ONION PRODUCTION FROM TRANSPLANTS IN 2020

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Introduction

Interest in an earlier start for onion harvest and marketing has led to interest in transplanting onions. In the Treasure Valley, onions are available out of the field from mid-August through October and then out of storage from October through March. An earlier harvest would extend the time when local onions are available, which is important for onion processors and for onion packing sheds. Onion varieties suitable for processing into onion rings must be single centered, produce large bulbs, and store well. Previous research at the OSU Malheur Experiment Station (MES) has shown that when onions are grown from transplants, they can be harvested starting in July (Shock et al. 2004, 2007–2009, 2011–2018; Reitz et al. 2019). The 2020 trial evaluated one red onion variety grown from transplants potentially suitable for processing or fresh market.

Materials and Methods

Transplants were grown at MES in a heated greenhouse with minimum air temperatures during the day of 65°F and 45°F at night. Onion seed of variety 'TAS027' (New Zealand Onion Co., Pukekohe, New Zealand) was planted in the greenhouse on January 13, 2020, in flats with a vacuum seeder at 72 seeds/flat. The seed was sown on a 1-inch layer of Sun Gro Horticulture professional growing mix (Sun Gro Horticulture, Agawam, MA). The seed was then covered with 1 inch of the potting mix. The flats were placed in metal trays in the greenhouse. Immediately after planting, the trays were filled enough water to allow the flats to be kept moist. Onion seedlings began emerging on January 27. Transplants were grown without supplemental light.

Onions were grown from the transplants on an Owyhee silt loam at MES previously planted to wheat. After the wheat was harvested in 2019, the stubble was shredded, the field was irrigated to sprout unharvested wheat kernels, and then the field was disked. A soil analysis taken in the fall of 2019 showed a pH of 7.8, 2.9 % organic matter, 2 ppm nitrogen (N) as nitrate, 2 ppm N as ammonium, 19 ppm phosphorus (P), 362 ppm potassium, 21 ppm sulfur (S), 4249 ppm calcium, 560 ppm magnesium, 101 ppm sodium, 3.8 ppm zinc, 2 ppm manganese (Mn), 0.5 ppm copper, 10 ppm iron, and 0.2 ppm boron (B). Based on the soil analysis, 100 lb N/acre, 87 lb P/acre, 200 lb S/acre, 9 lb Mn/acre, and 2 lb B/acre were broadcast before plowing. After plowing and groundhogging, the field was fumigated with Vapam® at 15 gal/acre and bedded at 22 inches.

Drip tape was laid at 4-inch depth between pairs of onion beds before planting. The drip tape had emitters spaced 12 inches apart and an 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 were transplanted on March 23. The seedlings were transplanted on four 22-inch beds in double rows 3 inches apart. The spacing between plants in each row was 4.8 inches, equivalent to 120,000 plants/acre. Five plots were planted. Plots were 20 ft long by 4 double rows wide.

The onion crop was managed to minimize yield reductions from weeds, pests, diseases, water stress, and nutrient deficiencies. The herbicides Prowl® H_2O (pendimethalin) at 2 pt/acre (0.95 lb ai/acre) and Shadow® 3EC (clethodim) at 5 oz/acre (0.12 lb ai/acre) were broadcast for weed control on April 3. Thrips were controlled by ground application using the following insecticides: Aza-Direct® (azadirachtin) at 12 oz/acre (0.00093 lb ai/acre) and M-Pede® (potassium salts of fatty acids) at 123 oz/acre on April 24; Aza-Direct at 12 oz/acre and Movento® (spirotetramat) at 5 oz/acre (0.008 lb ai/acre) on May 7 and May 15; and Radiant® (spinetoram) at 8 oz/acre (0.06 lb ai/acre) on May 27 and June 10.

A total of 80 lb N/acre was applied in four 20-lb increments during the season as urea ammonium nitrate solution (URAN) injected through the drip tape.

Onions were irrigated automatically to maintain the soil water tension (SWT) in the onion root zone below 20 cb (Figure 1, Shock et al. 2000). Soil water tension was measured with eight granular matrix sensors (GMS, Watermark soil moisture sensor model 200SS, Irrometer Co. Inc., Riverside, CA) installed at 8-inch depth in the center of the double row. Sensors had been calibrated to SWT (Shock et al. 1998). The GMS were connected to the datalogger via multiplexers (AM16/32, Campbell Scientific, Logan, UT). The datalogger (CR1000, Campbell Scientific) read the sensors and recorded the SWT every hour. The datalogger automatically made irrigation decisions every 12 hours. The field was irrigated if the average SWT of the eight sensors was 20 cb or higher. The irrigations were controlled by the datalogger using a controller (SDM-CD16AC, Campbell Scientific) connected to a solenoid valve. Irrigation durations were 8 hours, 19 minutes, to apply 0.48 inch of water. The water supply was well water maintained at a constant water pressure of 35 psi. The pressure in the drip lines was maintained at 10 psi by a pressure-regulating valve. The automated irrigation system was started on May 5 and terminated on July 30.

On July 16 and July 30, bulbs from 10 ft of the middle two double rows in each plot were topped and bagged. Decomposing bulbs were not bagged. At each harvest, onions in each plot were rated visually for the percentage of tops that were down. 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 calculated for each plot of every variety by weighing and counting all super colossal bulbs during grading.

After grading, bulbs from each harvest were stored in a shed at ambient temperature for 2 weeks. After 2 weeks the bulbs were evaluated for single centers and for the number of sprouted or decomposed bulbs.

