

# 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 when onions are grown from transplants they can be harvested in July (Shock et al. 2004, 2007-2013). This trial evaluated the performance of four onion varieties in 2014 grown from transplants produced in a greenhouse at the Malheur Experiment Station, in Ontario, Oregon and one variety brought in from Arizona.

## Materials and Methods

Onions were grown in 2014 on an Owyhee silt loam with a pH of 7.5 and 1.46% organic matter, previously planted to wheat. In the fall of 2013, the wheat stubble was shredded and the field was irrigated. The field was then disked, moldboard plowed, and groundhogged. Based on a soil analysis, 20 lb of nitrogen (N)/acre, 87 lb of phosphorus/acre, 100 lb of potassium/acre, 100 lb of sulfur/acre, 1 lb of manganese/acre, and 1 lb of boron/acre were broadcast before plowing. After plowing, the field was fumigated with Vapam<sup>®</sup> at 15 gal/acre and bedded at 22 inches.

Transplants of four onion varieties were grown in a heated greenhouse (65°F day, 45°F night air temperatures) at Ontario, Oregon. Onion seed was planted in the greenhouse in 162-cell plug trays. Seed of varieties ‘Avalon’, ‘Scimitar’ (Crookham Seed Co., Caldwell, ID), ‘Gunnison’ (Bejo Seed Co., Oceano, CA), and ‘Pulsar’ (Nunhems, Parma, ID) was planted on January 17, 2014. 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 trays were watered immediately after planting and were kept moist. Onion seedlings began emerging on January 24. Transplants were grown without supplemental light. Transplants of ‘Montero’ (Nunhems, Parma, ID) were grown in Arizona during the winter of 2013-2014 and were delivered as bare rooted.

The field had drip tape 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 grown in the greenhouse were transplanted on March 26. The transplants of Montero (grown in Arizona) were planted on April 7. The seedlings were planted in 2 rows spaced 3 inches apart on the 22-inch beds. The spacing between plants in each row was 4.8 inches, equivalent to 120,000 plants/acre. Plots of each variety were 20 ft long by 4 double rows wide. The experimental design was a randomized complete block with 5 replicates.

The onion crop was managed to avoid yield reductions from weeds, pests, diseases, water stress, and nutrient deficiencies. Prowl<sup>®</sup> H<sub>2</sub>O at 2 pt/acre was broadcast for weed control on April 21. On May 8, Goal<sup>®</sup> at 6 oz/acre, Buctril<sup>®</sup> at 16 oz/acre, and Poast<sup>®</sup> at 24 oz/acre were broadcast for weed control. Thrips were controlled using the following insecticides: Movento<sup>®</sup> at 5 oz/acre on May 16, Movento at 5 oz/acre and Radiant<sup>®</sup> at 10 oz/acre on May 23, and Radiant at 10 oz/acre on June 5 and 12. A total of 100 lb N/acre was applied during the season as uran 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 (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). The field was irrigated until the last harvest on August 4.

On July 21, bolted onions in each plot were counted. On July 21, July 28, and August 4, bulbs from 6 ft of the middle 2 double rows in each plot were topped and bagged. Decomposing bulbs were not bagged. At each harvest, onions in each plot were visually rated for the percentage of tops that were down and the percent leaf dryness. 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.

After grading the onions were placed in burlap bags 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.

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 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 multiple-centered onions had diameters under 1½ inch, medium multiple-centered onions had diameters from 1½ to 2¼ inches, and large multiple-centered onions had diameters over 2¼ inches. Onions were considered “functionally single centered” for processing if they were single centered or had a small multiple center.

Variety differences were compared using repeated measures analysis of variance. Means separation was determined using Fisher’s least significant difference test at the 5% probability level, LSD (0.05).

## Results and Discussion

### July 21 Harvest

Marketable yield on July 21 averaged 1,010 cwt/acre and ranged from 826 cwt/acre for Montero to 1,287 cwt/acre for Avalon (Table 1). The percentage of functionally single-centered bulbs

averaged 95.5% and ranged from 87.2% for Scimitar to 100% for Montero (Table 2). The percentage of tops down at harvest averaged 56% and ranged from 16% for Avalon to 92% for Pulsar (Table 3). Bulb decomposition or sprouting after 2 weeks of storage averaged 3.0% and ranged from 2.0% for Gunnison and Pulsar to 4.5% for Scimitar. Bolting was low for Scimitar (0.3%), Gunnison (0.4%), and Pulsar and Montero (0%). Avalon had the highest bolting at 7.5% (Table 1).

