

ONION PRODUCTION FROM SETS, 2011

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Introduction

Increased interest in an earlier start for onion harvest has led to interest in over-wintering onions, transplants, and set production. Transplants produced from field-grown over-wintering varieties have performed inconsistently (Shock et al. 2006a, 2007a). Also, onion production from fall direct-seeded over-wintering varieties has been inconsistent (Shock et al. 2005, 2006b, 2007b). In addition, the available over-wintering varieties do not have adequate bulb quality and appearance. Through 2009, transplants had to be grown locally as required by the local onion white rot quarantine that prohibited importation of onion transplants from areas outside the Treasure Valley. 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). Greenhouse transplant production in the Treasure Valley is relatively expensive due to the need for heated greenhouse production during the winter. Transplants produced in unheated “low tunnel” cold frames have had inferior performance compared to transplants produced in a heated greenhouse (Shock et al. 2008, 2009). Recently, a new rule that allows importation of onion transplants from outside of the Treasure Valley was approved.

An alternative to early onions from transplants is to produce onions from sets. Interest in onion production from sets continues, because, as opposed to transplants, set planting is easy to mechanize. Onion sets are produced by sowing seed very thickly one year, resulting in plants with very small bulbs. These sets are harvested, stored over the winter, and planted the following spring. Our earlier research screened 48 long-day varieties for bulb production from sets (Shock et al., 2006c). Of the 48 varieties screened, some produced sets and had high yields with low bolting, demonstrating the feasibility of bulb production from sets for six sweet Spanish long-day varieties. In 2009 and 2010, we tested bulb production from sets of varieties that we had grown in 2008 and 2009.

In 2011, bulb production was evaluated from sets of seven varieties that had been produced in Washington state in 2010.

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.

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.

On April 7, sets of each variety were planted manually in double rows spaced 3 inches apart on 22-inch beds. An additional replicate of 'Talon' was planted for a later harvest. The sets were approximately 0.4 to 0.7 inches in diameter and were planted at 2 sets/ft of single row (6-inch spacing between individual onion plants or 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 field was irrigated as necessary to maintain soil water tension at 8-inch depth at 20 cb. 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).

The onions were managed to avoid yield reductions from weeds, pests, diseases, water stress, and nutrient deficiencies. On April 27, Prowl H₂O[®] at 2 pt/acre was broadcast for weed control. On May 6, Goal[®] at 10 oz/acre, Buctril[®] at 12 oz/acre, and Select[®] 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 2 applications of Movento[®] at 5 oz/acre, followed by 2 applications of Radiant[®] at 8 oz/acre, followed by 1 application of Lannate[®] 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.

On July 27, August 3, and August 10, 6.7 ft of the middle 2 rows in each plot of all varieties were topped and bagged. The additional replicate of Talon was harvested in mid-September and was 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 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.

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.

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.

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).

Results and Discussion

July 27 Harvest

Marketable yield on July 27 averaged 519 cwt/acre and ranged from 387 cwt/acre for ‘Sabroso’ to 607 cwt/acre for NUN4004 (Table 1). ‘Arcero’, Sabroso, and ‘Montero’ had more than 80 percent functionally single-centered bulbs (Table 2). Montero, NUN4003, NUN4004, and Talon had less than 10 percent sprouted or decomposed bulbs 2 weeks after harvest (Table 3).

August 3 Harvest

Marketable yield on August 3 averaged 558 cwt/acre and ranged from 413 cwt/acre for Arcero to 683 cwt/acre for ‘Vaquero’. NUN4004, NUN4003, and Montero were among the varieties with the highest colossal yield (Table 1). Only Arcero had more than 80percent functionally single-centered bulbs (Table 2). Arcero, Sabroso, and Vaquero had more than 10 percent sprouted or decomposed bulbs 2 weeks after harvest (Table 3).

