ONION PRODUCTION FROM TRANSPLANTS

Clint Shock, Erik Feibert, and Lamont Saunders
Malheur Experiment Station
Oregon State University
Ontario, OR, 2006

Introduction

Increased interest in an earlier start for the onion harvest season has led to interest in transplanting. Our earlier research showed that onions can be harvested in July when grown from transplants started in the winter in a greenhouse (Shock et al. 2004). Transplants must be grown locally, required by the local onion white rot quarantine that prohibits importation of onion transplants from areas outside the Treasure Valley. Onion transplant production in the Treasure Valley is expensive due to the need for heated greenhouses during the winter.

In order to make early onion production from transplants cost effective, we hypothesized that transplants might be produced by growing them outdoors in late summer at a high density and transplanting them either in the fall or in March. This trial tested seven varieties grown from overwintering transplants. This trial also tested two long-season varieties grown from transplants started in the winter in a greenhouse. In addition, a small number of 'Vaquero' transplants were grown from unheated "low tunnel" cold frames and these transplants were planted along with the other varieties.

Materials and Methods

The transplants were grown from seed in a field of Greenleaf silt loam during the fall and winter of 2005-2006. Onion seed of seven overwintering varieties was planted in plots four double rows wide and 27 ft long on August 29, 2005. Seed was planted in double rows spaced 3 inches apart at 21 seeds/ft of single row. Each double row was planted on beds spaced 22 inches apart with a customized planter using John Deere Flexi Planter units equipped with disc openers. The field was furrow irrigated as necessary. Emergence started on September 6.

Repeated insecticide and herbicide applications were needed to control thrips and weeds. Poast® at 0.19 lb ai/acre was applied in 40 gal/acre of water on September 6. On September 8, the onions were sprayed with Malathion® at 1 lb ai/acre. On September 13, the onions were sprayed with Prowl® at 1.5 lb ai/acre and Warrior® at 0.03 lb ai/acre. On September 22 and September 30, the onions were sprayed with a tank mix of Warrior at 0.03 lb ai/acre and Malathion at 1 lb ai/acre. On October 10, Buctril® at 0.12 lb ai/acre and Select® at 0.25 lb ai/acre were applied to control weeds. On October 18, 50 lb N/acre were applied as water run uran. Due to unusually wet weather during the fall of 2005, fall transplanting was not possible.

Onion seed of long day varieties Vaquero and 'Ranchero' (Nunhems, Parma, ID) was planted in flats with a vacuum seeder at 72 seeds/flat on January 17, 2006. The seed was sowed on a 1-inch layer of Sunshine® (Sun Gro Horticulture, Canada, LTD) general purpose potting mix. The seed was then covered with 1 inch of potting mix. The flats were watered immediately after planting and were kept moist until emergence on February 1. The onion seedlings were grown in a heated greenhouse (65°F day, 45°F night air temperatures) until transplanting.

On April 11 and 12 the field- and greenhouse-grown seedlings were transplanted to a field of Nyssa-Malheur silt loam, 3 weeks later than planned. The seedlings were manually dug and planted in double rows on 22-inch beds. The spacing between plants in each single row was 6 inches (every 3 inches in the double row), equivalent to 95,000 plants per acre. Plots of each variety were 20 ft long by four double rows wide arranged in a randomized complete block design with five replicates. A limited number of Vaquero transplants grown by Bob Simerly in an unheated low tunnel cold frame were transplanted on April 17 into one plot.

The field was drip irrigated using drip tapes buried at 4-inch depth between the double onion rows. Thereafter the trial was irrigated when the soil water tension at 8-inch depth reached 20 cb (1 cb = 1 kPa). Soil water tension was monitored by six granular matrix sensors (GMS, Watermark Soil Moisture Sensors Model 200SS, Irrometer Co., Riverside, CA) installed below the onion row at 8-inch depth.

Weeds were controlled with an application of Prowl at 1 lb ai/acre on April 14, and Goal® at 0.2 lb ai/acre, Buctril at 0.3 lb ai/acre, and Select at 0.25 lb ai/acre on May 30. The field had 50 lb N/acre injected through the drip system as urea ammonium nitrate solution on April 17 and May 2, and 25 lb N/acre injected on June 2. The field was sprayed with Aza-Direct® at 0.025 lb ai/acre and Success® at 0.19 lb ai/acre on June 1 and June 9.

