SWEET ONIONS DURING CURING

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George E. Boyhan, Extension Horticulturalist
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Introduction

Sweet onions are soft and succulent. They are easily damaged, opening a way for disease to enter the bulb. A satisfactory harvesting program enables sweet onions to be harvested and handled as gently as possible, even through curing, storage and shipping.

Curing is an essential part of harvesting as it prepares onions for an extended shelf life, be it for the fresh market or for later markets following storage. Onions are cured in order to enhance dormancy and to dry the outer scales, roots and neck. By drying the scales, a bulb is sealed against internal water loss and the bulb is provided with an armor which enhances its durability. Drying the scales, roots and neck reduces the likelihood of disease entering the bulb by removing moisture, a requirement for most diseases to both travel and grow. Drying the outer flesh can also aid in the healing of scarred tissue and in providing an enhanced appearance for the bulb.

The shelf life of onions after harvesting and curing is dependent upon many factors including the presence of disease on or in the onions at the time the onions are harvested. Surface diseases tend to proliferate later in the harvesting season as climatical conditions become conducive for their development. Internal diseases may have entered the onion during the growing stage of onion production.

The removal of disease from an onion bulb is dependent upon the type and nature of the disease. Once established inside an onion bulb, internal diseases are difficult to remove. Surface diseases, however, may be controlled according to type and persistence, with mild cases possibly being dried and eliminated during curing. Yet there comes a level of disease infestation at which curing encourages disease growth. At least after curing those onions with surface diseases may more easily be recognized and sorted from those without disease compared with before curing.

Ozone (O_3) is a blue, gaseous, powerful oxidizing form of oxygen, derived from O_2 during an electrical discharge or exposure to ultraviolet radiation. It has a notable smell and its name is derived from the Greek word "ozein" meaning to smell or reek (Davis, P. 1976.). It is naturally occurring and may be smelt around electrical motors and during arc welding.

Ozone has pesticidal properties and may be considered a bacteriacide. Its mode of action is to irreparably damage cell walls belonging disease organisms. Practical uses of ozone as a bacteriacide are found in poultry houses for combating salmonella and inside onion stores for minimizing soft rot. Inside onion stores it may be administered to onions while they are in storage (Smith, C, 2005), the onions remaining in contact with ozone throughout their time of storage.

Nevertheless, little is known as to the short term effect of ozone. Therefore a study has been conducted to examine the behavior of ozone and its usefulness in cleansing or neutralizing surface diseases while onions are being cured, before they are placed in storage.

Materials and Methods

Onions were grown on the Vidalia Onion and Vegetable research farm, Reidsville, GA., according to recommendations (Sumner et al. 2001). They were harvested on six occasions throughout the season from 2nd May through 19th May, 2005, and varied in variety according the time of harvest, since onion varieties range from being early, mid season or late in their time of maturity within the harvesting season. During each of the six test runs, two pallet bins were used holding approximately 56,000 in^3 or 1,300 pounds of onions of the same variety.

Once harvested for each test run, both pallet bins of onions were cured by passing heated air (100 ^{0}F) provided by a Peerless Crop Dryer (Peerless Manufacturing, Shellman, GA) through a plenum (Nolin Erection Services, Ashburn, GA) then around onions supported in the pallet bins (MacroBins model TM34, Macro Plastics Inc. Fairfield, CA) air entering the pallet bin in a downdraft manner (Maw and Paulk, 2002). The pallet bins were delivered with vents in the sides as well as the bottom. The side vents were covered with plywood, each section bolted in place and sealed with tape. The remaining open vented area in the bottom was 7.4 % of the total bin base area. The onions were in open-mesh bags inside the pallet bin. The bags were closely packed in the bin over each other so as to reduce the likelihood of tunnels forming between the bags through which air could pass, thus evading some of the onions.

While being cured, one bin of onions was supplied with ozone and one was not. Ozone was produced by a generator (Ozone Technologies Inc.). Ozone was administered to the onions via a manifold into the curing air before the air circulated around the onions. The manifold was constructed of 0.5 in. pvc pipe in the form of a grid with the pipe having 0.24 in. holes spaced at various locations on the grid. The manifold was placed on the top of the pallet bin under one of the hoods of the dryer plenum and over the onions being held in the bin. Ozone was supplied to the manifold by a flexible pipe leading from the ozone generator, having first passed through a flow control valve. Among the six test runs, treatments varied as being of two ozone rates (5 L/min and 10 L/min); and three application durations (24, 48 and 72 h).

Following curing and ozonation, samples of onions from both bins of a test run were placed in 25 pound boxes (five boxes from each bin) a total of ten boxes per test run and a total of 60 boxes for the entire study in 2005. On being placed in a box the onions were counted and the entire box of onions weighed before being placed on shelves in a shelf life storage room. The climate in the storage room was controlled by a window type air-conditioner maintaining the temperature of the room at approximately 22 ^{0}C (71.6 ^{0}F) and the humidity at a level as prescribed by the air conditioner. Circulation fans constantly ran inside the storage room.

Test run number one. Onions of mixed varieties were harvested Monday, 2nd May, were placed on to cure Monday, 2nd May and were given 48 h of curing and ozonation at 10 L/min, the curing being switched off Wednesday, 4th May. The onions were placed in storage on Thursday, 5th May, 2005.

Test run number two. Onions of mixed varieties were harvested Wednesday, 4th May, were placed on to cure Thursday, 5th May and were given 24 h of curing and ozonation at 10 L/min, the curing being switched off Friday, 6th May. The onions were placed in storage on Tuesday 10th May, 2005.

Test run number three. Onions of mixed varieties were harvested Monday, 9th May, were placed on to cure Monday, 9th May and were given 72 h of curing and ozonation at 10 L/min, the curing being switched off Thursday, 12th May. The onions were placed in storage on Friday, 13th May, 2005.

Test run number four. Onions of mixed varieties were harvested Thursday, 12th May, were placed on to cure Thursday, 12th May and were given 24 h of curing and ozonation at 5 L/min, the curing being switched off Friday, 13th May. The onions were placed in storage on Tuesday, 17th May, 2005.

Test run number five. Onions of mixed varieties were harvested Thursday, May 12th, were placed on to cure Monday, May 16th and were given 72 h of curing and ozonation at 5 L/min, the curing being switched off Thursday, May 19th. The onions were placed in storage on Wednesday, May 25th, 2005.

Test run number six. Onions of mixed varieties were harvested Thursday, 19th May, were placed on to cure Tuesday, 24th May and were given 48 h of curing and ozonation at 5 L/min, the curing being switched off Thursday, 26th May. The onions were placed in storage on Friday, 27th May, 2005.

During storage the onions were periodically examined for shelf life, after two months in storage on the first occasion and at monthly intervals thereafter until all onion had decayed and had been removed. On each occasion the onions were sorted, the good onions being counted, weighed and replaced in the box with bad onions being counted, weighed and discarded. Results are based upon the percentage of good onions remaining in storage after each examination compared with the beginning weights of onions placed in storage. In order to truncate lower and upper values the percentage values have been transformed by using the arcsin of the square-root of the decimal version of the percentage value.

Results and Discussion

General observations: During the first examination, approximately two months after the onions had been placed in storage, some boxes had a high incidence of onions decaying from sour skin, with fruit flies swarming the boxes in storage. Other boxes of onions, however, survived with few or no onions decaying. On the second examination, approximately one month from the first, a few onions were removed from the boxes for having the presence of soft centers, sprouting, slippery skin with two onions having decomposed. During the second examination the diseases were observed to be void of the sweet smell of sour skin. Aspergillus niger was found on the surface of some onions, these onions having been isolated from circulating air. During the third and successive examinations most of the onions removed were beginning to sprout, being notably those onions from the second and third harvests. Only occasionally were onions found decomposed. Throughout the examinations those onions of the first, fifth and sixth harvests remained bright and attractive in complexion.

By ozonation rate. Ozonation was significantly ($P<0.05$) effective in extending shelf life when administered at the 5 L/m rate as compared with the 10 L/m rate or no ozonation at all (Table 1). This is noted in graphical form in Figure 1.

