

# ONION PRODUCTION FROM TRANSPLANTS

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## Introduction

Increased interest in an earlier start for onion harvest 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, 2010). This trial evaluated the performance of nine onion varieties grown from transplants brought in from Arizona or from a greenhouse in Ontario, Oregon.

## Materials and Methods

The trial was conducted in a field of Owyhee silt loam previously planted to wheat. In the fall of 2010, the wheat stubble was shredded and the field was irrigated and disked. Based on a soil test, 200 lb phosphorus/acre, 80 lb sulfur/acre, 7 lb manganese/acre, and 1 lb boron/acre were broadcast in the fall of 2010. The field was then moldboard-plowed and groundhogged.

Transplants of three varieties were grown in Arizona during the winter of 2010-2011.

In addition to the transplants grown in Arizona, transplants of six varieties were also grown in a heated greenhouse (65°F day, 45°F night air temperatures) at Ontario, Oregon. Onion seed was planted in the greenhouse in flats with a vacuum seeder at 72 seeds/flat on January 14, 2010. The seed was sown 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 January 31. Transplants were grown without supplemental light.

The field was bedded into 22-inch centers and drip tape was laid at 4-inch depth between 2 onion beds before planting. The drip tape had emitters spaced 12 inches apart and emitter flow rate of 0.22 gal/min/100 ft (Toro Aqua-Traxx, Toro Co., El Cajon, CA). The distance between the tape and the center of each double row of onions was 11 inches.

The seedlings from the Ontario greenhouse (8 varieties) were transplanted on April 6. The varieties grown in Arizona were transplanted as follows: 'Exacta' on April 18, 'NUN4004' on April 22, and 'Spanish Medallion' on April 26. The seedlings were planted in 2 rows spaced 3 inches apart on the 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/acre. Plots of each variety were 20 ft long by 4 double rows wide arranged in a randomized complete block design with 5 replicates.

The onions were managed to avoid yield reductions from weeds, pests, diseases, water stress, and nutrient deficiencies. On April 27, Prowl H<sub>2</sub>O<sup>®</sup> at 2 pt/acre was broadcast for weed control. On May 6, Goal<sup>®</sup> at 10 oz/acre, Buctril<sup>®</sup> at 12 oz/acre, and Select<sup>®</sup> at 10 oz/acre were broadcast for weed control. The trial was sprayed weekly for thrips control starting on June 14 for a total of five applications. The insecticide application sequence had two applications of Movento<sup>®</sup> at 5 oz/acre, followed by two applications of Radiant<sup>®</sup> at 8 oz/acre, followed by one application of Lannate<sup>®</sup> at 3 pt/acre. Root tissue samples were taken on June 21 and July 8. Based on the tissue analyses, a total of 155 lb nitrogen/acre, 2.5 lb magnesium/acre, and 0.2 lb boron/acre were applied during the season. The nutrients were 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, Irrrometer 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 27, August 3, and August 10, 6.7 ft of the middle 2 rows in each plot of all varieties except ‘Gunnison’ and ‘Crocket’ were topped and bagged. Varieties Gunnison and Crocket were harvested in mid-September and were evaluated out of storage on March 13, 2012.

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 was 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 super colossal (>4¼ inches). Bulb counts per 50 lb of super colossal onions were determined for each plot of every variety by weighing and counting all super colossal bulbs during grading.

Onion bulbs from all harvests were rated for single centers. Twenty-five onions ranging in diameter from 3½ to 4¼ inches from each plot were rated. The onions were cut equatorially through the bulb middle and separated into single-centered and multiple-centered bulbs. The multiple centered bulbs had the the long axis of the inside diameter of the first single ring measured. These multiple-centered onions were ranked according to the diameter of the first single ring: “small” had diameters under 1½ inch, “medium” had diameters from 1½ to 2¼ inches, and “large” had diameters over 2¼ 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 early harvest 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.

Variety 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).