On July 19, August 3, and August 30, 6.5 ft of the middle two rows in each plot were topped and bagged. Decomposed bulbs were not bagged. Following each harvest the onions were graded. Bulbs were separated according to quality: bulbs without blemishes (No. 1s), split bulbs (No. 2s), bulbs infected with neck rot (*Botrytis allii*) in the neck or side, plate rot (*Fusarium oxysporum*), or black mold (*Aspergillus niger*). The No. 1 bulbs were graded according to diameter: small (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and supercolossal (>4¼ inches). Bulb counts per 50 lb of supercolossal onions were determined for each plot of every variety by weighing and counting all supercolossal bulbs during grading.

Ten randomly chosen bulbs from every plot of the seven highest yielding varieties from the July 19 harvest were shipped on July 20 via UPS ground to Vidalia Labs International in Collins, Georgia. The bulb samples were analyzed for pyruvic acid content on August 3. Bulb pyruvic acid content is a measure of pungency with the unit being micro mols pyruvic acid per gram of fresh weight. Onion bulbs having a pyruvate

concentration of 5.5 micromols or less are considered sweet according to Vidalia Labs sweet onion certification specifications.

Onion bulbs from all harvests were rated for single centers. Twenty-five consecutive onions ranging in diameter from 3.5 to 4.25 inches from each plot were rated. The onions were cut equatorially through the bulb middle and, if multiple centered, the long axis of the inside diameter of the first single ring was measured. These multiple-centered onions were ranked according to the diameter of the first single ring: "small double" had diameters less than 1½ inch, "intermediate double" had diameters from 1½ to 2¼ inches, and "blowout" had diameters over 2¼ inches. Single-centered onions were classed as a "bullet". Onions were considered "functionally single centered" for processing if they were a "bullet" or "small double".

Varietal differences were compared using ANOVA and protected least significant differences at the 5 percent probability level, LSD (0.05).

Results and Discussion

Field-grown onions for transplants grew poorly in the fall of 2005, possibly due to cool weather in October. It was our intention to transplant onions in October of 2005 as well as March of 2006, but poor onion plant growth and rainy weather in October of 2005 did not allow field operations or fall transplanting. The weather in the spring was initially cooler than average in March and April, but was warmer than average in May and June. March had 61 percent fewer and April had 14 percent fewer growing degree days (50 to 86°F) than the 19-year average.

July 19 harvest

The overwintering varieties, grown from overwintering transplants, matured early, with most varieties being close to full maturity on July 19. Varieties 'Electric', 'Stanza', and 'XON-533Y' were less mature, but had ceased leaf growth by July 19 and were harvested along with the other overwintering varieties. Of the overwintering varieties, Stanza, Electric, and XON-533Y had among the highest total yield and jumbo bulb yield (Table 1).

The long-season varieties, grown from greenhouse transplants, had substantially higher total, colossal, and jumbo onion yields than the overwintering varieties. The long-season varieties showed vigorous leaf and bulb growth through the last harvest on August 30.

Varieties 'Olympic', XON-533Y, and Ranchero had pyruvate concentration low enough (5.5 or less) to be considered "sweet" according to Vidalia Labs sweet onion certification specifications (Table 3). Vaquero and Ranchero had the highest percentage of 'bullet' single-centered bulbs and functionally single-centered bulbs.

August 3 and August 30 harvests

Colossal onion yield for Vaquero and Ranchero was about double on August 3 compared to July 19 (Table 1, Fig. 1). Colossal onion yield more than doubled between August 3 and August 30. Vaquero yielded 59 cwt/acre and Ranchero yielded 87 cwt/acre of supercolossal onions on August 30. Vaquero had a higher percentage of bullet single-centered bulbs than Ranchero on August 30. Both varieties had higher than 70 percent bullet single-centered bulbs on all three harvest dates.

The low tunnel cold frame transplants of Vaquero had substantially lower yield and size than the heated greenhouse transplants on all harvest dates, but had similar single centeredness (Tables 2 and 4). Statistical comparisons were not possible since this treatment was not replicated.

References

Shock, C.C., E. B. G. Feibert, and L.D. Saunders. 2004. Onion production from transplants in the Treasure Valley. Oregon State University Agricultural Experiment Station Special Report 1055:47-52.

Table 1. Performance data for experimental and commercial onion varieties produced from field grown and greenhouse grown transplants from three harvest dates, Malheur Experiment Station, Oregon State University, Ontario, OR.

