ONION PRODUCTION FROM TRANSPLANTS

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

Bob Simerly,McCain Foods,Fruitland, ID

Introduction

Increased interest in an earlier start for the onion harvest season has led to interest in transplanting onions. 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, 2007, 2008, 2009). This trial evaluated the performance of 12 onion varieties grown from transplants brought in from Arizona.

Materials and Methods

The onions were grown on a Greenleaf silt loam previously planted to wheat. In the fall of 2009, prior to planting, the wheat stubble was shredded and the field was irrigated and disked. A soil sample taken in the fall of 2009 showed: pH 7.8, organic matter 1.6 percent, 29 ppm phosphorus (P), 379 ppm potassium (K), 19 ppm sulfate (SO_4), 2,442 ppm calcium (Ca), 556 ppm magnesium (Mg), 60 ppm sodium (Na), 2.6 ppm zinc (Zn), 1.4 ppm copper (Cu), 6 ppm maganese (Mn), 10 ppm iron (Fe), and 0.9 ppm boron (B). Soil analysis indicated the need for 100 lb phosphate (P_2O_5)/acre, 24 lb sulfur (S)/acre, 2 lb Mn/acre, 4 lb Zn/acre, and 1 lb B/acre. These nutrients were broadcast in the fall of 2009 after disking. The field was then moldboard-plowed, groundhogged, roller-harrowed, and bedded at 22 inches. The field was not fumigated due to a shortage of product.

Transplants of 12 varieties were grown in Arizona during the winter of 2009-2010. In addition to the transplants grown in Arizona, transplants of variety 'Ranchero' were also grown in a heated greenhouse (65°F day, 45°F night air temperatures) at Ontario, Oregon. Onion seed of Ranchero was planted in flats with a vacuum seeder at 72 seeds/flat on January 22, 2009. The seed was sowed on a 1-inch layer of Sunshine 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. Onion seedlings began emerging on February 8.

On April 2, the plants from the Ontario greenhouse and from Arizona were transplanted to a field of Greenleaf silt loam at the Malheur Experiment Station in Ontario, Oregon. The seedlings were planted in 2 rows spaced 3 inches apart on 22-inch beds. The spacing between plants in each row was 6 inches (every 3 inches in the double row), equivalent to 95,000 plants per acre. Plots of each treatment were 20 ft long by 4 double rows wide arranged in a randomized complete block design with 5 replicates.

Drip tape was laid at 4-inch depth between 2 onion beds at the same time as planting. The drip tape had emitters spaced 12 inches apart and an emitter flow rate of 0.22 gal/min/100 ft (T-tape, T-systems International, San Diego, CA). The distance between the tape and the center of each double row of onions was 11 inches.

The onions were managed to avoid yield reductions from weeds, pests, diseases, water stress, and nutrient deficiencies. On April 9, Prowl® at 2 pt/acre and Select® at 10 oz/acre were broadcast for weed control. On May 14, Goal® at 10 oz/acre, Buctril® at 12 oz/acre, and Select at 10 oz/acre were broadcast for weed control. Lannate® at 48 oz/acre and Movento® at 5 oz/acre were applied on May 25 for thrips control. On June 7, Dithane® at 3 lb/acre for fungus control and Movento at 5 oz/acre were applied. On May 25, uran (urea ammonium nitrate solution) at 50 lb N/acre was injected through the drip tape.

The field was irrigated as necessary to maintain soil water tension at 20 cb at 8-inch depth. Soil water tension was monitored by six granular matrix sensors (GMS, Watermark Soil Moisture Sensors Model 200SS, Irrometer Co. Inc., Riverside, CA) centered at 8-inch depth below the onion row. The sensors were automatically read three times a day with an AM-400 meter (Mike Hansen Co., East Wenatchee, WA).

On July 19, July 26, and August 3, 6.7 ft of the middle 2 rows in each plot were topped and bagged. Decomposing bulbs were not bagged. At each harvest, the onions in each plot were visually rated for the percentage of tops that were down and the percent leaf dryness. The number of bolted onions in each plot were also counted. 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.

Onion bulbs from all harvests were rated for single centers. Twenty-five 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” had diameters under 1.5 inch, “medium” had diameters from 1.5 to 2.25 inches, and “large” had diameters over 2.25 inches. Onions were considered “functionally single centered” for processing if they were single centered or had a small multiple center.