## Results and Discussion

### July 27 Harvest

Marketable yield on July 27 averaged 662 cwt/acre and ranged from 484 cwt/acre for ‘Pulsar’ to 766 cwt/acre for Spanish Medallion. Exacta, Spanish Medallion, and NUN4004 were among the varieties with the highest colossal yield (Table 1). All varieties except NUN4003 and Exacta had more than 80 percent functionally single-centered bulbs (Table 2). All varieties except Nun4003, Pulsar, and Exacta had less than 10 percent tops down (Table 3). NUN4003, Pulsar, Exacta, and Spanish Medallion had fewer than 10 percent sprouted or decomposed bulbs 2 weeks after harvest (Table 3).

### August 3 Harvest

Marketable yield on August 3 averaged 721 cwt/acre and ranged from 559 cwt/acre for Pulsar to 817 cwt/acre for NUN4004. NUN4003, NUN4003, Exacta, and Spanish Medallion were among the varieties with the highest colossal yield (Table 1). All varieties, except NUN4003, Pulsar, Exacta, and Spanish Medallion had more than 80 percent functionally single-centered bulbs (Table 2). All varieties had more than 10 percent tops down except ‘Valero’, and ‘Barbaro’ (Table 3). All varieties, except ‘Ranchero’ and ‘Montero’ had fewer than 10 percent sprouted or decomposed bulbs 2 weeks after harvest (Table 3).

### August 10 Harvest

Marketable yield on August 10 averaged 809 cwt/acre and ranged from 724 cwt/acre for Spanish Medallion to 915 cwt/acre for NUN4003. All varieties, except Pulsar, had more than 300 cwt/acre colossal yield (Table 1). Only Montero, Valero, and Barbaro had more than 80 percent functionally single-centered bulbs (Table 2). All varieties had fewer than 10 percent sprouted or decomposed bulbs 2 weeks after harvest (Table 3).

Overall, Barbaro and Montero were among the varieties with the most single centers. The percentage of single-centered bulbs decreased with the successive harvests for Ranchero, Montero, Pulsar, Exacta, and Spanish Medallion. Spanish Medallion and NUN4004 had reached almost full yield by July 27.

### September 13 Harvest, 2 Varieties

Crockett had significantly higher yield of super colossal bulbs than Gunnison (Table 4). Gunnison had significantly lower decomposition in storage than Crockett. Gunnison had a higher percentage of tops down at harvest than Crockett (Table 5). There was no significant difference in the percentage of single-centered bulbs between varieties.

## 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.
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- Shock, C.C., E.B.G. Feibert, L.D. Saunders, and B. Simerly. 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.
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Table 1. Yield and grade of nine varieties at three harvest dates for onions grown from transplants, Malheur Experiment Station, Oregon State University, Ontario, OR, 2011.