By duration of ozonation. There was no significant ($P<0.05$) benefit in curing at one duration over another (Table 1 and figure 2), although there was, according to the means, a slight benefit with increased duration of ozonation. From Figure 3 there was the least variation in effect from ozone rates at the 48 h of duration, there was a moderate variation in effect from ozone rates at the 24 h of duration and there was the most variation in effect from ozone rates at the 72 h of duration.

By rate and duration of ozonation. Whereas non of the treatment rates were significantly different at the 48h duration, 5 L/m was significantly more effective at both the 24 and 72h duration than either the 0 or 10 L/m (Table 1). This relationship is further illustrated in the graph of Figure 3, when the benefit of ozonation by either one rate or the other is shown at all ozonation durations.

Overall by examination date. There was a significant ($P<0.01$) difference in the overall reduction of onions in shelf life storage from one month to the next though these varied by harvest with harvests one, four, five and six having more onions remaining throughout the duration of storage.

Summary and Conclusions

The shelf life of an onion is dependent upon the condition or health of the onion as it goes into storage. This is likely to be the condition of the onion at the time of harvest, assuming that following harvest the onion is immediately cured, sorted and shipped, before being placed in storage. The extent of the presence of any disease is likely to influence shelf life. Though the choice of duration of cure may depend upon other factors, such as maturity at the time of harvest, the results of this study are given in terms of the benefits of duration of cure as it pertains to the duration of ozone application and rate of ozone.

* The overall best ozone rate was found to be 5L/m rate, probably because at a lower rate, the concentration would be higher than at the higher rate when the concentration would be low, although the concentrations were not known.
* The overall best duration of ozonation was found to be 48 h, yet the two best duration-rate combinations were 5L/m at 24 h and 5L/m at 72 h.
* At no ozone there appears to have been a slight benefit in curing duration and with an increasing duration when ozone was administered.
* At 5L/m there appears to have been little benefit from 24 to 48 h, but a greater benefit from 48 to 72 h, with a slight benefit from 24 to 72 h.
* At 10L/m, there appears to have been a benefit going from 24 to 48 h duration of ozonation, yet no benefit when going from 48 to 72 h duration of ozonation.

Acknowledgements

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Table 1. Least square means for the shelf life of onions having been treated with ozone, good onions remaining in storage by weight (arcsin (decimal %)[1,2]), analyzing by ozonation rate and duration of ozonation.

Overall by ozonation rate	Rate(L/m)		0	5	10	SE
			26 b	35 a	19 c	1.3 *

Overall by ozonation duration	Duration(h)		24	48	72	
			27	28	26	9.1 NS

By ozonation rate and ozonation duration	Duration(h)		24	48	72
	Rate(L/m)	0	23 b	26 a	28 b
		5	38 a	26 a	42 a
		10	20 b	31 a	7 c
		SE	2.8	2.8	2.8

Overall by examination date	Date				
	May	100	Dec.	21 cd	2.8
	July	50 a	Jan.	15 de	
	Aug.	41 ab	Feb.	13 de	
	Sept.	38 b	Mar.	7 e	
	Nov.	28 c			

Means with the same letter are not significantly different at the P=0.05 level. Means without letters are not significantly different from each other.

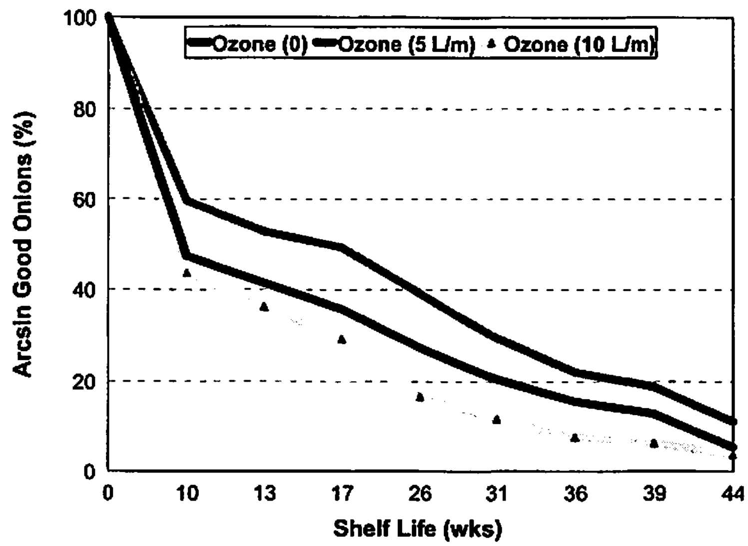

Figure 1. Shelf life of sweet onions stored for 44 weeks, indicating the variation in onions remaining according to ozone rate (0, 5, 10L/m).

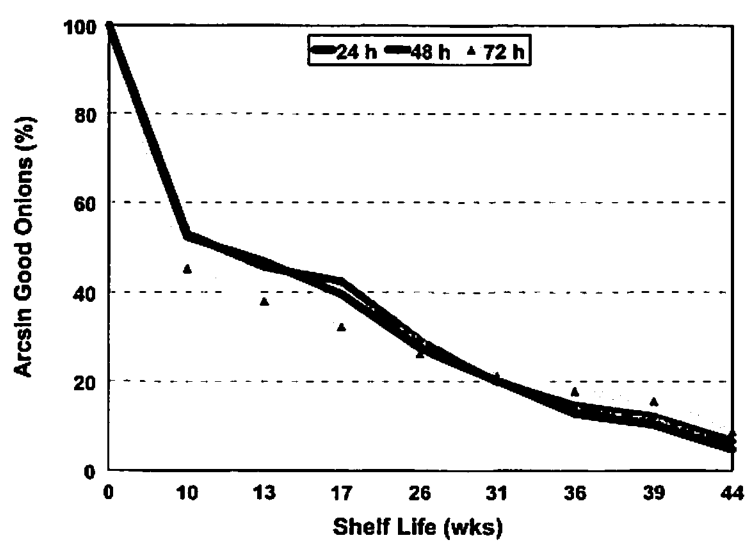

Figure 2. Shelf life of sweet onions stored for 44 weeks, indicating the variation in onions remaining according to duration of ozonation (24,48,72 h).

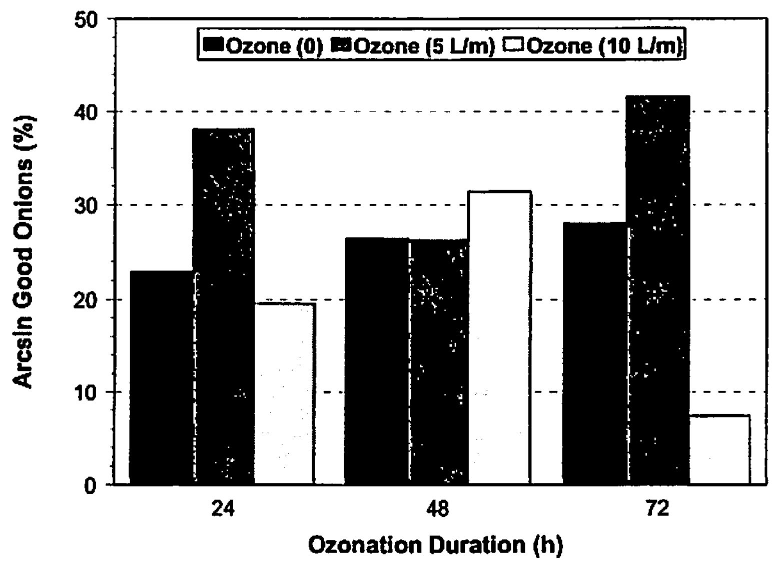

Figure 3. Shelf life of sweet onions stored for 44 weeks, according to duration of ozonation (24,48,72 h) and ozonation rate (0, 5, 10L/m).

ACTIVITY REPORT FOR THE VIDALIA ONION RESEARCH LABORATORY
UNIVERSITY OF GEORGIA – TIFTON CAMPUS
CALENDAR YEAR: 2006

Thad Paulk, Research Professional, Vidalia Onion Research Laboratory
George Boyhan, Extension Horticulturalist

Introduction

There have been several changes at the Vidalia Onion Research Laboratory during the past year. The Onion Lab is now the hub for all Post-harvest handling of fruits and vegetables from research projects at the Tifton Campus.