After grading, a sample of approximately 100 No. 1 jumbo bulbs of each variety was placed in crates and stored in a shed at ambient temperature for 2 weeks. After 2 weeks the samples were evaluated for the number of sprouted or decomposed bulbs.

Treatment differences were compared using repeated measures analysis of variance. Means separation was determined using Fisher’s least significant difference test at the 5 percent probability level, LSD (0.05). Increases in yield over time were evaluated by regression.

Results and Discussion

Marketable yield increased with harvest date (Table 1, Fig. 1).

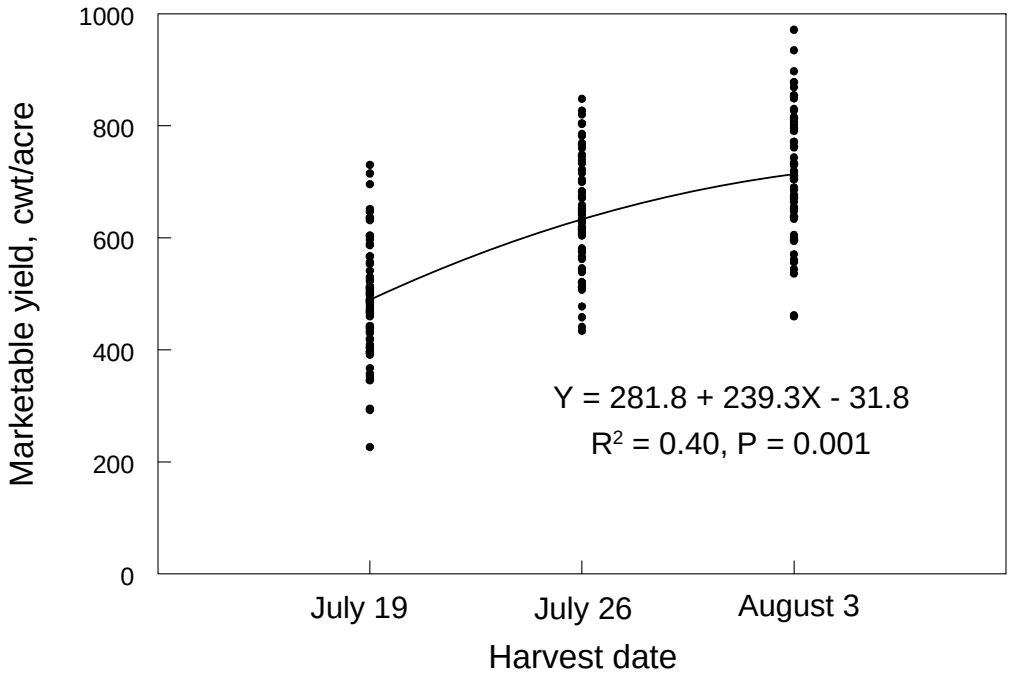

Figure 1. Marketable yield over 3 harvest dates averaged over 12 varieties of onions produced from transplants. Malheur Experiment Station, Oregon State University, Ontario, OR, 2010.

July 19 Harvest

All varieties had less than 10 percent tops down (Table 3). 'Exacta', 'NUN4003', and 'NUN4004' were among the varieties with the highest colossal yield (Table 1). NUN4004, 'Crocket', and NUN4003 were among the varieties with the highest jumbo yield. Only NUN4004 and Exacta had less than 10 percent sprouted or decomposed bulbs 2 weeks after harvest (Table 3).

July 26 Harvest

Only Exacta and NUN4003 had more than 10 percent tops down. Exacta had the highest supercolossal and colossal yield followed by NUN4003. Exacta, 'Barbaro', NUN4003, Crocket, and 'Swale' had less than 10 percent of sprouted or decomposed bulbs 2 weeks after harvest.

August 3 Harvest

All varieties had more than 20 percent tops down with Exacta having more than 60 percent tops down. Exacta had the highest supercolossal yield followed by NUN4003 and 'Valero'. Exacta and NUN4003 had the highest colossal yield followed by NUN4004, Barbaro, 'Arcero', and Swale. Exacta and NUN4004 had less than 5 percent of sprouted and decomposed bulbs 2

weeks after harvest. Numerous varieties had less than 10 percent of sprouted and decomposed bulbs 2 weeks after harvest (Table 3).

Single Centers

All varieties had more than 80 percent single-centered bulbs on all three harvest dates (Table 2).

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.