Twenty-five onions ranging in diameter from 3½ to 4¼ inches from each plot and each harvest were rated for single centers. 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 a protected Fisher's least significant difference test at the 5% probability level, LSD (0.05).

Results and Discussion

July 16 Harvest

Total yield was 730 cwt/acre and marketable yield was 722 cwt/acre on July 16 (Table 1). The percentage of functionally single-centered bulbs was 65% on July 16 (Table 2). The percentage of tops down at harvest was 30% (Table 3). The percentage of bulbs decomposed or sprouted after 2 weeks of storage was 85% (Table 3). Bulb decomposition was characterized by soft rot on the outer one to two rings.

July 30 Harvest

Total yield was 928 cwt/acre and marketable yield was 917 cwt/acre on July 30 (Table 1). The percentage of functionally single-centered bulbs was 25% on July 30 (Table 2). The percentage of tops down at harvest was 80% (Table 3). No bolting was observed. Bulb decomposition after 2 weeks of storage was 6% (Table 3).

Acknowledgements

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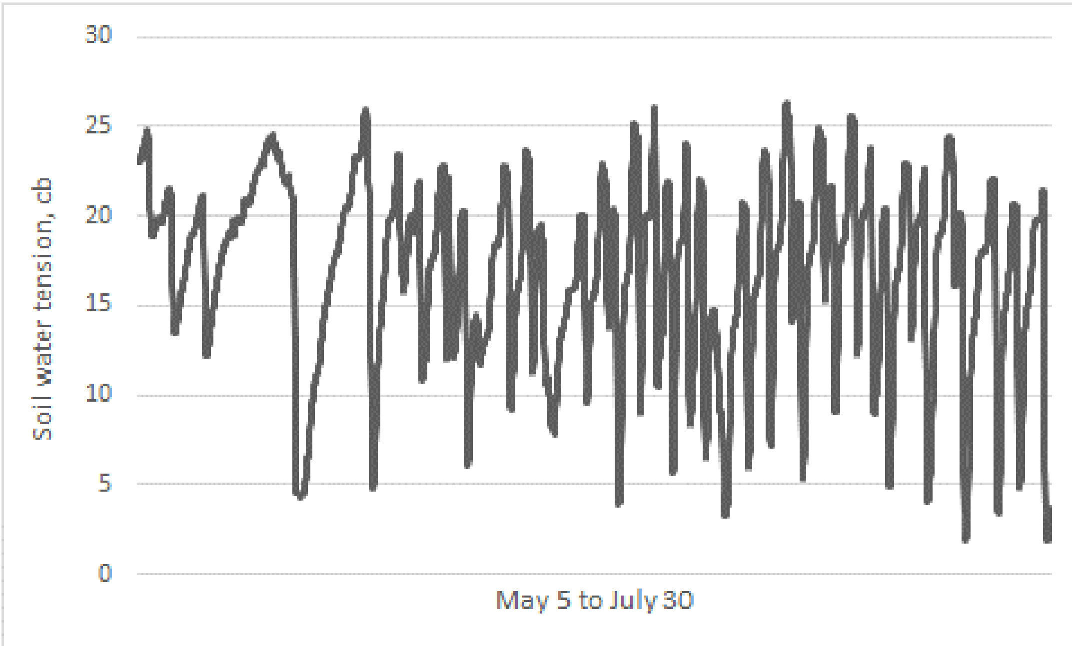

Figure 1. Soil water tension at 8-inch depth, Malheur Experiment Station, Oregon State University, Ontario, OR, 2020.

Table 1. Bulb yield and grade over two harvest dates for red onion variety TAS027 grown from transplants, Malheur Experiment Station, Oregon State University, Ontario, OR, 2020.

Date	Total yield	Marketable yield by grade					Small	Doubles	Bulb counts >4¼ in
		Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in			
	------	------	------	cwt/acre	------	------	------	------	#/50 lb
16-Jul	730.1	721.7	0.0	60.0	634.5	27.2	8.5	1.1	
30-Jul	928.2	916.6	29.9	324.4	552.2	10.1	6.9	23.5	30.8
Average	829.2	819.1	14.9	192.2	593.4	18.7	7.7	12.3	
LSD (0.05) date	49.6	48.5	NS	38.6	NS	NS	NS	NS	

Table 2. Single- and multiple-centered bulbs over two harvest dates for red onion variety TAS027 grown from transplants, Malheur Experiment Station, Oregon State University, Ontario, OR, 2020.

Date	Multiple center			Single center	
	Large	Medium	Small	Functional[a]	Bullet[b]
	------	------	%	------	------
July 16 harvest	10.4	24.8	52.0	64.8	12.8
July 30 harvest	24.0	51.2	18.4	24.8	6.4
Average	17.2	38.0	35.2	44.8	9.6
LSD (0.05) date	11.4	NS	31.5	21.7	NS

[a]Functional single centers are the small multiple centers plus the bullet single centers.
[b]Bullet: single center.

Table 3. Maturity at harvest and bulb quality 2 weeks after harvest over two harvest dates for red onion variety TAS027 grown from transplants, Malheur Experiment Station, Oregon State University, Ontario, OR, 2020.

Date	Maturity at harvest		Bulb quality 2 weeks after harvest			
	Tops down	Leaf dryness	Sprouted	Decomposed	Sprouted and decomposed	Total sprouted or decomposed
	------	------	------	%	------	------
July 16 harvest	30.0	10.0	0.8	83.2	0.8	84.8
July 30 harvest	80.0	30.0	0.0	6.4	0.0	6.4
Average	55.0	20.0	0.4	44.8	0.4	45.6
LSD (0.05) date	8.8	NS	NS	6.5	NS	6.7