Results and Discussion

A new 16' x 20' drive-in cooler was constructed inside the warehouse this past summer. This cooler not only increases the holding and storage capacity at the lab, but reduces the amount of labor required for loading and unloading commodities.

A new Durrand-Wayland vegetable grading line with a Kerian Speed Sizer was installed on the rear loading dock. This grading line replaces the Tew grading line used for several years. The new grader is capable of handling larger volumes of produce and a greater diversity of produce. This is a much needed upgrade for the Onion Lab.

Also, we upgraded the control unit for the Controlled Atmosphere Storage unit. The old system could no longer be supported by the supplying companies. The new GCS-670 controller adds real-time monitoring as well as the ability to monitor and control the unit from remote sites via the internet.

A diverse array of commodities were stored and processed at the lab this past year. Storage trials have consisted of Onions, Satsumas, Broccoli, Bell Peppers, Eggplants, Tomatoes, Pecans, Pumpkins and cucumbers. Table 1 is a list of experiments and use of the Vidalia Onion Research Laboratory this past year.

Table 1. A list of experiments and use of the Vidalia Onion Research Laboratory during the 2006 calender year.

Cell Number	Researcher	Type Experiment	Crop	Atmosphere	% rh	Temp
CA 1	Boyhan	Variety Trial 2006	Onion	3% O_2 + 5% CO_2 + 92% N_2	70	34°F
CA 2	Boyhan	Variety Trial 2006	Onion	3% O_2 + 5% CO_2 + 92% N_2	70	34°F
CA 3	Ruter	Seed Stratification	Various	Air	70	60°F
	Boyhan	Storage Evaluation	Pumpkin	3% O_2 + 3% CO_2 + 92% N_2	70	50°F
CA 4	Boyhan	No Spray	Onion	3% O_2 + 5% CO_2 + 92% N_2	70	34°F
	Boyhan	Fertility #2	Onion	3% O_2 + 5% CO_2 + 92% N_2	70	34°F
CA 5	Boyhan	Fertility #1	Onion	3% O_2 + 5% CO_2 + 92% N_2	70	34°F
CA 6	Gitaitis	Fumigant Evaluation	Onion	3% O_2 + 5% CO_2 + 92% N_2	70	34°F
CA 7	Langston	Fungicide	Onion	Air	70	34°F
CA 8	Picha	Storage	Satsuma	Air	90	40°F
	Riley	Storage	Onion	Air	70	34°F
	Ruter	Seed Stratification	Various	Air	70	60°F
CA 9	Picha	Storage	Satsuma	3% O_2 + 0% CO_2 + 97% N_2	90	40°F
	Maw – Paulk	Ozone – Chlorine Dioxide	Onion	Air	70	34°F
CA 10	Picha	Storage	Satsuma	5% O_2 + 0% CO_2 + 95% N_2	90	40°F
	Randle	Storage	Onion	Air	70	34°F
CA 11	Picha	Storage	Satsuma	10% O_2 + 0% CO_2 + 90% N_2	90	40°F
	Coolong	Storage	Onion	Air	70	34°F
CA 12	Picha	Storage	Satsuma	5% O_2 + 5% CO_2 + 90% N_2	90	40°F
	Langston	Fungicide	Onion	Air	70	34°F
CA 13	Picha	Storage	Satsuma	5% O_2 + 10% CO_2 + 85% N_2	90	40°F
	Langston	Fungicide	Onion	Air	70	34°F
CA 14	Picha	Storage	Satsuma	10% O_2 + 5% CO_2 + 85% N_2	90	40°F
	Randle	Breeding Stock	Onion	Air	70	34°F
CS 1	Conner	Breeding Stock	Pecan	Air	70	34°F
	Torrence	Virus Fertility	Onion	Air	70	34°F
	Boyhan	Organic	Onion	Air	70	34°F
	Boyhan	Grano	Onion	Air	70	34°F
	Maw	Ozone – Chlorine Dioxide	Onion	Air	70	34°F
	Diaz-Perez	Storage	Broccoli	Air	70	34°F
CS 2	Boyhan	Millet Cover Crop	Onion	Air	70	34°F
	Boyhan	Seed Spacing	Onion	Air	70	34°F
	Torrence	Various	Onion	Air	70	34°F
	Maw	Ozone – Chlorine Dioxide	Onion	Air	70	34°F
CS 3	Boyhan	Seed Storage	Pumpkin	Air	50	50°F
	Phatak	Seed Storage	Various	Air	50	50°F
CS 4	Veg. Team	Shelf Life	Pepper	Air	90	40°F

SUPPLEMENTAL CALCIUM CHLORIDE ENHANCES FIRMNESS IN VIDALIA ONIONS

Timothy W. Coolong, Horticultural Graduate Student
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Introduction

In an effort to improve onion bulb quality and storability, some growers in the Vidalia, Georgia, growing region have chosen to apply an aqueous calcium chloride solution onto onions. Commonly sold under the trade name of HI-CAL® Liquid (TETRA Technologies, The Woodlands, TX), this aqueous solution is saturated with calcium chloride, containing 12% calcium and 26% chloride by weight. Having a neutral pH, this liquid formulation may be conveniently applied either through a sprayer or through center pivot systems.

Soil in the Vidalia growing region is sometimes found to be low or deficient in calcium, therefore supplemental calcium may be necessarily applied during the growing season. Onions that were grown in 2005 on the Vidalia Onion and Vegetable Research Farm in Reidsville, Georgia were found to have calcium concentrations near 0.2% in mature dry bulb tissue (Coolong et al., 2005). This was less than the desirable range of 1.0 to 3.0% (Mills and Jones, 1991).

Calcium, an immobile plant macro-nutrient, has a number of functions in the plant, ranging from an osmotic regulator, to important component of the second messenger system in cells (Marschner, 1995). An interest lies in the role that calcium ions play in the pectin layer of the plant cell walls. The plant cell wall is made of three primary building blocks, cellulose, hemi-cellulose, and pectins. Pectins help form a gel-like layer that is integral to the cell wall matrix. Calcium ions are important for pectin development because they form covalent linkages between individual pectin polymers improving the strength of the pectin gel and overall integrity of the cell wall (Ridley et al., 2001). By increasing the calcium status in an onion plant the cell wall integrity may be improved as realized in the texture or firmness of an onion bulb.

In November, 2004, a two year field study was begun to determine if supplemental calcium chloride (0, 100, and 200 lb $CaCl_2$/acre) supplied as liquid drenches throughout the growing season would affect bulb firmness at harvest. Since Vidalia growers often grow onions in soil with low levels of sulfur, calcium levels were applied over three different soil sulfur regimes.

Materials and Methods

This study was conducted as a randomized 3 x 3 factorial design, with three levels of calcium chloride (0,100 and 200 lb/acre) and three levels of sulfur fertility (36, 72 and 108 lb S/acre). Sulfur fertility levels were achieved by using ammonium sulfate. The onion variety "Georgia Boy" was transplanted on 23rd November, 2004 and 1st December, 2005, respectively into 30 foot long raised beds at the Vidalia Onion and Vegetable Research Farm in Reidsville, Georgia. Five and four replications were used in years 1 and 2 respectively. Onions were grown using standard procedures outlined by the University of Georgia Agriculture Extension Service with the exception of fertility procedures. Plots received 400 lb/acre of 5-10-15 with 9% S pre-plant. At six and eight weeks post transplant 200 lb/acre 6-12-18 equivalent with no S was supplied. At approximately 14 weeks post transplant, 200 lb/acre calcium nitrate was applied. Ammonium sulfate applications were made at 6 and 12 weeks post transplant giving 36, 72 and 108 lb/acre S for the entire growing season (including the S supplied pre-plant). Four applications of calcium chloride at approximately 8, 12, 16 and 20 weeks after transplanting were performed providing 0, 100 and 200 lb/acre $CaCl_2$. All fertility treatments were applied by hand at the base of the plant. Onions were undercut and harvested on 9th May, 2005 and 10th May, 2006.

