

ONION SPACING EFFECT ON YIELD

*G.E. Boyhan, Reid Torrance, Chris Hopkins, Cliff Riner,
Randy Hill, Thad Paulk
University of Georgia
Department of Horticulture
East Georgia Extension Center
PO Box 8112, GSU
Statesboro, GA 30460
gboyhan@uga.edu*

Plant populations of 150,000 or more are reported in for some production regions with concomitant increases in yield (Oregon, 2004; Voss and Mayberry, 1999). Many regions in the western U.S. use larger equipment with wheel spacings up to 88 in. In southeast Georgia most tractors have wheel spacings of 72 in. This in and of itself will reduce the potential plant populations per acre. Within the confines of this equipment limitation, we decided to investigate the possibility of increasing plant densities to improve yields. Although the environment in southeast Georgia can be very wet with increased incidence of disease and crowded plants may be more susceptible to disease, the advent of some newer fungicides may help alleviate some of these potential problems. The purpose of these experiments was to investigate the effect of plant spacing on yield.

Methods

Varieties Century and Sapelo Sweet were transplanted on 6 Dec 2004 to the various plant spacings with an experimental design of a randomized complete block design (RCBD) with four replications. Each experimental unit was a 20 ft long bed planted to the various spacings.

The standard spacing for onions at the Vidalia Farm is to plant four rows on beds prepared on 6-ft centers between adjacent beds with a between-row spacing of 12 in. and an in-row spacing of 5.5 in. A high density planting with between row spacing of 6 in. and in-row spacing of 5.5 in. was another treatment spacing. Two low density plantings were also included. One had 12 in. between rows with 11 in. in-row spacing. The second low density planting had 5.5 in. in-row spacing and a 24 in. between row spacing.

Variety Sapelo Sweet at these various plant spacings was harvested on 11 May 2005, while 'Century' was harvested on 19 May 2005. Field or total weights were recorded immediately upon harvest and graded weights were recorded about one week later after curing. The graded sizes were jumbo (≥ 3 in.) and mediums (≥ 2 in. and < 3 in.).

In the 2005-06 season 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 29 Nov. 2005. In addition to these three varieties there were normal and high density plant spacings and normal and high fertility levels in this experiment.

Plants were transplanted onto beds formed 6-ft on center. In the normal plant spacing, four rows were planted on these beds with in-row spacing of 5.5 in. and between-row spacing of 12 in. The high density planting had seven rows an in-row spacing of 5.5 in. and a between-row spacing of 6 in.

The final factor evaluated was fertility level. The normal fertility consisted of 400 lbs/acre of 5-10-15 applied on 14 Nov. 2005, 150 lbs/acre 18-46-0 applied on 20 Dec. 2005, 200 lbs/acre of 6-12-18 applied on 6 Jan. 2006 and 17 Jan. 2006, and 200 lbs/acre of 15.5-0-0 applied on 1 Feb. 2006 and 15 Feb. 2006. This resulted in 133-157-132 of N-P-K. The high fertility treatment followed this program with the addition of 323 lbs/acre of 15.5-0-0, which resulted in 183-157-132 of N-P-K.

These 12 treatments were arranged in a randomized complete block design with four replications. Each experimental unit or plot was 20 ft. long. Plots were separated by in-row, 5 ft. alleys. Variety WI-131 was harvested on 10 April 2006 while Sweet Vidalia and Georgia Boy were harvested on 24 April 2006. Total or 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 and medium yields were recorded. Jumbo yields were onions ≥ 3 in. and medium yields consisted of onions ≥ 2 in and < 3 in.

Results and Discussion

In 2005, the highest yielding treatment for field or total yield was 1,245 50-lb bags/acre with 'Century' at the high density planting (Table 1). This represents over a 90% increase over either of the low-density plantings for 'Century', but represents only a 24% increase from the standard planting density for this variety.

For 'Sapelo Sweet' the high density planting represents more than a 44% increase over either of the low-density plantings for field yield. The high density planting, however, represents only a 4% increase over the standard planting density for this variety.

The highest jumbo yield for 'Century' was 847 50-lb bags/acre, which was significantly higher than the standard spacing for this variety with 678 50-lb bags/acre. In addition, jumbo yields for both low-density plantings of 'Century' were significantly lower than either the high density or standard density plantings for this variety.

The highest jumbo yield for 'Sapelo Sweet' was with the standard planting density with a yield of 664 50-lb bags/acre. This, however, was not significantly greater than the high density planting or the low density planting with 11 in. in-row spacing.