August 10 Harvest

Marketable yield on August 10 averaged 694 cwt/acre and ranged from 584 cwt/acre for Arcero to 858 cwt/acre for Montero. Montero and NUN4004 were among the varieties with the highest colossal yield (Table 1). Vaquero was not available for the August 10 harvest due to a shortage of sets. None of the varieties had more than 80 percent functionally single-centered bulbs (Table 2). All varieties had 12percent or less sprouted or decomposed bulbs 2 weeks after harvest Table 3). Averaged over harvest dates, NUN4003 had the highest percentage of bolted bulbs (11.6%, Table 3). All other varieties had less than 4 percent bolted bulbs. Averaged over varieties, the percentage of single-centered bulbs decreased with the successive harvests.

September 13 Harvest, Talon

Total yield for Talon was 581 cwt/acre (Table 4). Total yield for Talon did not increase between the August 10 and September 13 harvests. There was an increase in yield of colossal and supercolossal bulbs between the August 10 and September 13 harvests. Storage decomposition was 19 percent. The percentage of single-centered bulbs was 24 percent (Table 5).

References

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Acknowledgments

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Table 1. Yield and grade of seven varieties at three harvest dates for onions grown from sets. Malheur Experiment Station, Oregon State University, Ontario, OR, 2011.

| Company | Variety | Total yield | Marketable yield by grade | | | | | Small | Bulb counts >4¼ in |
|---------------------------|--------------------|-------------|---------------------------|--------|---------|--------|---------|-------|--------------------|
| | | | Total | >4¼ in | 4-4¼ in | 3-4 in | 2¼-3 in | | |
| ----- cwt/acre ----- | | | | | | | | | |
| July 27 | | | | | | | | | |
| Nunhems | Arcero | 427.7 | 415.1 | 0.0 | 13.3 | 371.4 | 30.4 | 12.5 | |
| | Sabroso | 406.4 | 386.6 | 0.0 | 0.0 | 328.8 | 57.7 | 19.8 | |
| | Vaquero | 611.1 | 600.9 | 17.6 | 66.4 | 487.9 | 29.0 | 10.2 | 40.5 |
| | Montero | 583.5 | 570.0 | 4.2 | 71.7 | 457.8 | 36.4 | 13.5 | 42.4 |
| | NUN4003 | 621.2 | 605.7 | 20.6 | 83.7 | 462.6 | 38.8 | 15.5 | 43.1 |