After curing and bagging, onions were tested for firmness. Firmness was tested by taking the first fully fleshy scale from the outside of the bulb (usually 2nd or 3rd from outside) and cutting a 1 inch square section from the equatorial region of the bulb then measuring the force needed to puncture the scale using a 0-500 gram penetrometer. A probe with a surface area of 1mm^2 was attached to the penetrometer. Fifteen bulbs were sampled three times (45 measurements) and averaged for every treatment-replication combination. The data was analyzed using SAS statistical software (Version 9.1, SAS instituted, Cary, NC).

Results and Discussion

Bulb firmness was affected by additional calcium chloride in both years (Table 1). In year one, 200 lb/acre of calcium chloride significantly increased firmness over the 0 and 100 lb/acre treatments ($P < 0.05$, $F = 4.46$), and in year two both 100 and 200 lb/acre treatments of calcium chloride were significantly firmer than the 0 treatment ($P < 0.001$, $F = 10.14$). Bulbs grown in year two were significantly firmer than those grown in year one ($P < 0.001$, $F = 45.8$) and there was a significant interaction between year and calcium fertility ($P<0.05$, $F=3.67$). There was a larger increase in firmness resulting from calcium chloride fertility in year two than in year one. Sulfur fertility levels did not significantly affect bulb firmness. Neither were there any significant interactions between calcium and sulfur treatments.

Summary and Conclusions

Increasing calcium chloride fertility improves the firmness of onion bulbs over a wide range of sulfur fertility levels. In year one a significant increase was not observed until 200 lb/acre of calcium chloride was applied; however, in year two a significant increase was observed after just 100 lb/acre was applied. A large difference between the two years indicates that there is an interaction between calcium and the environment. In year one although a significant increase was observed, it resulted in only a 2.8% increase in firmness from lowest to highest calcium chloride levels. In year two the increase was 6.9%. Although such a small increase in firmness may or may not go unnoticed by the consumer, it is evidence that supplemental calcium chloride fertility does result in textural changes in the bulb. Although relative changes in firmness are low, there may be enough improvement in cell wall strength and cell to cell cohesion that postharvest quality is positively affected. In order to evaluate if storability is positively affected by supplemental calcium, larger sample sizes may be needed. Overall, it appears that in a low calcium soils such as may be found in Southeastern Georgia, supplemental calcium chloride will improve texture of fresh onion bulbs.

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Table 1. Mean firmness (grams/mm^2) and standard errors for years one and two at three different levels of calcium chloride fertility. Different letters (a & b) represent significance at $P < 0.05$.

CaCl level	*Year 1*	Year 2
	Firmness (grams/mm^2)	
0	314±1.8 (b)	322±3.2 (b)
100	313±2.4 (b)	337±3.6 (a)
200	323±3.3 (a)	345±3.9 (a)
Avg.	317±1.7	335±2.5

THRIPS CONTROL ON ONIONS, 2005-2006

David G. Riley, Research Entomologist
Jackie Davis, Research technician

Introduction

In 2006, an insecticide efficacy trial was conducted to evaluate various chemicals for the control of thrips in onions in Tift County, Georgia.

Materials and Methods

Onions (variety Pegasus) were transplanted in December, 2005 into four rows per bed at approximately 2-3 in. between plants, and grown according to standard cultural practices. Total numbers of thrips per plant were counted on five plants per plot each week beginning on 25th January, 2006 and categorized as either *Frankliniella fusca* adults or other. Most of the thrips were collected from the plant during late season, during the time of bulb formation. Five weekly applications of insecticide were applied beginning on 3rd March, 2006. Insecticide treatments were applied with a tractor mounted, compressed air sprayer delivering 61 g.p.a. with three TX18 hollow cone nozzels per row. An unsprayed check was included. Treatment plots were one bed of four rows by 40 feet and each treatment was replicated four times in a randomized complete block design.

Results and Discussion

Frankliniella fusca was the dominant species in this test (Table 1). In the field scouting sample, the highest level of thrips occurred on 26th April at the end of the test and averaged 2-3 thrips per plant in the untreated check. Based on the field scouting samples, the best overall insecticide treatment was Warrior T 1EC 0.03 lb ai/acre followed by Spintor 2SC 6 oz product/a, and E2Y45 at 0.022 lb ai/a. There was no significant yield loss in this test.

Table 1. Total thrips scouted in the field per plant.

Treatment	Amount product/acre	Overall Total Thrips	Overall Tobacco Thrips	Total Onion Weight per Plot
Untreated check		2.4 a	1.9 a	100 a
New experimental insecticide		2.5 a	2.2 a	128 a
E2Y45	0.022 lb ai/a	2.2 ab	1.9 a	91 a
Spintor 2SC	5.7 oz	1.7 b	1.3 b	118 a
Warrior T 1EC	3.8 oz	1.5 b	1.2 b	123 a

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

CONSUMER ACCEPTABILITY OF VIDALIA ONION VARIETIES, 2005-2006

Robert L. Shewfelt, Research Food Scientist

Summary

Forty two varieties of Vidalia onions were evaluated by 700 consumers on The University of Georgia campus. Seven varieties (4, 10, 12, 21, 26, 40 & 42) were superior while eight varieties (8, 19, 22, 24, 33, 34, 35, & 38) were rated inferior. This information should be considered with yield and growth characteristics in selecting varieties for the next growing season. Despite an increase in panelists from 30 to 50 tasting each variety in the acceptability test, sample differentiation was not as clean as expected. The test population was 62% female and 38% male. The age groupings of participants were 39% under 30, 20% in their 30s, 21% in their 40s and 20% over 49. An associated questionnaire revealed that 91% of responses indicated that they purchased onions at the supermarket, 74% purchased them by the Vidalia name, 57% used appearance and 33% use size as primary characteristics for purchasing the onions. Of those participating 86% considered taste to be the most important quality characteristic, 70% stored their whole onions or leftovers in the refrigerator, 35% expected a storage life of less than 2 weeks while over 93% did not expect a storage life of more than 4 weeks and 80% were satisfied with the onions available for purchase.

Introduction

In 2005, 49 varieties of Vidalia onions were evaluated for consumer acceptability at the University of Georgia (Shewfelt, 2005). The study provided useful information for variety selection, but the separation of varieties was limited and an increase of participants from 30 to 50 was recommended where each participant tasted every variety. It was suggested that an experienced panel evaluate the varieties for sweetness and pungency in conjunction with the consumer panel. It was the objective of this study to evaluate the consumer acceptability and sensory quality of 42 varieties of Vidalia onions harvested in the Spring of 2006. Differences between the two years are given in Table 1.

Materials and Methods

Onions were grown at the University of Georgia Vidalia Onion and Vegetable Research Farm under standard conditions on 6 ft wide beds with four rows per bed, in a randomized complete block design in plots 35 ft long. Plant densities approximated 12 plants per linear foot. Each replication was a minimum of 25 ft. Onions were harvested at maturity and transported to the Department of Food Science and Technology of The University of Georgia in Athens. They were stored at 34 °F prior to being tested. Samples showing damage or decay were discarded rather than being used in the test.

Onions were evaluated during seven days in May and June at seven different locations on The University of Georgia campus in Athens with 100 participants tasting three varieties that were clearly described as Vidalia. Thus, twelve varieties were assigned a three-digit code and evaluated each day by 25 participants. Each variety was evaluated on two occasions. Sample presentation was randomized and samples were presented one at a time. Participants were asked if the sample "Tastes Great," was "Acceptable" or was "Unacceptable". They were asked not to compare one sample with another. Each variety was thus tasted by a total of 50 participants.

Samples were presented in diced form. In cutting the samples approximately 10-20% of the top and bottom of each onion was removed before the diced samples were prepared. A total of 490 consumers participated. Each participant received $5.00 for participating in the test. While some consumers who were approached declined the opportunity to taste raw onions, most willingly participated. After tasting the samples and before receiving compensation, each participant answered a short survey.