Company	Variety	Total yield	Marketable yield by grade					Small	Bulb counts >4¼ in #/50 lb
			Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in		
----- cwt/acre -----									
July 27 harvest									
Nunhems	Ranchero	574.0	564.6	0.0	49.7	462.2	52.7	9.3	
	Montero	669.0	664.4	4.7	140.1	501.1	18.5	4.6	37.9
	Valero	655.7	654.6	0.0	40.6	582.4	31.6	1.1	
	NUN 4003	754.7	751.0	15.9	139.3	569.7	26.2	3.7	32.9
	NUN 4004	749.3	745.9	14.6	217.1	489.3	24.9	3.4	35.6
	Pulsar	484.1	470.8	0.0	2.3	358.7	109.8	13.3	
Seminis	Exacta	669.3	664.1	10.7	274.6	355.8	22.9	5.3	33.3
	Barbaro	638.5	629.8	7.8	56.1	516.1	49.8	8.8	45.5
Sakata	Spanish Medallion	765.5	761.5	13.5	224.3	496.0	27.7	4.0	43.2
	Average	662.3	656.3	7.5	127.1	481.3	40.4	6.0	38.1
August 3 harvest									
Nunhems	Ranchero	674.2	672.1	16.5	197.8	444.8	13.0	2.1	43.3
	Montero	663.6	656.5	49.2	195.2	399.2	12.9	7.1	38.9
	Valero	681.6	681.6	7.6	67.1	600.3	6.5	0.0	46.7
	NUN 4003	817.2	816.1	26.3	354.3	423.8	11.7	1.1	45.2
	NUN 4004	820.7	817.4	72.8	291.8	444.9	7.8	3.4	41.4
	Pulsar	561.3	559.3	0.0	4.7	527.8	26.7	2.0	
Seminis	Exacta	722.9	715.0	74.1	287.3	325.1	28.4	8.0	36.3
	Barbaro	748.1	744.4	10.8	130.9	591.6	11.0	3.7	49.3
Sakata	Spanish Medallion	801.0	797.5	129.2	276.6	371.3	20.4	3.5	37.0
	Average	721.2	717.8	43.0	200.7	458.8	15.4	3.4	42.3
August 10 harvest									
Nunhems	Ranchero	866.0	864.0	145.6	385.6	323.5	9.2	2.0	30.8
	Montero	779.2	777.0	149.3	333.9	289.1	4.7	2.1	35.1
	Valero	765.0	759.4	12.1	347.1	397.9	2.4	5.6	29.8
	NUN 4003	918.8	915.3	257.9	417.9	229.5	9.9	3.6	32.1
	NUN 4004	793.2	792.0	193.6	340.5	252.8	5.1	1.2	31.4
	Pulsar	749.0	744.0	0.0	101.6	632.3	10.1	5.1	
Seminis	Exacta	890.5	882.3	316.9	332.1	216.1	17.3	8.2	30.9
	Barbaro	820.1	818.4	129.9	367.3	318.4	2.8	1.6	32.3
Sakata	Spanish Medallion	725.4	723.7	241.8	300.8	173.0	8.1	1.6	29.5
	Average	811.9	808.5	160.8	325.2	314.7	7.7	3.4	31.5
Average over harvest dates									
Nunhems	Ranchero	704.7	700.2	54.0	211.0	410.2	25.0	4.5	32.9
	Montero	703.9	699.3	67.7	223.1	396.5	12.0	4.6	36.9
	Valero	700.8	698.5	6.6	151.6	526.9	13.5	2.2	35.5
	NUN 4003	830.3	827.5	100.0	303.8	407.7	15.9	2.8	36.2
	NUN 4004	787.8	785.1	93.7	283.1	395.7	12.6	2.7	36.3
	Pulsar	598.1	591.3	0.0	36.2	506.3	48.9	6.8	
Seminis	Exacta	760.9	753.8	133.9	298.0	299.0	22.8	7.2	33.6
	Barbaro	735.6	730.9	49.5	184.8	475.4	21.2	4.7	36.6
Sakata	Spanish Medallion	763.9	760.9	128.2	267.2	346.8	18.7	3.0	34.9
LSD (0.05) Variety		96.5	97.5	38.1	79.8	65.3	10.6	2.0	NS
LSD (0.05) Date		47.9	48.1	23.1	36.8	31.5	4.4	6.0	NS
LSD (0.05) Variety X Date		NS	NS	69.2	110.5	94.6	13.0	NS	NS

Table 2. Bulb single centers for three harvest dates for nine onion varieties grown from transplants, Malheur Experiment Station, Oregon State University, Ontario, OR, 2011.