| | NUN4004 | 629.5 | 606.7 | 10.0 | 86.0 | 485.4 | 25.3 | 22.8 | 35.7 |
| Bejo | Talon | 453.1 | 444.9 | 0.0 | 3.6 | 377.5 | 63.8 | 8.2 | |
| | Average | 533.2 | 518.6 | 7.5 | 46.4 | 424.5 | 40.2 | 14.6 | 40.4 |
| August 3 | | | | | | | | | |
| Nunhems | Arcero | 416.0 | 412.9 | 3.5 | 82.1 | 293.8 | 33.6 | 3.1 | 51.0 |
| | Sabroso | 460.0 | 447.7 | 0.0 | 10.1 | 399.5 | 38.1 | 12.3 | |
| | Vaquero | 689.9 | 683.4 | 8.3 | 141.5 | 512.9 | 20.6 | 6.6 | 42.9 |
| | Montero | 609.2 | 599.7 | 18.7 | 177.0 | 387.1 | 17.0 | 9.5 | 37.2 |
| | NUN4003 | 630.3 | 623.3 | 8.7 | 170.4 | 417.1 | 27.0 | 7.1 | 41.0 |
| | NUN4004 | 664.6 | 660.3 | 18.8 | 208.5 | 413.6 | 19.5 | 4.2 | 37.7 |
| Bejo | Talon | 483.9 | 475.2 | 0.0 | 14.3 | 417.1 | 43.8 | 8.7 | |
| | Average | 564.8 | 557.5 | 8.3 | 114.8 | 405.9 | 28.5 | 7.3 | 42.0 |
| August 10 | | | | | | | | | |
| Nunhems | Arcero | 586.5 | 583.7 | 31.2 | 193.6 | 326.6 | 32.3 | 2.8 | 42.3 |
| | Sabroso | 596.9 | 589.5 | 0.0 | 94.4 | 455.6 | 39.4 | 7.4 | |
| | Vaquero | na* | na* | na* | na* | na* | na* | na* | |
| | Montero | 863.6 | 857.5 | 145.2 | 415.3 | 281.1 | 16.0 | 6.1 | 33.3 |
| | NUN4003 | 783.8 | 777.4 | 109.7 | 285.2 | 364.2 | 18.2 | 6.4 | 30.7 |
| | NUN4004 | 770.7 | 762.3 | 44.3 | 363.9 | 341.2 | 12.9 | 8.4 | 32.4 |
| Bejo | Talon | 603.3 | 595.6 | 0.0 | 63.8 | 501.3 | 30.5 | 7.7 | |
| | Average | 700.8 | 694.3 | 55.1 | 236.0 | 378.3 | 24.9 | 6.5 | 34.7 |
| Average over dates | | | | | | | | | |
| Nunhems | Arcero | 476.7 | 470.6 | 11.6 | 96.3 | 330.6 | 32.1 | 6.1 | 44.1 |
| | Sabroso | 487.8 | 474.6 | 0.0 | 34.9 | 394.7 | 45.1 | 13.2 | |
| | Vaquero | 650.5 | 642.1 | 13.0 | 103.9 | 500.4 | 24.8 | 8.4 | 41.7 |
| | Montero | 685.4 | 675.7 | 56.0 | 221.3 | 375.3 | 23.1 | 9.7 | 35.6 |
| | NUN4003 | 678.5 | 668.8 | 46.3 | 179.8 | 414.7 | 28.0 | 9.6 | 35.7 |
| | NUN4004 | 688.3 | 676.4 | 24.4 | 219.5 | 413.4 | 19.2 | 11.8 | 34.6 |
| Bejo | Talon | 513.4 | 505.2 | 0.0 | 27.2 | 432.0 | 46.0 | 8.2 | |
| | LSD (0.05) Variety | | 47.3 | 13.4 | 55.3 | 44.7 | 10.1 | NS | NS |
| LSD (0.05) Date | | | NS | NS | 25.2 | NS | 7.4 | 4.2 | NS |
| LSD (0.05) Variety X Date | | | NS | 24.5 | 66.7 | 73.7 | NS | NS | NS |