On the day following the consumer test, twelve experienced panelists evaluated the sweetness and pungency of the twelve varieties evaluated by the consumers. Panelists were asked to chew the sample with a closed mouth to evaluate sweetness on a 5-point scale (4 = extremely sweet, 0 = not sweet) and then open the mouth to evaluate pungency (4 = extremely pungent, 0 = not pungent).

Data were analyzed by Analysis of Variance with mean separations by Least Significant Difference (LSD) using SAS. Differences in methodology between the study last year and the one this year are shown in Table 1.

Results and Discussion

A complete means separation using LSD based on an average of the three points in the acceptability scale is shown in Table 2. A comparison of all the means as shown by the letters following show that there is no significant difference between the top 20 varieties (all followed by the letter a) or between the bottom 36 varieties (followed by the letter f). Of these varieties, fourteen were neither significantly different from the best nor the worst ones (followed by the letters abcdef). Increasing the number of participants from 30 to 50 did not improve differentiation of the varieties as hoped. Thus, we must conclude that differences in the consumer acceptability among the varieties are small.

The 42 varieties have been grouped into four somewhat arbitrary classes, but these divisions are not clear-cut. A way of evaluating the differences between varieties described in the last report (Shewfelt, 2005) represents the percentage of participants who rated the samples either "Tastes Great" or "Acceptable" (shown in the last column of Table 2). The lowest rating in this column was 78% up from a low of 70% in 2005. Ideally, at least 90% of the participants should rate the sample "Tastes Great" or "Acceptable". Using this criterion, varieties 4, 12, 13 & 21 were acceptable to more than 95% of participants while varieties 1, 7, 15 & 34 were acceptable to more than 90% of participants. Last year there were 28 varieties of the 49 tested that were rated above 90% acceptability. Thus there were smaller differences in acceptability among the varieties tested this year than those tested last year.

Unlike 2005, in 2006 an experienced panel of twelve judges evaluated sweetness and pungency for all varieties. The results are shown in Table 3. Panelists rated four varieties (10, 12, 40 and 42) with a pungency score less than 1 (slightly pungent) and an additional nine varieties (9, 11, 14, 15, 21, 26, 36, 38 & 41) with a pungency less than 1.15. The LSD mean separation test was not able to differentiate between the top twenty varieties, however. Increased sweetness did not relate directly to lower pungency. While the two varieties (10 & 40) with the lowest pungency (0.75) had a reasonably high sweetness (1.58), there were many varieties that did not show an inverse relationship. Likewise, there was not a strong relationship between low pungency (Table 3) and high acceptability (Table 2). Two varieties (12 & 21) showed low pungency and high acceptability, but one variety (13) was highly acceptable to the consumers and rated sweet but pungent to sensory panelists. The variety (34) with the lowest acceptability rating was also lowest in sweetness and highest in pungency.

No varieties were rated superior for pungency, acceptability and sweetness, but variety 34 was rated inferior for all three measures. Varieties 9, 10, 12, 13, 21, 26, 31, 40 and 42 were superior for two of the three measures. Varieties 8, 15, 22, 24, 28 and 37 were inferior for two of the three measures. While we did not conduct a shelflife study we did find that one variety (28) deteriorated so rapidly that we were not able to retain enough sample to test it a second time.

The demographic profile of the participants is shown in Table 4. The population was not as closely split between males and females this year with over 60% females. Unlike last year, it was not as dominated by participants under the age of 30. Careful selection of the seven locations decreased student participation at the expense of a gender imbalance.

Consumer behavior data are shown in Tables 57. As observed last year the most popular place to buy Vidalia onions for the participants is the supermarket (82.2% of responses) with less than 10% citing a farmer's market or roadside stand (Table 5). Over half (73.7%) of the sample specified Vidalia as the type of onion they bought indicating a high loyalty for the Vidalia name. Appearance (57.0%) and size (32.7%) were the two most important characteristics used by consumers in purchasing Vidalia onions, while taste (85.9%) was critical in satisfaction during consumption of the onion (Table 6). The refrigerator (70.0%) is the most common place of storage for onions in the home with on (25.1%) or under (5.1%) the counter accounting for most other methods (Table 7). Some dedicated participants reported tying their onions up in old stockings (5.9%). Many consumers store whole onions outside the refrigerator and place leftovers in the refrigerator. A large number of participants (35.0%) expect less than a twoweek shelf life, while a majority (57.9%) expect a shelf life of two to four weeks. These numbers combined with the high satisfaction rate (80.7%) suggests that shelflife extension is not a critical area for onions. The level of satisfaction for onions is much higher than what we have observed for fresh fruits and vegetables.

Summary and Conclusions

A complete means separation using LSD based on an average of the three points did not provide a clear separation of varieties leading us to conclude that there are not great differences among the varieties. Use of an experienced panel to evaluate pungency and sweetness helps provide more information with the pungency data more meaningful than the sweetness data. Based on evaluation of consumer acceptability, pungency and sweetness, nine varieties (9, 10, 12, 13, 21, 26, 31, 40 & 42) were found to be superior to the other varieties while six varieties (8, 15, 22, 24, 28 & 37) were found to be inferior. In general, however, the differences among the varieties was small. The selection of sites provided a better balance of age groups but was dominated by females. As found last year onions, particularly Vidalia onions, have a good reputation on the University of Georgia campus and the satisfaction level is high.

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Table 1. Differences in methodology between the two years of study.

	2005 study	2006 study
varieties	49	42
consumers tasting each variety	30	50
consumers each day	70	100
total consumers	490	700
sensory testing	none	Pungency and sweetness
sensory panelists	0	12
panelists tasting each variety	0	12

Table 2. Separation of varieties by mean score [2=tastes great(TG), 1=acceptable(Acc), 0=unacceptable].

Variety	Mean		%Taste Great	%Acceptable	%TG+Acc	Class
12	1.52	a	56.0	40.0	96.0	Best
29	1.48	ab	56.2	35.4	91.6	
4	1.44	abc	47.9	47.9	95.8	
31	1.40	abcd	43.7	52.1	95.8	Close
19	1.38	abcde	45.8	45.8	91.6	
42	1.37	abcde	48.1	40.7	88.8	
13	1.36	abcdef	40.4	55.3	95.7	
21	1.35	abcdef	39.2	56.8	96.0	
16	1.33	abcdef	44.2	44.2	88.4	Mid-range
37	1.31	abcdef	41.2	49.0	90.2	
2	1.31	abcdef	39.2	52.9	92.1	
40	1.31	abcdef	39.5	52.1	91.6	
38	1.31	abcdef	41.6	47.9	89.5	
9	1.31	abcdef	42.3	44.2	86.5	
20	1.29	abcdef	38.7	51.0	89.7	
17	1.27	abcdef	39.6	47.9	87.5	
39	1.27	abcdef	33.3	60.4	93.7	
6	1.27	abcdef	36.5	53.8	90.3	
24	1.26	abcdef	41.5	43.4	84.9	
27	1.26	abcdef	38.2	48.9	87.1	
1	1.25	bcdef	45.8	33.3	79.1	
14	1.25	bcdef	39.6	45.8	85.4	
30	1.24	bcdef	35.3	52.9	88.2	
36	1.22	bcdef	34.7	53.1	87.8	
25	1.22	bcdef	33.3	55.5	88.8	
18	1.22	bcdef	37.2	45.1	82.3	
3	1.22	bcdef	37.3	47.1	84.3	
32	1.21	cdef	33.3	54.1	87.4	
22	1.20	cdef	32.6	55.1	87.7	
26	1.20	cdef	35.3	49.0	84.3	
23	1.19	cdef	35.4	47.9	83.3	Poor
41	1.19	cdef	33.3	51.8	85.1	
5	1.17	def	32.7	51.9	84.6	
35	1.17	def	31.2	54.1	85.3	
8	1.17	def	31.4	53.7	85.1	
7	1.16	def	37.2	41.2	78.4	
11	1.16	def	29.4	56.9	86.3	
10	1.15	def	29.1	56.3	85.4	
33	1.13	ef	28.8	55.7	84.5	
28	1.12	ef	28.1	57.9	86.0	
15	1.12	ef	33.3	45.1	78.4	
34	1.10	f	31.5	47.9	79.4	

Values followed by the same letter are not significantly different ($p<0.05$)

Table 3. Separation of varieties by pungency [4=extremely pungent, 3=very pungent, 2= pungent, 1=slightly pungent, 0=not pungent] and sweetness [4=extremely sweet, 3=very sweet, 2= sweet, 1=slightly sweet, 0=not sweet]. Classes based on pungency scores.