Company	Variety	Multiple center			Single center	
		Large	Medium	Small	Functional <sup>a</sup>	Single
----- % -----						
July 27						
Nunhems	Ranchero	0.0	4.0	3.2	96.0	92.8
	Montero	0.8	0.8	0.0	98.4	98.4
	Valero	0.8	6.4	3.2	92.8	89.6
	NUN 4003	11.9	35.0	4.7	53.1	48.3
	NUN 4004	1.6	11.2	0.8	87.2	86.4
	Pulsar	0.0	10.2	13.4	89.8	76.4
Seminis	Exacta	6.4	26.4	3.2	67.2	64.0
	Barbaro	0.0	0.0	0.0	100.0	100.0
Sakata	Spanish Medallion	0.8	18.4	3.2	80.8	77.6
	Average	2.5	12.5	3.5	85.0	81.5
August 3						
Nunhems	Ranchero	0.8	6.4	2.4	92.8	90.4
	Montero	2.4	7.2	1.6	90.4	88.8
	Valero	3.2	7.2	0.0	89.6	89.6
	NUN 4003	19.8	31.5	3.1	48.8	45.7
	NUN 4004	1.6	10.4	4.8	88.0	83.2
	Pulsar	0.8	35.0	10.4	64.2	53.8
Seminis	Exacta	11.2	36.8	3.2	52.0	48.8
	Barbaro	0.0	0.8	0.0	99.2	99.2
Sakata	Spanish Medallion	4.0	21.6	3.2	74.4	71.2
	Average	4.9	17.4	3.2	77.7	74.5
August 10						
Nunhems	Ranchero	3.2	19.2	2.4	77.6	75.2
	Montero	1.7	7.3	3.3	91.0	87.7
	Valero	1.6	9.6	1.6	88.8	87.2
	NUN 4003	35.6	30.5	1.7	33.9	32.2
	NUN 4004	9.1	13.9	1.6	77.0	75.4
	Pulsar	8.8	40.8	12.8	50.4	37.6
Seminis	Exacta	23.9	37.7	6.4	38.4	32.1
	Barbaro	0.0	2.4	0.0	97.6	97.6
Sakata	Spanish Medallion	7.2	28.8	2.4	64.0	61.6
	Average	10.1	21.1	3.6	68.7	65.2
Average over dates						
Nunhems	Ranchero	1.3	9.9	2.7	88.8	86.1
	Montero	1.6	5.1	1.6	93.3	91.6
	Valero	1.9	7.7	1.6	90.4	88.8
	NUN 4003	22.4	32.3	3.2	45.3	42.1
	NUN 4004	4.1	11.8	2.4	84.1	81.7
	Pulsar	3.2	28.7	12.2	68.1	55.9
Seminis	Exacta	13.8	33.6	4.3	52.5	48.3
	Barbaro	0.0	1.1	0.0	98.9	98.9
Sakata	Spanish Medallion	4.0	22.9	2.9	73.1	70.1
	LSD (0.05) Variety	3.4	7.3	3.0	8.0	8.5
LSD (0.05) Date	1.8	3.4	NS	3.5	3.1	
LSD (0.05) Variety X Date	5.2	10.2	NS	10.4	9.3	

<sup>a</sup> single center plus small multiple center.

Table 3. Bolting and maturity at harvest, and bulb quality 2 weeks after harvest for nine onion varieties grown from transplants harvested on three dates, Malheur Experiment Station, Oregon State University, Ontario, OR, 2011.