		Total yield	Marketable yield by grade					Bulb counts			Maturity	Bolters
Company	Variety		Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	>4¼ in	No. 2s	Small		
		cwt/acre						#/50 lb	- cwt/acre -		%	#/plot
July 19												
A. Takii	Hi Keeper	208.6	11.3	0.0	0.0	0.0	11.3	-	0.0	197.3	80.0	0.0
	T-420	208.0	9.2	0.0	0.0	0.0	9.2	-	0.0	198.8	86.0	0.0
	T-440	145.0	1.1	0.0	0.0	0.0	1.1	-	0.0	144.0	86.0	0.0
Bejo	Electric	523.0	306.8	0.0	0.0	54.8	252.0	-	1.1	216.3	9.0	0.0
	Olympic	192.3	6.4	0.0	0.0	0.0	6.4	-	0.0	185.9	66.0	0.0
	Stansa	642.9	426.6	0.0	0.0	36.1	390.4	-	0.3	216.3	22.0	0.0
Sakata	XON-533Y	453.9	298.5	0.0	0.0	72.3	226.2	-	3.8	155.4	7.5	0.0
Nunhems	Vaquero	617.7	611.8	0.0	73.1	473.1	65.6	-	0.0	5.9	0.0	0.0
	Ranchero	579.8	560.5	0.0	42.5	439.4	78.7	-	0.0	19.3	0.0	0.0
LSD (0.05)		116.7	140.4	-	32.6	91.1	108.0		NS	52.0	7.5	-
August 3												
Nunhems	Vaquero	754.6	751.1	0.0	122.1	597.9	31.0	-	7.4	3.5	10.0	0.0
	Ranchero	693.3	690.5	0.0	132.7	514.6	43.2	-	4.8	2.8	10.0	0.0
LSD (0.05)		NS	NS	-	NS	NS	NS		NS	NS	NS	
August 30												
Nunhems	Vaquero	960.3	945.2	59.3	381.4	474.2	30.4	28.7	0.0	15.1	50.0	13.5
	Ranchero	957.5	944.0	87.3	351.8	477.9	27.0	26.4	8.6	13.5	50.0	17.1
LSD (0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Performance data for 'Vaquero' onions produced from transplants grown in a heated greenhouse and in an unheated low tunnel cold frame from three harvest dates, Malheur Experiment Station, Oregon State University, Ontario, OR.

Company	Variety	Total yield	Marketable yield by grade					Bulb counts			Maturity	Bolters
			Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	>4¼ in	No. 2s	Small		
		cwt/acre						#/50 lb	- cwt/acre -		%	#/plot
July 19												
Nunhems	Vaquero	617.7	611.8	0.0	73.1	473.1	65.6	-	0.0	5.9	0.0	0.0
	Vaquero[a]	376.4	333.7	0.0	0.0	191.0	142.7		0.0	42.7	0.0	0.0
August 3												
Nunhems	Vaquero	754.6	751.1	0.0	122.1	597.9	31.0	-	7.4	3.5	10.0	0.0
	Vaquero[a]	412.3	398.2	0.0	0.0	335.3	62.9			14.1	10.0	0.0
August 30												
Nunhems	Vaquero	960.3	945.2	59.3	381.4	474.2	30.4	28.7	0.0	15.1	50.0	13.5
	Vaquero[a]	573.8	523.9	0.0	0.0	449.1	74.8		0.0	49.9	50.0	0.0

[a]Transplants grown in a low tunnel cold frame, unreplicated data.

Table 3. Pyruvate concentrations and multiple center rating for selected onion varieties produced from field grown and greenhouse grown transplants from three harvest dates, Malheur Experiment Station, Oregon State University, Ontario, OR.