Class	Variety	Pungency		Sweetness
Best	40	0.75	a	1.54
	10	0.75	a	1.54
	12	0.83	ab	1.38
	42	0.88	abc	1.21
Close	9	1.00	abcd	1.54
	39	1.04	abcd	1.42
	26	1.04	abcd	1.75
	21	1.08	abcd	1.50
	41	1.08	abcd	1.50
	11	1.08	abcd	1.42
	14	1.12	abcd	1.38
	36	1.12	abcd	1.38
	15	1.12	abcd	1.12
Mid-range	38	1.17	abcde	1.33
	28	1.17	abcde	0.67
	5	1.21	abcdef	1.42
	17	1.25	abcdefg	1.21
	6	1.33	abcdefg	1.08
	7	1.33	abcdefg	1.42
	4	1.38	abcdefg	1.58
	20	1.42	bcdefgh	1.33
	30	1.42	bcdefgh	1.71
	3	1.42	bcdefgh	1.38
	29	1.46	bcdefgh	1.21
	2	1.50	cdefghi	1.58
	23	1.50	cdefghi	1.38
	35	1.50	cdefghi	1.38
	13	1.54	defghij	1.58
	18	1.54	defghij	1.62
	1	1.58	defghijk	1.42
	25	1.58	defghijk	1.46
	31	1.62	defghijk	1.71
	16	1.62	defghijk	1.12
Poor	24	1.79	efghijk	1.00
	27	1.83	fghijk	1.79
	33	1.88	ghijk	1.00
Worst	22	2.04	hijkl	1.17
	37	2.08	ijkl	1.12
	32	2.17	jkl	1.29
	8	2.17	jkl	1.42
	19	2.21	kl	1.29
	34	2.67	l	0.92

Values followed by the same letter are not significantly different ($p<0.05$)

Table 4. Demographic profile of consumers evaluating Vidalia onions in this study.

		N	%
Gender	Male	264	37.7
	Female	436	62.3
		700	100.0
Age range	18-29	269	38.4
	31-40	142	20.3
	41-49	150	21.4
	>49	138	19.7
		490	100.0

Table 5. Point of purchase information for test participants.

		Responses	%
Purchase Location	Supermarket	631	82.2
	Farmer's Market	39	5.1
	Roadside Stand	39	5.1
	Other	48	6.3
Type of onion purchased	Vidalia	516	73.7
	Green onions	157	22.4
	Other sweets	116	16.6
	Spanish	78	11.1
	Other	400	57.1

Table 6. Quality characteristics important to consumers of Vidalia onions at purchase and consumption.

		Responses	%
Purchase Quality	Appearance	399	57.0
	Size	229	32.7
	Aroma	70	10.0
	Label	48	6.9
	Other	287	41.0
Consumption Quality	Taste	601	85.9
	Firmness	138	19.7
	Aroma	88	13.4
	Other	178	25.4

Table 7. Consumer behavior, expectations and satisfaction.

		Responses	%
Method of home storage	Refrigerator	490	70.0
	On counter	176	25.1
	Under counter	36	5.1
	In stocking	41	5.9
	Other	170	24.3
Expectation of storage life	Less than 2 weeks	245	35.0
	2-4 weeks	405	57.9
	5-8 weeks	23	3.3
	9-12 weeks	15	2.1
	More than 12 weeks	7	1.0
Satisfaction	Satisfied with available onions	505	80.7
	Not satisfied	47	6.7
	Not always satisfied	86	12.3

EFFICACY OF FOLIAR 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 foliar applied insecticides for control of thrips. Identification of adult thrips collected prior to and during the tests indicated that the population consisted entirely of tobacco thrips, *Frankliniella fusca*.

Materials and Methods

Experimental plots were one bed wide (with 4 rows on a 6 foot bed) and 25 feet long. Plots were arranged in a complete block design with four replications. Treatments evaluated were: Carzol 92WP at 0.5, 0.75 and 1.0 lb/ac; Assail 30SG at 5.3 oz/ac; Lannate 2.4EC at 1.5 and 3.0 pt/ac; Warrior 1SC at 3.84 oz/ac; Venom 70SG at 4 oz/ac; and a Non-treated control. All insecticide treatments were tank mixed with Penetrator Plus at 6 pt/100 gal as a surfactant and to buffer the treatments (Carzol requires buffering of the solution to pH of 6). Treatments were applied with a CO_2 pressurized backpack sprayer (60 PSI) in a total volume of 40 GPA, with four hollow-cone nozzles per bed (broadcast application). Insecticides were applied on 6 and 13th April, 2006.

To monitor efficacy, thrips were sampled periodically after treatment application. On each sample date, five plants were randomly selected in each plot and visually examined for thrips. Entire plants were examined and the number of adult and immature thrips on each plant was recorded. Thrips counts were summed for each plot prior to analyses; thus, data were analyzed and are reported as number of thrips per 5 plants. Data were analyzed with the PROC ANOVA procedure of PC-SAS. Where significant differences were detected ($P<0.05$), means were separated with LSD ($P=0.05$).

Results and Discussion

All insecticides tested provided significant reductions in adult and immature thrips densities as compared with the control treatment (Table 1. and Table 2.). Differences among insecticide treatments for immature thrips were inconsistent and generally not statistically different because of greater variation in these counts. Adult thrips counts showed more consistent differences among insecticide treatments. In general, Carzol provided the greatest reduction in thrips densities, particularly after the second application. Carzol is not currently registered for use on onions (or any other vegetable crops), but is under consideration for potential registration in cooperation with IR-4.

It was anticipated that Warrior would provide greater reduction in thrips than was documented, as pyrethroid insecticides are considered 'standard' products for this pest. This apparent reduction in efficacy, if indicative of thrips response to pyrethroid insecticides throughout the onion production region, should be monitored. Resistance to the pyrethroid insecticides would make thrips management much more difficult, as few alternative insecticides are currently available.

Table 1. Adult thrips densities, onion efficacy test, Toombs County, Georgia, 2006.

Treatment	Adult thrips per 5 plants			
	4/10	4/13	4/17	4/21
Check	33.0 a	39.5 a	47.3 a	77.0 a
Lannate 1 pt.	19.0 b	21.3 bc	14.0 b	20.5 bcd
Lannate 3 pt.	9.3 c	21.75 b	18.3 b	32.8 b
Warrior	11.3 bc	16.5 bcd	17.5 b	24.3 bc
Venom	13.5 bc	22.3 b	17.8 b	31.5 b
Assail	7.5 c	16.0 bcd	13.8 b	28.0 b
Carzol 0.5 lb.	7.5 c	8.8 d	4.0 c	4.8 d
Carzol 0.75 lb.	4.5 c	13.0 cd	4.0 c	5.0 cd
Carzol 1.0 lb.	5.0 c	12.3 d	3.5 c	3.8 d

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

Table 2. Immature thrips densities, onion efficacy test, Toombs County, Georgia, 2006.

Treatment	Immature thrips per 5 plants			
	4/10	4/13	4/17	4/21
Check	13.5 a	17.0 ab	20.3 a	29.0 a
Lannate 0.45	4.8 b	13.8 abc	4.5 b	10.0 a
Lannate 0.9	3.0 b	7.3 bcd	4.0 b	9.0 a
Warrior	3.8 b	6.5 bcd	9.0 b	14.8 a
Venom	3.8 b	20.5 a	5.8 b	9.3 a
Assail	5.3 b	7.3 bcd	4.8 b	15.8 a
Carzol 0.5	3.3 b	5.8 cd	1.8 b	2.3 a
Carzol 0.75	2.3 b	2.0 d	1.5 b	2.0 a
Carzol 1.0	3.0 b	6.3 cd	1.5 b	1.8 a

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

VIDALIA ONION PACKINGHOUSE EVALUATION AND PRODUCT FLOW SIMULATION WITH AND WITHOUT X-RAY INSPECTION TECHNOLOGY

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Introduction

Lack of information on Vidalia onion packinghouse performance hinders exploration and assessment of improvement opportunities. This study evaluated the sizing and inspection performance of three Vidalia onion packinghouses and developed a simulation model to demonstrate the impact of improving these two performance variables on potential sales revenue generation.