Company	Variety	Maturity			Bulb quality 2 weeks after harvest			
		Bolting	Tops down	Leaf dryness	Sprouted	Decomposed	Sprouted and decomposed	Total sprouted or decomposed
----- % -----								
July 27								
Nunhems	Ranchero	0.0	4	0	43.3	5.2	0.0	48.4
	Montero	0.1	8	2	22.0	2.0	0.0	24.0
	Valero	2.0	0	0	16.8	2.1	1.1	20.0
	NUN 4003	1.9	18	0	0.0	4.3	0.0	4.3
	NUN 4004	0.3	8	2	10.0	5.0	6.0	21.0
	Pulsar	0.0	10	2	0.0	0.0	0.0	0.0
Seminis	Exacta	0.1	26	0	1.0	2.1	0.0	3.1
	Barbaro	0.0	0	0	21.6	1.1	5.4	28.1
Sakata	Spanish Medallion	0.1	8	0	4.0	0.0	0.0	4.0
Average		0.5	9	1	13.2	2.4	1.4	17.0
August 3								
Nunhems	Ranchero	0.2	12	0	6.8	12.8	0.9	20.4
	Montero	0.4	22	6	0.0	11.1	0.0	11.1
	Valero	2.2	6	2	0.0	3.8	0.0	3.8
	NUN 4003	2.2	36	8	0.0	6.5	0.0	6.5
	NUN 4004	0.5	16	4	0.0	1.0	0.0	1.0
	Pulsar	0.2	38	14	0.0	5.3	0.0	5.3
Seminis	Exacta	0.2	50	6	0.0	6.4	0.0	6.4
	Barbaro	0.1	2	0	2.1	1.1	0.0	3.2
Sakata	Spanish Medallion	0.0	26	0	1.1	8.6	0.0	9.6
Average			23	4	1.1	6.3	0.1	7.5
August 10								
Nunhems	Ranchero	0.1	22	16	2.9	5.8	0.0	8.6
	Montero	0.4	42	24	0.0	1.1	0.0	1.1
	Valero	2.6	20	18	0.0	1.1	0.0	1.1
	NUN 4003	2.5	72	22	0.0	2.0	0.0	2.0
	NUN 4004	0.5	36	18	0.0	0.0	0.0	0.0
	Pulsar	0.2	90	30	0.0	1.0	0.0	1.0
Seminis	Exacta	0.1	74	20	0.0	2.3	0.0	2.3
	Barbaro	0.0	12	12	1.1	1.1	0.0	2.2
Sakata	Spanish Medallion	0.0	52	20	0.0	3.1	0.0	3.1
Average		1	47	20	0.4	1.9	0.0	2.4
Average over dates								
Nunhems	Ranchero	0.1	13	5	17.6	7.9	0.3	25.8
	Montero	0.3	24	11	7.3	4.7	0.0	12.1
	Valero	2.3	9	7	5.6	2.3	0.4	8.3
	NUN 4003	2.2	42	10	0.0	4.3	0.0	4.3
	NUN 4004	0.4	20	8	3.3	2.0	2.0	7.3
	Pulsar	0.1	46	15	0.0	2.1	0.0	2.1
Seminis	Exacta	0.1	50	9	0.3	3.6	0.0	3.9
	Barbaro	0.1	5	4	8.3	1.1	1.8	11.2
Sakata	Spanish Medallion	0.0	29	7	1.7	3.9	0.0	5.6
LSD (0.05) Variety		1.6	7	4				
LSD (0.05) Date		0.1	3	2				
LSD (0.05) Variety X Date		0.3	9	5				

Table 4. Yield and grade of two onion varieties grown from transplants, harvested on September 13, and graded out of storage on March 13, 2012, Malheur Experiment Station, Oregon State University, Ontario, OR, 2011.

Company	Variety	Total yield	Marketable yield by grade				Bulb counts >4¼ in	Neck rot	Plate rot	Total rot		
			Total	>4¼ in	4-4¼ in	3-4 in					2¼-3 in	
		----- cwt/acre -----						#/50 lb	----- cwt/acre -----		%	
Bejo	Gunnison	833.0	693.7	32.9	260.8	389.0	11.0	32.2	1.6	96.1	41.6	16.3
Bejo	Crockett	986.8	585.2	109.1	261.8	208.8	5.5	31.1	0.8	293.9	106.9	40.4
LSD (0.05)		NS	NS	69	NS	97.7	NS	NS	NS	78.9	60.3	6.6

Table 5. Bulb single centers, bolting, and tops down at harvest for two varieties grown from transplants, harvested on September 13, and evaluated out of storage on March 13, 2012, Malheur Experiment Station, Oregon State University, Ontario, OR, 2011.

Company	Variety	Multiple center			Single center		Bolting	Tops down
		Large	Medium	Small	Functional <sup>a</sup>	Single		
		----- % -----						
Bejo	Gunnison	5.6	24.0	24.0	70.4	46.4	2.0	93.0
Bejo	Crockett	3.2	17.6	23.2	79.2	56.0	3.3	44.0
LSD (0.05)		NS	NS	NS	NS	NS	NS	10.2

<sup>a</sup> single center plus small multiple center.