### **July 28 Harvest**

Marketable yield on July 28 averaged 1,062 cwt/acre and ranged from 872.5 cwt/acre for Gunnison to 1,387 cwt/acre for Avalon (Table 1). The percentage of functionally single-centered bulbs averaged 92.8% and ranged from 82.5% for Scimitar to 100% for Montero (Table 2). The percentage of tops down at harvest averaged 67% and ranged from 30% for Avalon to 90% for Pulsar and Scimitar (Table 3). Bulb decomposition or sprouting after 2 weeks of storage averaged 1.1% and ranged from 0% for Gunnison to 1.6% for Montero.

### **August 4 Harvest**

Marketable yield on August 4 averaged 1,120 cwt/acre and ranged from 855 cwt/acre for Pulsar to 1,488 cwt/acre for Avalon (Table 1). The percentage of functionally single-centered bulbs averaged 90.1% and ranged from 81.7% for Scimitar to 100% for Montero (Table 2). The percentage of tops down at harvest averaged 83% and ranged from 64% for Avalon to 98% for Pulsar (Table 3). Bulb decomposition or sprouting after 2 weeks of storage averaged 1.8% and ranged from 0% for Montero to 3.7% for Gunnison.

### **Overall**

Varieties Avalon, Scimitar, and Montero showed gains in yield at each harvest. Varieties Gunnison and Pulsar did not show a yield gain beyond the first harvest. Averaged over harvest dates, Avalon had the highest yield of marketable bulbs and supercolossal bulbs, but also had the highest bolting. Montero performance was at a disadvantage since it was planted later than the other varieties and from bare-rooted plants.

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Table 1. Bulb yield and grade for five onion varieties grown from transplants at three harvest dates, Malheur Experiment Station, Oregon State University, Ontario, OR, 2014.

Company	Variety	Total yield	Marketable yield by grade					Bulb counts		
			Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	Small	>4¼ in	Bolters
			----- cwt/acre -----					#/50 lb	%	
July 21 harvest										
Crookham	Avalon	1288.7	1287.0	260.3	668.4	358.3	0.0	1.7	31.2	7.5
	Scimitar	1210.0	1204.6	163.2	558.6	465.9	17.0	5.4	30.8	0.3
Bejo	Gunnison	863.8	855.4	0.0	94.6	732.9	28.0	8.4		0.4
Nunhems	Pulsar	888.5	878.7	7.6	55.9	789.5	25.7	9.8	26.0	0.0
	Montero	839.1	825.9	0.0	198.5	602.0	25.4	11.6		0.0
	Average	1018.0	1010.3	86.2	315.2	589.7	19.2	7.4	29.4	1.7
July 28 harvest										
Crookham	Avalon	1388.4	1387.0	359.3	781.1	231.9	14.7	1.4	33.7	
	Scimitar	1262.9	1261.8	214.9	600.4	439.2	7.3	1.1	33.4	
Bejo	Gunnison	876.1	872.5	0.0	87.6	756.8	28.1	3.5		
Nunhems	Pulsar	879.9	878.0	0.0	36.3	823.1	18.6	1.9		
	Montero	916.7	911.0	0.0	294.9	610.6	5.4	3.6		
	Average	1064.8	1062.1	114.8	360.1	572.3	14.8	2.3	33.6	
August 4 harvest										
Crookham	Avalon	1489.6	1487.5	600.7	666.5	219.4	1.0	0.0	30.0	
	Scimitar	1355.9	1333.1	260.0	716.5	353.4	3.2	1.1	31.0	
Bejo	Gunnison	906.8	899.8	0.0	119.8	757.5	22.6	2.9		
Nunhems	Pulsar	865.3	855.0	0.0	97.3	739.4	18.4	0.9		
	Montero	1023.9	1023.8	6.1	385.5	624.8	7.4	0.0	32.5	
	Average	1128.3	1119.8	173.4	397.1	538.9	10.5	1.0	31.1	
Average over harvest dates										
Crookham	Avalon	1388.9	1387.2	406.7	705.4	269.9	5.2	1.0	31.6	
	Scimitar	1276.3	1266.5	212.7	625.2	419.5	9.2	2.5	31.7	
Bejo	Gunnison	882.2	875.9	0.0	100.6	749.1	26.2	4.9		
Nunhems	Pulsar	877.9	870.6	2.5	63.1	784.0	20.9	4.2	26.0	
	Montero	926.5	920.2	2.0	293.0	612.5	12.7	5.1	32.5	
LSD (0.05) Variety		71.6	71.2	92.3	85.9	91.5	10.0	2.0	NS	0.9
LSD (0.05) Date		29.9	31.5	34.3	54.6	NS	5.9	1.9	NS	
LSD (0.05) Variety X Date		67.1	70.5	76.7	NS	NS	NS	NS	NS	

Table 2. Bulb single and multiple centers for five onion varieties grown from transplants at three harvest dates, Malheur Experiment Station, Oregon State University, Ontario, OR, 2014.