Materials and Methods

A total of 550 Vidalia onions were obtained from three packinghouses for the two-performance variable evaluation.

Results and Discussion

Results indicated significant differences ($p<0.05$) among the three packinghouses in terms of sizing error rate. The major departure from homogeneity was caused by a relatively higher fraction of incorrectly sized onions in one packinghouse. There was no significant difference ($p>0.05$) between the packinghouses in terms of percentage rejects in the sorted Grade 1 onions. One packinghouse failed to meet the tolerance limit for defects, as specified by the US Grade Standards.

A simulation model, was developed from the onion attributes of the 2005 and 2006 four-cultivar samples and from the 2006 three-packinghouse time study. It demonstrated the potential sales revenue differentials that could be realized in packinghouses by improving sizing accuracy and human grader performance.

A discrete-event simulation model was developed to determine the approximate X-ray machine conveyor belt speed for feasible incorporation of the technology in Vidalia onion packinghouses. The results of the simulation model was also used to estimate the unit cost and selling price per box of inspected onions to ensure a profitable operation. It is a fundamental assumption of this work in that the increase in quality resulting from the x-ray inspection would justify a higher sales price. Data assumptions were derived from two May 2006 packinghouse time studies, from the four-cultivar 2005 and 2006 onion sample measurements, from the 2006 laboratory X-ray inspection study in onions and from published cost estimates of Vidalia onion production and packing.

Results indicate the feasibility of incorporating three and four X-ray inspection units at 0.25 meter per second belt speed under the simulated conditions. Estimated cost of per 18.14 kg box of X-ray inspected onions ranged from $9.00 to $15.00 while the estimated selling price ranged from $11.35 to $25.34, depending on farm yield, quality of incoming crop and on gross profit margin goals.

RESPONSE OF VIRALLY INFECTED ONION PLANTS TO OXYFLUORFEN HERBICIDE ON PLANT BEDS

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Introduction

Goal (oxyfluorfen) herbicide has been used for many years on onions in Georgia, both on direct seeded and transplanted crops. In onion plant beds, direct seeded onions grown in high plant populations for the production of transplants, low rates of Goal are often used. While most growers use fumigants to aid in the control of both weeds and certain soilborne diseases on plant beds, some weeds remain.

Goal applications are preferably begun when onion plants are in the 2-3 leaf stage of growth, and may include sequential treatments. Goal should be applied when temperatures are above 60 degrees Fahrenheit, and the humidity is fairly low. Onions in the 3-6 in. growth stage generally have less injury than plants that are smaller or larger. Rates generally range from 2-4 oz/acre. Higher rates may be used if required, but injury would be more substantial. A bleaching of the foliage is the standard injury symptom expressed by Goal. This bleaching can be reduced by monitoring weather conditions, assessing plant size, and adjusting rates. Injury symptoms are evident for about two weeks. Beyond two weeks there is no visible injury.

Two new forms of onion virus have recently been found in the Vidalia onion production area and have complicated the use of Goal on plant beds. If plants are infected with a virus they may respond to the herbicide in a different manner as compared with the response of a healthy plant. A virus may display symptoms of bleaching similar to that of Goal herbicide injury. A study was undertaken to differentiate the cause of symptoms similar to one another by examining the longevity of the symptoms.

Materials and Methods

The site used in this study consisted of plant beds sown on 12th September, 2005, with onion variety Sweet Vidalia. There were four rows per six ft wide bed. There were approximately 70 plants per foot of row.

Onion plant samples were collected on 13th October, 2005, and tested for both Tomato Spotted Wilt Virus (TSWV) and Iris Yellow Spot Virus (IYSV). Through the use of PCR testing it was found that 90% of the plants were positive for TSWV and 4% were positive for IYSV.

Goal XL was applied on 20th October, 2005, in a randomized complete block design with 4 replications in the trial with rates of 2 and 4 oz/acre. Each of the four replications were six ft wide by 25 feet long. Additional observational treatments included a 6 and 8 oz/acre rate, each 6 ft by 25 feet. The atmospheric temperature was 88 °F, along with clear skies and the time was high noon when applications were made, conditions considered ideal for minimum injury. Onion plants were approximately six inches tall at the time of application.

At the time of treatment there were no bleaching symptoms on the onions. Though a high infection rate of TSWV was determined, no symptoms were present. Viral symptoms are known to appear and disappear according to plant stress. Treatments were assessed at one day, four days and eleven days after application.

Results and Discussion

At one day after treatment (DAT) there was no visible injury to the onions at any of the rates. At 4 DAT there was minor injury at the 2 oz./acre rate. On a scale of 1-10 with 10 representing the highest degree of crop injury, this treatment averaged 1.25 over all replications. The 4 oz/acre rate had slightly more bleaching, assessed at 2.5 over all replications. The untreated control exhibited no symptoms. The 6 oz/acre observational treatment expressed moderate injury, rated 4.0, while the 8 oz/acre treatment rated 6.0 or rather severe injury. The 8 oz/acre rate was readily visible from a distance of some 100 yards. At 11 DAT there was no visible injury in any of the replicated or observational treatments.

Summary and Conclusions

The response of these plants to the treatments could be characterized as expected in a healthy plant populations under the conditions experienced throughout the experiment. Injury symptoms occurred within a few days and persisted no longer than 11 days. Based on this study, there appeared to be no adverse reaction to oxyfluorfen applications on onion plants known to be infected with Tomato Spotted Wilt Virus.

References

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EVALUATION OF CYTOKININ AND TOPSIN M TREATMENTS OF ONION TRANSPLANTS FOR YIELD AND STORABILITY

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Introduction

The effect of Cytokinin products and other plant growth regulators on onions have been studied and much of this data shows no statistical difference in yield, although in Georgia some increases in storability have been observed. There is some evidence that cytokinin products are beneficial in aiding plant establishment by enhancing root development. A study was developed to further investigate these claims.

Materials and Methods

Sweet Vidalia onions were sown on 12th September, 2005. Approximately 1600 plants were dipped in Cytokinin (.01% cytokinin) on 29th November, 2005. A ¼% solution of Cytokinin was prepared (1 qt./100 gal water) in trays. Part of this mixture was a common fungicide, Topsin M, at a rate of ½ lb/gal. water. An additional 1600 plants were pulled from the same beds, but were not dipped in the solution. For use as a control.

On the same morning, of 29th November, 2005, the plants were transplanted to 50 foot plots. Each plot consisted of 4 rows on a 6 foot wide bed, with plots replicated three times. Informal visual observations were made several weeks after transplanting, at mid-season and again several weeks prior to harvest. The onions were harvested 2nd May 2006, and transported to the Vidalia Onion and Vegetable Research Center for grading, sizing, and weighing and later to the Vidalia Onion Research Laboratory for storage. Onions were removed from storage on 10th July 2006 and evaluated.

Results and Discussion

There were no visual differences in plant stand or plant size and development at the times of observation during the growing season as a result of dipping the plants in a solution of Cytokinin (Table 1.). Neither was there any statistical difference in yield or size following harvest. The treated onions produced 321 60-lb. bags/acre while the untreated produced 295 bags/acre. Though the yields seem low in both cases seedstems were left in the field unclippped. Following examination of the stand and harvested onions there was no difference in storage of the onions as outlined in Table 2.

Table 1. Cytokinin and Topsin M transplant treatment evaluation.

	Total Yield	Jumbos	Mediums
		(lbs/plot)	
Treated	132.7	109.3	3.6
Untreated	122.1	103	3
CV	11%	16%	67%
LSD(p=.05)	NS	NS	NS

Table 2. Evaluation of cytokinin effects on onion storage.