Company	Variety	Multiple center			Bullet	Functionally single centered[a]	Pyruvate concentration
		Blowout	Intermediate double	Small double			
		%					µmoles/g FW
July 19							
A. Takii	Hi Keeper	na[b]	na	na	na	na	
	T-420	na	na	na	na	na	6.2
	T-440	na	na	na	na	na	6.1
Bejo	Electric	83.2	12.8	4.0	0.0	4.0	
	Olympic	na	na	na	na	na	5.0
	Stansa	81.0	11.1	7.1	0.8	7.9	5.8
Sakata	XON-533Y	79.0	8.0	10.0	3.0	13.0	4.9
Nunhems	Vaquero	1.3	2.7	4.0	92.0	96.0	5.6
	Ranchero	0.0	1.6	13.6	84.8	98.4	5.4
LSD (0.05)		18.1	NS	NS	9.7	13.6	NS
August 3							
Nunhems	Vaquero	1.3	8.0	10.7	80.0	91.0	
	Ranchero	0.8	7.2	15.2	76.8	92.0	
LSD (0.05)		NS	NS	NS	NS	NS	
August 30							
Nunhems	Vaquero	0.0	4.0	1.3	94.7	96.0	
	Ranchero	0.0	7.0	5.0	88.0	93.0	
LSD (0.05)		NS	NS	NS	5.0	NS	

[a]Bullet + small double.

[b]Not available, because none of the bulbs had adequate size to evaluate for single centers.

Table 4. Multiple center rating for 'Vaquero' onions produced from transplants grown in a heated greenhouse and in an unheated low tunnel cold frame from three harvest dates, Malheur Experiment Station, Oregon State University, Ontario, OR.

Company	Variety	Multiple center			Bullet	Functionally single centered[a]
		Blowout	Intermediate double	Small double		
		%				
		July 19				
Nunhems	Vaquero	1.3	2.7	4.0	92.0	96.0
	Vaquero[b]	0.0	0.0	0.0	100.0	100.0
		August 3				
Nunhems	Vaquero	1.3	8.0	10.7	80.0	91.0
	Vaquero[b]	0.0	8.0	8.0	84.0	92.0
		August 30				
Nunhems	Vaquero	0.0	4.0	1.3	94.7	96.0
	Vaquero[b]	0.0	0.0	16.0	84.0	100.0

[a]Bullet + small double.
[b]Transplants grown in a low tunnel cold frame, unreplicated data.

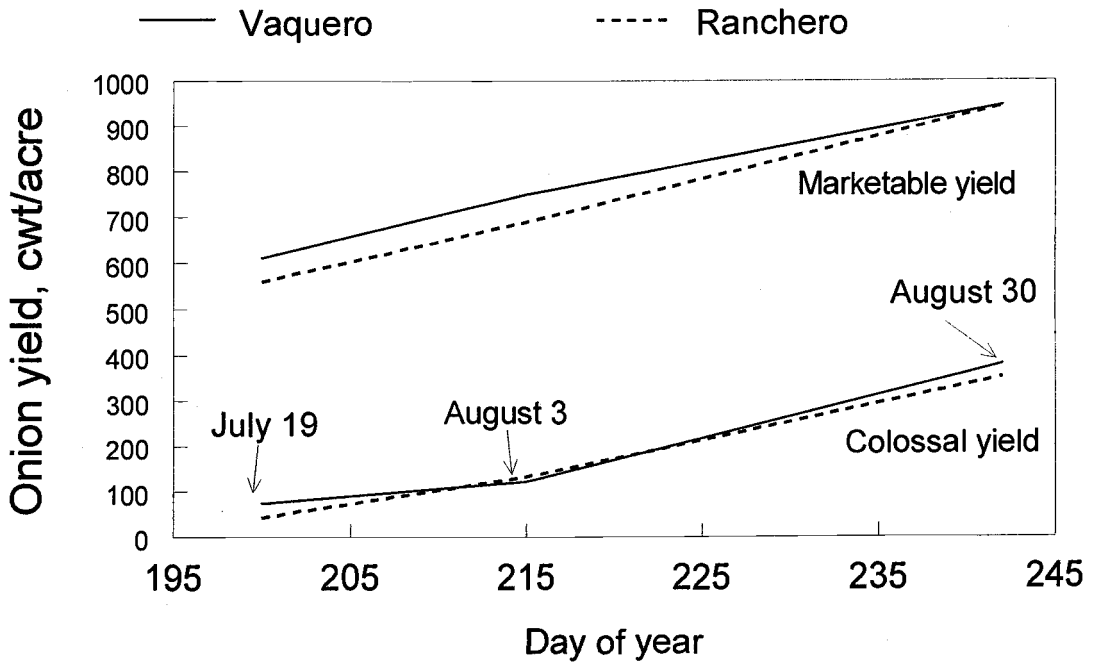

Figure 1. Onion yield at three harvests for two varieties grown from heated greenhouse transplants. Malheur Experiment Station, Oregon State University, Ontario, OR.