*na: Vaquero from the August 10 harvest was not available due to a shortage of sets.

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

| Company | Variety | Multiple center | | | Single center | |
|---------------------------|---------|-----------------|-----------------|-----------------|-------------------------|-----------------|
| | | Large | Medium | Small | Functional ^a | Single |
| ----- % ----- | | | | | | |
| July 27 | | | | | | |
| Nunhems | Arcero | 4.8 | 6.4 | 1.6 | 88.8 | 87.2 |
| | Sabroso | 2.4 | 15.2 | 6.4 | 82.4 | 76.0 |
| | Vaquero | 15.1 | 29.4 | 0.8 | 55.5 | 54.7 |
| | Montero | 5.6 | 13.6 | 2.4 | 80.8 | 78.4 |
| | NUN4003 | 25.6 | 40.8 | 1.6 | 33.6 | 32.0 |
| | NUN4004 | 18.7 | 25.3 | 3.3 | 56.0 | 52.6 |
| Bejo | Talon | 3.2 | 24.0 | 2.4 | 72.8 | 70.4 |
| Average | | 10.8 | 22.1 | 2.6 | 67.1 | 64.5 |
| August 3 | | | | | | |
| Nunhems | Arcero | 2.4 | 12.0 | 5.6 | 85.6 | 80.0 |
| | Sabroso | 5.6 | 16.0 | 7.2 | 78.4 | 71.2 |
| | Vaquero | 28.8 | 25.6 | 4.0 | 45.6 | 41.6 |
| | Montero | 8.0 | 21.6 | 4.0 | 70.4 | 66.4 |
| | NUN4003 | 38.2 | 31.0 | 0.8 | 30.9 | 30.1 |
| | NUN4004 | 17.6 | 21.6 | 0.8 | 60.8 | 60.0 |
| Bejo | Talon | 6.4 | 33.6 | 4.0 | 60.0 | 56.0 |
| Average | | 15.3 | 23.1 | 3.8 | 61.7 | 57.9 |
| August 10 | | | | | | |
| Nunhems | Arcero | 8.8 | 12.0 | 3.2 | 79.2 | 76.0 |
| | Sabroso | 6.4 | 31.2 | 7.2 | 62.4 | 55.2 |
| | Vaquero | na ^b | na ^b | na ^b | na ^b | na ^b |
| | Montero | 6.4 | 17.6 | 4.8 | 76.0 | 71.2 |
| | NUN4003 | 56.8 | 21.6 | 0.8 | 21.6 | 20.8 |
| | NUN4004 | 24.8 | 24.0 | 5.6 | 51.2 | 45.6 |
| Bejo | Talon | 14.4 | 46.0 | 7.7 | 39.6 | 31.9 |
| Average | | 17.1 | 22.6 | 4.2 | 60.3 | 56.1 |
| Average over dates | | | | | | |
| Nunhems | Arcero | 5.3 | 10.1 | 3.5 | 84.5 | 81.1 |
| | Sabroso | 4.8 | 20.8 | 6.9 | 74.4 | 67.5 |
| | Vaquero | 18.6 | 23.9 | 2.0 | 57.5 | 55.5 |
| | Montero | 6.7 | 17.6 | 3.7 | 75.7 | 72.0 |
| | NUN4003 | 40.2 | 31.1 | 1.1 | 28.7 | 27.6 |
| | NUN4004 | 20.4 | 23.6 | 3.2 | 56.0 | 52.7 |
| Bejo | Talon | 8.0 | 34.5 | 4.7 | 57.5 | 52.8 |
| LSD (0.05) Variety | | 5.0 | 9.1 | 3.1 | 9.3 | 10.6 |
| LSD (0.05) Date | | 2.8 | NS | NS | NS | 6.9 |
| LSD (0.05) Variety X Date | | 7.4 | 14.6 | NS | 17.2 | 18.2 |

^asingle center plus small multiple center.

^bna: Vaquero from the August 10 harvest was not available due to a shortage of sets.