Code	Initiation Date	Pre-Storage Wt (lbs)	Post-Storage Wt (lbs)	Code	Initiation Date	Pre-Storage Wt (lbs)	Post-Storage Wt (lbs)
BU1	5/8/2006	47.8	46.6	BT1	5/8/2006	45.2	44.2
BU2	5/8/2006	51.4	50	BT2	5/8/2006	46.4	45.2
BU3	5/8/2006	47.8	46.8	BT3	5/8/2006	49.6	48.4

INFLUENCE OF EARLY SEASON FERTILITY REGIMES ON VIRALLY INFECTED TRANSPLANTS

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Introduction

Iris Yellow Spot Virus (IYSV) and Tomato Spotted Wilt Virus (TSWV) have been detected in onion plant beds around the Vidalia onion growing region. There is concern over the effect these pathogens will have on plant growth and stand development. The development of these pathogens may be influenced by plant stress fertilizer application and timing. A study was developed to determine the effect fertilizer timing has on virus infected onion plants.

Materials and Methods

Two different plant beds under the same fertility program were given different levels of virus infection. Sweet Vidalia plants from Dowdy Farm were first tested on 13th October, 2005. These plants were 90% positive for TSWV and 4% positive for IYSV. Sweet Vidalia plants from Joe Rogers' Farm were first tested on 7th November, 2005, and were 100% positive for TSWV and 30% positive for IYSV. These same plant beds were sampled again on 30th November, 2005. The Dowdy Farm plants had 9% TSWV and 9% IYSV and the Joe Rogers' Farm plants had 55% TSWV and 18% IYSV. On those occasions they were identified as having a low virus infection and a high virus infection, respectively.

Plots of these plants were transplanted on 28th November, 2005. Four replications of six fertility treatments for each viral infection level were established at the Vidalia Onion and Vegetable Research Center (Table 1). Two of the treatments on each plant source included preplant fertilization just prior to planting with 400 lb/acre of 5-10-15. The other four treatments had no preplant fertilizer, only 150 lb/acre of diammonium phosphate (DAP, 18-46-0) at various weekly intervals. DAP was applied either at planting, 7 days after planting, 14 days after planting or 21 days after planting. Treatment six received both the preplant 5-10-15 and the DAP at 14 days. It should be noted that the remainder of the fertility program was as given in Table 1a.

On 7th March, 2006, leaf samples from each plot were collected and tested for IYSV and TSWV by enzyme linked immunoabsorbant assay (ELISA). This test relies on a color change, which is measured by light absorbance (Table 2).

Results and Discussion

Climatical conditions were favorable for plant growth in as temperatures remained mild throughout the early part of the growing season. There were no differences in stand establishment based upon plant source or the fertility treatments yet there were visible differences in growth, (Figure 1, taken 9th January, 2006) and these growth differences translated into yield variations as shown in Table 1.

There was a statistical difference in total yield between treatments 1,5,7,11 and the other fertility regimes. This study shows that preplant fertilizer applications are not vital to early season growth or yield where 150 lb/acre 18-46-0 is being applied within 14 days of transplanting.

In the plots where no preplant fertilizer was used, the total N-P-K for the season was only 113-117-72.. Being able to maintain industry standard yields with lower fertilization is important for improved fertilizer use efficiency and profitability.

There was no difference in virus infection for either IYSV or TSWV based on fertility treatment (Table 2). There was no difference between farms for IYSV, but there was a difference for TSWV with the Dowdy Farm plants having a significantly higher absorbance reading. This contradicts the earlier evaluations where the Dowdy Farm had 90% and then 9% TSWV infection compared with the Joe Rogers' Farm plants with 100% and 55% infection (Table 2).

Efficient transmission of IYSV has been primarily associated with onion thrips rather than Western flower thrips. Interestingly, onion thrips are rare in the Vidalia onion growing region compared with Western flower thrips (Kritzman et al., 2001, Mullis et al., 2004). This may partially explain why IYSV has been a relatively unimportant disease in the Vidalia region up to 2006. In many Western regions of the U.S. this disease has been devastating on maturing crops and seed crops (Creamer et al., 2004, Crowe and Pappu, 2005, Toit et al., 2004). The classic symptoms of diamond shaped lesions have not been observed in the Vidalia region.

Widespread differences in detection percentages for IYSV and TSWV may be a result of the apparent sequestering of the virus in onion tissue (unpublished data). When leaves are sectioned and each section is tested for these viruses each section may result in a different reading. This brings into question the reliability of single leaf testing as a means of assessing virus disease status in the Vidalia region.

Along with reporting absorbance readings, a positive threshold for the tested viruses was determined. For IYSV this threshold was equal to or higher than 0.101 and for TSWV it is 0.115. Using this threshold for IYSV, only the preplant 5-10-15 with DAP at 14 days had an absorbance value above this value. Considering TSWV, treatments of DAP at 21 days with the Dowdy Farm plants and DAP at 14 and 21 days with the Joe Rogers Farm plants showed results below the threshold. Preplant applications of 5-10-15 with DAP at 14 days on Joe Rogers Farm plants were also below this threshold for TSWV. In light of the high variability in virus testing it is unclear if these results have any meaning.

Summary and Conclusions

Since the discovery of these viruses is recent in theVidalia region, it is difficult to assess their impact. The high variability in testing of results from different locations, times and tissue make this understanding even more difficult.

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Table 1. Effect of plant source and fertilizer treatment on onion yield.

Source	Treatment Number	Fertilizer	Total Yield	Jumbos (50-lb bags/acre)	Med.
Dowdy	1	Preplant at planting 400 lbs 5-10-15	1064	736	3
	2	DAP at planting	1169	933	3
	3	DAP 7 days after planting	1183	954	3
	4	DAP 14 days after planting	1112	869	4
	5	DAP 21 days after planting	1073	864	8
	6	Preplant 400 lbs 5-10-15 + 14 days DAP	1168	942	1
Joe Rogers	7	Preplant at planting 400 lbs 5-10-15	1086	777	6
	8	DAP at planting	1185	895	2
	9	DAP 7 days after planting	1200	998	2
	10	DAP 14 days after planting	1198	892	1
	11	DAP 21 days after planting	1097	856	4
	12	Preplant 400 lbs 5-10-15 + 14 days DAP	1164	949	2
		CV	6%	12%	95%
		LSD (p=0.05)	95	153	NS

Table 1a. Remainder of the fertility program in association with the treatments.

200lb/acre 6-12-18	6th, January, 2006.
200lb/acre 6-12-18	17th, January, 2006.
200lb/acre Ca $(NO_3)_2$	1st, February, 2006.
200lb/acre Ca $(NO_3)_2$	15th, February, 2006.

Table 2. Evaluation of virus screen with ELISA.

					Absorbance			
					Fertility		Farm	
Source	Date	IYSV Infected (%)	TSWV Infected (%)	Fertility	IYSV	TSWV	IYSV	TSWV
Dowdy Farm	10/13/05	4	90	Preplant at planting 400 lbs 5-10-15	0.014	0.912	0.035	0.431
	11/30/05	9	9	DAP at planting	0.017	0.618		
				DAP 7 days after planting	0.041	0.204		
				DAP 14 days after planting	0.004	0.650		
				DAP 21 days after planting	0.018	0.033		
				Preplant 400 lbs 5-10-15 + at 14 days DAP	0.117	0.167		
Joe Rogers	11/7/05	30	100	Preplant at planting 400 lbs 5-10-15	0.002	0.352	0.011	0.107
	11/30/05	18	55	DAP at planting	0.003	0.041		
				DAP 7 days after planting	0.003	0.246		
				DAP 14 days after planting	0.022	0.002		
				DAP 21 days after planting	0.032	0.001		
				Preplant 400 lbs 5-10-15 + at 14 days DAP	0.003	0.001		
				Probabilities				
				Farm			0.257	0.043
				Fertility	0.736	0.197		
				Farm x Fertility	0.510	0.638		

Figure 1. Plot differences due to early fertilizer treatment on onion transplants (9 Jan. 2006).