Shock, C.C., E.B.G. Feibert, and L.D. Saunders. 2007. Onion production from transplants. Oregon State University Agricultural Experiment Station Special Report 1075:45-50.

Shock, C.C., E.B.G. Feibert, and L.D. Saunders. 2008. Onion production from transplants grown in a low tunnel cold frame and in a greenhouse. Oregon State University Agricultural Experiment Station Special Report 1087:26-33.

Shock, C.C., E.B.G. Feibert, and L.D. Saunders. 2009. Onion production from transplants grown in a low tunnel cold frame and in a greenhouse. Oregon State University Agricultural Experiment Station Special Report 1094:32-40.

Table 1. Yield and grade of 12 varieties at 3 harvest dates for onions grown from transplants. Malheur Experiment Station, Oregon State University, Ontario, OR, 2010. Continued on next page.

Company	Variety	Total yield	Marketable yield by grade					Bulb counts	Small	No. 2
			Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	>4¼ in		
		---------- cwt/acre ----------						#/50 lb	- cwt/acre -	
July 19 harvest										
Nunhems	Ranchero	435.9	427.2	0.0	0.0	359.5	67.7		8.7	2.0
	Ranchero (greenhouse)	365.0	327.3	0.0	0.0	160.0	167.4		37.6	0.0
	Vaquero	430.5	414.9	0.0	6.8	287.1	120.9		15.7	0.0
	Montero	490.3	478.9	0.0	2.4	415.5	61.0		11.4	0.0
	Arcero	472.3	457.7	0.0	0.0	399.0	58.7		14.6	0.0
	Nun7015	431.0	414.7	0.0	4.1	297.7	112.8		16.3	0.0
	Valero	513.9	507.2	0.0	0.0	433.3	73.9		6.7	0.0
	Nun4003	617.4	610.9	11.9	38.1	485.0	65.6	44.0	6.5	0.0
	Nun4004	619.7	617.3	6.0	26.8	554.6	29.9	60.8	2.4	0.0
Seminis	Swale	522.0	516.4	0.0	6.7	448.4	61.2		5.6	0.0
	Barbaro	462.5	445.4	0.0	5.1	342.2	98.2		17.0	0.0
	Exacta	594.5	582.6	14.5	91.6	437.7	38.7	36.6	11.9	5.7
Bejo	Crocket	573.1	568.8	0.0	17.0	508.5	43.3		4.3	0.0
	Average	502.2	489.9	2.5	15.3	394.5	76.9	2.5	12.2	0.6
July 26 harvest										
Nunhems	Ranchero	586.2	573.7	0.0	33.6	499.3	40.8		12.6	0.0
	Ranchero (greenhouse)	399.3	396.5	0.0	0.0	340.2	56.4		2.7	0.0
	Vaquero	594.1	586.4	0.0	37.1	502.2	47.1		7.7	0.0
	Montero	623.4	611.7	0.0	46.0	540.2	25.5		11.7	0.0
	Arcero	595.4	586.7	0.0	35.9	500.9	50.0		8.7	0.0
	ON7015	584.7	576.2	0.0	5.6	524.4	46.3		8.4	0.0
	Valero	639.8	636.3	0.0	30.7	559.3	46.3		3.6	0.0
	Nun4003	792.1	786.9	13.2	164.6	579.5	29.6	40.5	5.2	0.0
	Nun4004	727.1	721.7	0.0	69.6	608.7	43.4		5.4	0.0
Seminis	Swale	636.6	628.3	0.0	19.0	581.3	28.1		8.3	0.0
	Barbaro	669.3	660.0	4.4	35.7	585.4	34.5	40.3	9.3	0.0
	Exacta	771.6	764.4	47.1	223.4	465.8	28.2	41.0	7.1	0.0
Bejo	Crocket	710.7	702.9	8.2	77.8	587.4	29.5	43.8	7.8	0.0
	Average	640.8	633.2	5.6	59.9	528.8	38.9	41.4	7.6	0.0

Table 1 (continued)