The highest yield of medium onions was with the high-density plantings. The high density 'Century' planting was significantly greater than the other planting densities for this variety. In addition, the high density planting of 'Sapelo Sweet' with 232 50-lb bags/acre was significantly higher than the other planting densities for this variety.

In 2005-2006, the highest total yield of WI-131 was with the high fertility and high density spacing with 1,366 50-lb bags/acre, but this did not differ significantly from the high density spacing and normal fertility (Table 2). It did, however, differ from WI-131 at the normal density spacings regardless of fertility. Sweet Vidalia total yield results were similar. For Georgia Boy, the high density spacing and high fertility was significantly greater than the other treatments for Georgia Boy.

Jumbo yields for WI-131 were greatest with the high density planting and high fertility, which was significantly greater than the normal spacing regardless of fertility. For Sweet Vidalia jumbo yields there were no differences based on spacing or fertility. With Georgia Boy, there were no differences in jumbo yields.

The high density plantings either in 2004-2005 or 2005-2006 never reached an increase in yield that matched the increase in number of plants. The increase in plant

population was 75% for the high density plantings compared to the standard density. This was the case even in the 2005-2006 season with treatments that had additional fertilizer. Substantially increasing yield to mirror some of the yields in other regions probably requires the use of larger equipment and reconfiguring the entire planting scheme. Although we plan on repeating this experiment one more year, it is becoming clear that increasing yields comparable to the increase in plant populations is probably not possible within the confines of our equipment limitations.

Citations

Oregon, S.U. 2004. Dry Bulb Onions - Eastern Oregon. October 23, 2006.
<<http://oregonstate.edu/Dept/NWREC/onionb-e.html>>.

Voss, R.E. and K.S. Mayberry. 1999. Fresh-market bulb onion production in California. Vegetable Production Series. Publication 7242.

Table 1. Effect on yield with various onion spacings with two varieties, 2004-2005 season.

Treatment ^z	Total yield	Jumbos (50-lbs bags/acre)	Mediums
LD1 Century	630	340	13
LD2 Century	667	470	11
HD Century	1,245	847	95
Std Century	1,005	678	29
LD1 Sapelo Sweet	637	514	21
LD2 Sapelo Sweet	583	460	36
HD Sapelo Sweet	917	534	232
Std Sapelo Sweet	883	664	104
CV	22%	20%	53%
LSD (p=0.05)	263	167	52

^zStd: 12 inch between row and 5.5 in. in-row

HD: 6 inch between row and 5.5 in. in-row

LD1: 12 in. between row and 11 in. in-row

LD2: 24 in. between row and 5.5 in. in-row

Table 2. Effect of variety, spacing, and fertility on onion yield (2005-2006).

Variety	Spacing ^z	Fertility ^y	Harvest Date	Total Yield	Jumbo	Medium	Marketable	Percent of Normal		
				50-lb bags/acre			(%)	Total	Jumbo	Medium
WI-131	Normal	Normal	4/10/06	1,055	641	17	62%	-	-	-
WI-131	Normal	High	4/10/06	1,037	673	13	66%	-2%	5%	-24%
WI-131	High	Normal	4/10/06	1,305	769	66	64%	24%	20%	293%
WI-131	High	High	4/10/06	1,366	914	78	73%	29%	43%	370%
Sweet Vidalia	Normal	Normal	4/24/06	1,102	721	4	66%	-	-	-
Sweet Vidalia	Normal	High	4/24/06	1,071	692	10	66%	-3%	-4%	145%
Sweet Vidalia	High	Normal	4/24/06	1,306	800	76	67%	18%	11%	1800%
Sweet Vidalia	High	High	4/24/06	1,290	796	62	67%	17%	10%	1464%
Georgia Boy	Normal	Normal	4/24/06	1,032	678	8	66%	-	-	-
Georgia Boy	Normal	High	4/24/06	1,083	734	8	69%	5%	8%	0%
Georgia Boy	High	Normal	4/24/06	1,197	827	28	72%	16%	22%	271%
Georgia Boy	High	High	4/24/06	1,420	820	57	62%	38%	21%	648%
CV				12%	14%	60%				
LSD (p=0.05)				205	157	31				

^zNormal spacing: 5.5 in. in-row and 12 in. between-row, high spacing: 5.5 in-row and 6 in. between-row.

^yNormal fertility: 133N-157P-132K, high fertility: 183N-157P-132K.