Company	Variety	Multiple center			Single center	
		Large	Medium	Small	Functional <sup>a</sup>	Single
----- % -----						
July 21 harvest						
Crookham	Avalon	3.2	0.0	7.1	96.8	89.7
	Scimitar	1.6	11.2	20.8	87.2	66.4
Bejo	Gunnison	3.2	1.6	7.2	95.2	88.0
Nunhems	Pulsar	0.0	1.6	20.0	98.4	78.4
	Montero	0.0	0.0	0.0	100.0	100.0
	Average	1.6	2.9	11.0	95.5	84.5
July 28 harvest						
Crookham	Avalon	3.2	2.4	17.6	94.4	76.8
	Scimitar	3.2	14.3	22.3	82.5	60.2
Bejo	Gunnison	0.0	1.6	12.8	98.4	85.6
Nunhems	Pulsar	10.4	0.8	24.8	88.8	64.0
	Montero	0.0	0.0	4.8	100.0	95.2
	Average	3.4	3.8	16.5	92.8	76.4
August 4 harvest						
Crookham	Avalon	0.8	12.0	13.6	87.2	73.6
	Scimitar	2.4	15.9	19.8	81.7	61.9
Bejo	Gunnison	1.6	3.2	10.4	95.2	84.8
Nunhems	Pulsar	0.0	13.6	26.4	86.4	60.0
	Montero	0.0	0.0	5.6	100.0	94.4
	Average	1.0	8.9	15.2	90.1	74.9
Average over harvest dates						
Crookham	Avalon	2.4	4.8	12.8	92.8	80.0
	Scimitar	2.4	13.8	21.0	83.8	62.8
Bejo	Gunnison	1.6	2.1	10.1	96.3	86.1
Nunhems	Pulsar	3.5	5.3	23.7	91.2	67.5
	Montero	0.0	0.0	3.5	100.0	96.5
LSD (0.05) Variety		NS	6.3	7.5	5.8	6.9
LSD (0.05) Date		NS	4.2	NS	NS	NS
LSD (0.05) Variety X Date		NS	NS	NS	NS	NS

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

Table 3. Maturity at harvest and bulb quality 2 weeks after harvest for five onion varieties grown from transplants at three harvest dates, Malheur Experiment Station, Oregon State University, Ontario, OR, 2014.

Company	Variety	Maturity at harvest		Bulb quality 2 weeks after harvest				
		Tops down	Leaf dryness	Sprouted	Decomposed	Sprouted and decomposed	Total sprouted or decomposed	
		----- % -----						
		July 21						
Crookham	Avalon	16.0	14.0	0.6	2.2	0.0	2.8	
	Scimitar	84.0	24.0	1.9	2.6	0.0	4.5	
Bejo	Gunnison	74.0	22.0	1.0	1.0	0.0	2.0	
Nunhems	Pulsar	92.0	24.0	1.0	1.0	0.0	2.0	
	Montero	12.0	16.0	0.8	3.1	0.0	3.9	
		Average	56.0	20.0	1.0	2.0	0.0	3.0
		July 28						
Crookham	Avalon	30.0	20.0	0.7	0.7	0.0	1.4	
	Scimitar	90.0	26.0	0.7	0.7	0.0	1.4	
Bejo	Gunnison	86.0	34.0	0.0	0.0	0.0	0.0	
Nunhems	Pulsar	90.0	32.0	0.0	1.1	0.0	1.1	
	Montero	40.0	28.0	1.6	0.0	0.0	1.6	
		Average	67.0	28.0	0.6	0.5	0.0	1.1
		August 4						
Crookham	Avalon	64.0	24.0	0.6	1.2	0.0	1.8	
	Scimitar	88.0	38.0	1.1	0.6	0.0	1.7	
Bejo	Gunnison	90.0	48.0	2.8	0.9	0.0	3.7	
Nunhems	Pulsar	98.0	42.0	2.0	0.0	0.0	2.0	
	Montero	76.0	32.0	0.0	0.0	0.0	0.0	
		Average	83.0	37.0	1.3	0.5	0.0	1.9
		Average over dates						
Crookham	Avalon	37.0	19.0	0.6	1.4	0.0	2.0	
	Scimitar	87.0	29.0	1.3	1.3	0.0	2.6	
Bejo	Gunnison	83.0	35.0	1.3	0.6	0.0	1.9	
Nunhems	Pulsar	93.0	33.0	1.0	0.7	0.0	1.7	
	Montero	43.0	25.0	0.8	1.0	0.0	1.8	
LSD (0.05) Variety		8.0	4.0					
LSD (0.05) Date		4.0	3.0					
LSD (0.05) Var. X Date		9.0	6.0					