Company	Variety	Total yield	Marketable yield by grade					Bulb counts		
			Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	>4¼ in	Small	No. 2
		---------- cwt/acre ----------						#/50 lb	- cwt/acre -	
August 3 harvest										
Nunhems	Ranchero	665.8	659.9	33.2	161.1	440.4	25.3	45.0	5.9	0.0
	Ranchero (greenhouse)	624.4	618.5	3.0	41.1	556.0	18.3	56.8	5.9	0.0
	Vaquero	632.4	623.4	3.2	64.6	526.3	29.3	51.0	9.0	0.0
	Montero	674.0	668.3	12.6	114.6	524.3	16.8	47.2	5.7	0.0
	Arcero	636.6	632.8	22.3	174.6	417.3	18.6	50.2	3.8	0.0
	ON7015	608.5	604.7	0.0	40.0	546.7	18.0		3.9	0.0
	Valero	738.5	723.6	39.5	102.1	570.3	11.7	49.9	14.9	0.0
	Nun4003	824.8	818.7	55.6	342.7	393.5	26.8	40.1	6.1	0.0
	Nun4004	774.3	768.2	16.4	219.9	517.5	14.4	42.4	6.0	0.0
Seminis	Swale	752.3	747.7	5.2	173.5	539.2	29.9	34.3	4.6	0.0
	Barbaro	763.1	753.9	51.0	238.4	446.3	18.2	42.9	9.2	0.0
	Exacta	905.6	903.1	183.0	396.1	301.5	22.5	32.4	2.5	0.0
Bejo	Crocket	741.4	734.6	35.9	160.6	521.1	16.9	48.2	6.9	0.0
	Average	718.6	712.1	35.5	171.5	484.6	20.5	45.0	6.5	0.0
Averaged over harvest dates										
	Ranchero	562.6	553.6	11.1	64.9	433.1	44.6	45.0	9.0	0.7
	Ranchero (greenhouse)	451.3	436.3	0.9	28.9	333.0	73.5	56.8	15.1	0.0
	Vaquero	552.3	541.5	1.1	36.2	438.5	65.7	51.0	10.8	0.0
	Montero	595.9	586.3	4.2	54.3	493.3	34.4	47.2	9.6	0.0
	Arcero	568.1	559.1	7.4	70.2	439.1	42.4	50.2	9.0	0.0
	ON7015	541.4	531.9	0.0	16.6	456.3	59.0		9.5	0.0
	Valero	630.7	622.3	13.2	44.3	521.0	43.9	49.9	8.4	0.0
	Nun4003	758.7	752.5	28.8	194.6	486.0	40.6	41.1	5.9	0.0
	Nun4004	707.0	702.4	7.5	105.5	560.3	29.2	51.6	4.6	0.0
	Swale	637.0	630.8	1.7	66.4	523.0	39.7	34.2	6.2	0.0
	Barbaro	631.6	619.8	18.5	93.1	457.9	50.3	42.4	11.9	0.0
	Exacta	757.2	750.0	81.5	237.0	401.7	29.8	36.3	7.2	1.9
	Crocket	675.1	668.7	14.7	85.1	539.0	29.9	46.0	6.3	0.0
	LSD (0.05) Variety	67.2	68.8	15.8	42.7	68.4	17.5	NS	NS	NS
	LSD (0.05) Date	21.4	22.2	8.3	20.3	26.2	8.2	NS	2.8	NS
	LSD (0.05) Var X date	NS	NS	30	73.2	94.6	29.5	NS	10	NS

Table 2. Bulb single centers for three harvest dates for 12 onion varieties grown from transplants. Malheur Experiment Station, Oregon State University, Ontario, OR, 2010. Continued on next page.

		Multiple center			Single center	
Company	**Variety**	**Large**	**Medium**	**Small**	**Functional[a]**	**Single**
		---------- % ----------				
July 19 harvest						
Nunhems	Ranchero	0.0	0.0	0.8	100.0	99.2
	Ranchero (greenhouse)	0.0	0.0	0.0	100.0	100.0
	Vaquero	0.0	0.0	0.0	100.0	100.0
	Montero	0.0	0.0	0.0	100.0	100.0
	Arcero	0.0	0.0	0.0	100.0	100.0
	ON7015	0.0	0.0	0.0	100.0	100.0
	Valero	0.0	0.0	0.0	100.0	100.0
	Nun4003	0.0	1.6	4.8	98.4	93.6
	Nun4004	0.0	0.0	1.6	100.0	98.4
Seminis	Swale	0.0	0.0	0.0	100.0	100.0
	Barbaro	0.0	0.0	0.0	100.0	100.0
	Exacta	0.0	0.8	2.4	99.2	96.8
Bejo	Crocket	0.0	0.4	12.0	99.6	87.6
	Average	0.0	0.2	1.7	99.8	98.1
July 26 harvest						
Nunhems	Ranchero	0.0	2.4	0.0	97.6	97.6
	Ranchero (greenhouse)	0.0	0.0	0.0	100.0	100.0
	Vaquero	0.0	0.0	0.0	100.0	100.0
	Montero	0.0	0.0	0.0	100.0	100.0
	Arcero	0.0	0.0	0.0	100.0	100.0
	ON7015	0.0	0.0	0.0	100.0	100.0
	Valero	0.0	0.8	0.0	99.2	99.2
	Nun4003	0.8	8.0	4.8	91.2	86.4
	Nun4004	0.0	1.6	1.6	98.4	96.8
Seminis	Swale	0.0	0.0	0.8	100.0	99.2
	Barbaro	0.0	0.8	0.0	99.2	99.2
	Exacta	0.0	4.0	2.4	96.0	93.6
Bejo	Crocket	0.8	2.4	4.0	96.8	92.8
	Average	0.1	1.5	1.0	98.3	97.3