Table 3. Bolting and maturity at harvest, and bulb quality 2 weeks after harvest for seven onion varieties grown from sets 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 | Arcero | 0.8 | 0.0 | 0.8 | 22.1 | 0.0 | 0.9 | 23.0 |
| | Sabroso | 0.5 | 0.0 | 0.5 | 21.3 | 2.7 | 5.3 | 29.3 |
| | Vaquero | 3.7 | 6.0 | 3.7 | 15.8 | 1.0 | 0.0 | 16.8 |
| | Montero | 2.3 | 2.0 | 2.3 | 2.9 | 0.0 | 0.0 | 2.9 |
| | NUN4003 | 11.0 | 6.0 | 11.0 | 0.0 | 3.7 | 0.0 | 3.7 |
| | NUN4004 | 3.4 | 6.0 | 3.4 | 0.9 | 0.9 | 0.0 | 1.8 |
| Bejo | Talon | 0.2 | 2.0 | 0.2 | 0.9 | 6.4 | 0.0 | 7.4 |
| | Average | 3.1 | 3.1 | 3.1 | 9.1 | 2.1 | 0.9 | 12.1 |
| August 3 | | | | | | | | |
| Nunhems | Arcero | 1.0 | 4.0 | 1.0 | 5.1 | 16.3 | 0.0 | 21.4 |
| | Sabroso | 0.6 | 6.0 | 0.6 | 0.9 | 14.8 | 0.9 | 16.5 |
| | Vaquero | 4.0 | 8.0 | 4.0 | 0.9 | 8.2 | 0.9 | 10.0 |
| | Montero | 2.5 | 6.0 | 2.5 | 0.0 | 5.7 | 0.0 | 5.7 |
| | NUN4003 | 11.8 | 12.0 | 11.8 | 0.0 | 5.2 | 0.0 | 5.2 |
| | NUN4004 | 3.6 | 10.0 | 3.6 | 0.0 | 0.8 | 0.0 | 0.8 |
| Bejo | Talon | 0.3 | 10.0 | 0.3 | 0.0 | 1.7 | 0.0 | 1.7 |
| | Average | | 8.0 | 3.4 | 1.0 | 7.5 | 0.3 | 8.8 |
| August 10 | | | | | | | | |
| Nunhems | Arcero | 1.1 | 22.0 | 1.1 | 1.9 | 8.6 | 0.0 | 10.6 |
| | Sabroso | 0.7 | 20.0 | 0.7 | 0.0 | 6.7 | 1.1 | 7.8 |
| | Vaquero | na* | na* | na* | na* | na* | na* | na* |
| | Montero | 2.3 | 24.0 | 2.3 | 0.0 | 4.0 | 1.0 | 5.0 |
| | NUN4003 | 12.0 | 24.0 | 12.0 | 0.0 | 2.0 | 0.0 | 2.0 |
| | NUN4004 | 3.8 | 24.0 | 3.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| Bejo | Talon | 0.5 | 24.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Average | 3.4 | 23.0 | 3.4 | 0.6 | 3.6 | 0.3 | 4.5 |
| Average over dates | | | | | | | | |
| Nunhems | Arcero | 0.96 | 8.7 | 1.0 | 9.7 | 8.3 | 0.3 | 18.3 |
| | Sabroso | 0.58 | 8.7 | 0.6 | 7.4 | 8.1 | 2.4 | 17.9 |
| | Vaquero | 3.86 | 7.0 | 3.9 | 6.4 | 4.3 | 0.3 | 11.0 |
| | Montero | 2.36 | 10.7 | 2.4 | 1.0 | 3.2 | 0.3 | 4.5 |
| | NUN4003 | 11.60 | 14.0 | 11.6 | 0.0 | 3.6 | 0.0 | 3.6 |
| | NUN4004 | 3.61 | 13.3 | 3.6 | 0.3 | 0.6 | 0.0 | 0.9 |
| Bejo | Talon | 0.33 | 12.0 | 0.3 | 0.3 | 2.7 | 0.0 | 3.0 |
| LSD (0.05) Variety | | 1.5 | 6.6 | 3.1 | | | | |
| LSD (0.05) Date | | 0.2 | 2.9 | 2.0 | | | | |
| LSD (0.05) Variety X Date | | NS | NS | NS | | | | |

*na: Vaquero from the August 10 harvest was not available due to a shortage of sets.

Table 4. Yield and grade of onion variety Talon grown from sets, 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 #/50 lb | Small | Neck rot cwt/acre | Plate rot | Total rot % | |
|---------|---------|-------------|---------------------------|--------------------|---------|--------|----------------------------------|-------|----------------------|-----------|----------------|---------|
| | | | Total | >4¼ in cwt/acre | 4-4¼ in | 3-4 in | | | | | | 2¼-3 in |
| Bejo | Talon | 580.5 | 464.0 | 5.0 | 110.3 | 333.9 | 14.8 | 36.1 | 5.9 | 80.9 | 47.3 | 19.0 |

Table 5. Bulb single centers for onion variety Talon grown from sets, 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 ^a % | Single | | |
| Bejo | Talon | 4.0 | 33.6 | 38.4 | 62.4 | 24.0 | 4.4 | 88.0 |

^asingle center plus small multiple center.