[a] single center plus small multiple center.

Table 2 (continued)

Company	Variety	Multiple center			Single center	
		Large	Medium	Small	Functional[a]	Single
		---------- % ----------				
August 3 harvest						
Nunhems	Ranchero	0.0	0.0	0.0	100.0	100.0
	Ranchero (greenhouse)	0.8	1.6	0.0	97.6	97.6
	Vaquero	0.0	0.8	0.8	99.2	98.4
	Montero	0.0	1.6	3.2	98.4	95.2
	Arcero	0.0	0.0	0.0	100.0	100.0
	ON7015	0.0	0.0	0.0	100.0	100.0
	Valero	0.0	0.0	0.0	100.0	100.0
	Nun4003	4.0	4.8	1.6	91.2	89.6
	Nun4004	0.0	0.0	3.2	100.0	96.8
Seminis	Swale	0.0	0.0	1.6	100.0	98.4
	Barbaro	0.0	0.0	0.0	100.0	100.0
	Exacta	2.4	8.0	4.0	89.6	85.6
Bejo	Crocket	4.0	7.2	5.6	88.8	83.2
	Average	0.9	1.8	1.5	97.3	95.8
Averaged over harvest dates						
Nunhems	Ranchero	0.0	0.8	0.3	99.2	98.9
	Ranchero (greenhouse)	0.3	0.6	0.0	99.1	99.1
	Vaquero	0.0	0.3	0.3	99.7	99.5
	Montero	0.0	0.5	1.1	99.5	98.4
	Arcero	0.0	0.0	0.0	100.0	100.0
	ON7015	0.0	0.0	0.0	100.0	100.0
	Valero	0.0	0.3	0.0	99.7	99.7
	Nun4003	1.6	4.8	3.7	93.6	89.9
	Nun4004	0.0	0.5	2.1	99.5	97.3
Seminis	Swale	0.0	0.0	0.8	100.0	99.2
	Barbaro	0.0	0.3	0.0	99.7	99.7
	Exacta	0.8	4.3	2.9	94.9	92.0
Bejo	Crocket	1.6	3.3	7.2	95.1	87.9
	LSD (0.05) Variety	0.7	2.6	3.0	2.7	4.4
	LSD (0.05) Date	0.4	0.9	NS	1.0	1.7
	LSD (0.05) Var X date	1.3	3.2	NS	3.5	NS

[a] single center plus small multiple center.

Table 3. Bolting and maturity at harvest, and bulb quality 2 weeks after harvest for 12 onion varieties grown from transplants harvested on three dates. Malheur Experiment Station, Oregon State University, Ontario, OR. Continued on next page.

					Bulb quality 2 weeks after harvest		
			Maturity at harvest				
Company	Variety	Bolting	tops down	dryness	sprouted	decomposed	total sprouted or decomposed
					%		
July 19 harvest							
Nunhems	Ranchero	0.1	0.0	0.0	34.5	2.3	33.3
	Ranchero (greenhouse)	0.0	0.0	0.0	44.3	2.8	41.5
	Vaquero	0.0	0.0	0.0	31.6	7.1	34.7
	Montero	0.1	0.0	4.0	15.7	7.8	22.5
	Arcero	0.0	0.0	0.0	29.5	6.7	32.4
	Nun7015	0.0	0.0	0.0	34.6	3.7	35.5
	Valero	0.0	0.0	0.0	18.7	15.9	31.8
	Nun4003	0.9	6.0	2.0	2.2	17.4	19.6
	Nun4004	0.1	0.0	2.0	0.0	7.5	6.5
Seminis	Swale	0.6	0.0	0.0	17.1	4.8	21.0
	Barbaro	0.0	0.0	0.0	23.9	5.7	26.1
	Exacta	2.5	2.0	2.0	1.4	8.1	9.5
Bejo	Crocket	0.3	0.0	0.0	19.0	2.0	21.0
	Average	0.4	1.0	1.0	21.0	7.0	25.8
July 26 harvest							
Nunhems	Ranchero	0.5	0.0	0.0	9.7	16.7	26.4
	Ranchero (greenhouse)	0.0	0.0	0.0	18.1	7.4	24.5
	Vaquero	0.0	0.0	2.0	10.9	12.9	19.8
	Montero	1.9	4.0	6.0	5.1	7.1	12.2
	Arcero	0.1	2.0	2.0	7.8	7.8	15.6
	Nun7015	0.0	6.0	6.0	26.6	2.8	29.4
	Valero	0.8	0.0	2.0	11.2	10.3	21.5
	Nun4003	2.4	14.0	10.0	0.0	2.7	2.7
	Nun4004	0.4	8.0	8.0	0.0	14.6	14.6
Seminis	Swale	2.3	2.0	2.0	1.2	6.0	7.2
	Barbaro	0.0	0.0	0.0	1.8	0.0	1.8
	Exacta	5.1	24.0	12.0	0.0	0.0	0.0
Bejo	Crocket	0.0	6.0	6.0	1.2	2.4	3.7
	Average	1.0	5.0	4.0	7.0	7.0	13.8

Table 3 (continued)

Company	Variety	Bolting	Maturity at harvest: tops down	Maturity at harvest: dryness	Bulb quality 2 weeks after harvest: sprouted	Bulb quality 2 weeks after harvest: decomposed	Bulb quality 2 weeks after harvest: total sprouted or decomposed
		---------- % ----------					
August 3 harvest							
Nunhems	Ranchero	1.6	24.0	22.0	13.3	4.0	17.3
	Ranchero (greenhouse)	0.0	20.0	20.0	9.5	3.6	13.1
	Vaquero	1.4	24.0	24.0	9.0	0.0	9.0
	Montero	3.3	26.0	30.0	2.9	4.3	7.1
	Arcero	0.3	24.0	24.0	7.4	0.0	7.4
	Nun7015	0.4	24.0	22.0	16.5	4.7	21.2
	Valero	7.0	24.0	24.0	3.4	7.9	10.1
	Nun4003	2.4	48.0	30.0	0.0	7.5	7.5
	Nun4004	0.4	32.0	28.0	0.0	2.6	2.6
Seminis	Swale	3.6	26.0	22.0	1.3	3.8	5.0
	Barbaro	0.4	20.0	20.0	4.5	3.0	7.5
	Exacta	6.5	60.0	30.0	0.0	0.0	0.0
Bejo	Crocket	1.5	30.0	26.0	3.6	2.4	6.0
	Average	2.2	29.0	25.0	5.0	3.0	8.8
Averaged over harvest dates							
Nunhems	Ranchero	0.8	8.0	7.0	19.2	7.7	25.7
	Ranchero (greenhouse)	0.0	7.0	7.0	24.0	4.6	26.4
	Vaquero	0.5	8.0	9.0	17.2	6.7	21.2
	Montero	1.8	10.0	13.0	7.9	6.4	14.0
	Arcero	0.1	9.0	9.0	14.9	4.8	18.5
	Nun7015	0.1	10.0	9.0	25.9	3.7	28.7
	Valero	2.6	8.0	9.0	11.1	11.3	21.1
	Nun4003	1.9	23.0	14.0	0.7	9.2	9.9
	Nun4004	0.3	13.0	13.0	0.0	8.3	7.9
Seminis	Swale	2.2	9.0	8.0	6.5	4.8	11.1
	Barbaro	0.1	7.0	7.0	10.1	2.9	11.8
	Exacta	4.7	29.0	15.0	0.5	2.7	3.2
Bejo	Crocket	0.6	12.0	11.0	7.9	2.3	10.2
	LSD (0.05) Variety	1.6	4.0	3.0			
	LSD (0.05) Date	0.4	1.0	1.0			
	LSD (0.05) Var X date	1.4	5.0	NS			