ONION PRODUCTION FROM TRANSPLANTS IN THE TREASURE VALLEY

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Introduction

The objective of this trial was to evaluate whether yellow, white, and red onion varieties planted as transplants would have adequate bulb yield and quality when grown in the Treasure Valley.

Methods

The 2003 trial was conducted on an Owyhee silt loam with 1.2 percent organic matter and a pH of 7.4. The field had previously been planted to wheat. In the fall of 2002, the wheat stubble was shredded, and the field was disked, irrigated, ripped, moldboard-plowed, roller-harrowed, fumigated with Telone C-17 at 20 gal/acre, and bedded. Soil analysis indicated the need for 100 lb P_2O_5/acre, 150 lb K /acre, 6 lb Mn/acre, 2 lb Cu/acre, and 1 lb B/acre, which was broadcast in the fall.

Onion seed of 19 varieties was planted in flats with a vaccum seeder at 72 seeds/flat on January 30, 2003. 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 until emergence on February 7. On March 18 and 19 the seedlings were transplanted to the field. The seedlings were manually planted in double rows on 22-inch beds. The spacing between plants in each single row was 6 inches, equivalent to 95,000 plants per acre. The seedlings had one to two true leaves at the time of transplanting. The field was furrow irrigated on March 20. Plots of each variety were 20 ft long by four double rows wide arranged in a randomized complete block design with four replicates.

The onions were managed to avoid yield reductions from nutrient and irrigation deficiencies, weeds, pests, and diseases. The field had 100 lb N/acre applied on April 22 as water-run urea during an irrigation. Weeds were controlled with an application of Goal at 0.12 lb ai/acre, Buctril at 0.12 lb ai/acre, Poast at 0.38 lb ai/acre on April 16, and Prowl at 1 lb ai/acre on May 22. After lay-by the field was hand weeded as necessary. Thrips were controlled with one aerial application of Warrior on June 5 and two aerial applications of Warrior and Lannate (July 16 and August 4). Warrior was applied at 0.03 lb ai/acre and Lannate was applied at 0.4 lb ai/acre.

The trial was furrow irrigated when the soil water potential at 8-inch depth reached -20 kPa. Soil water potential was monitored by six granular matrix sensors (GMS,

Watermark Soil Moisture Sensors Model 200SS, Irrometer Co., Riverside, CA) installed on June 10 below the onion row at 8-inch depth. Sensors were automatically read three times a day with an AM-400 meter (Mike Hansen Co., East Wenatchee, WA).

On July 9 and again on July 22, 9.5 ft of the middle two rows in each plot were topped and bagged. Decomposed bulbs were not bagged. The onions were put in a barn at room temperature for 3 days. After 3 days the onions were graded. Bulbs were separated according to quality: bulbs without blemishes (No. 1s), split bulbs (No. 2s), neck rot (bulbs infected with the fungus *Botrytis allii* in the neck or side), plate rot (bulbs infected with the fungus *Fusarium oxysporum*), and black mold (bulbs infected with the fungus *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 supercolossal onions were determined for each plot of every variety by weighing and counting all super colossal bulbs during grading. Varietal differences were compared using ANOVA and protected least significant differences at the 5 percent probability level, LSD (0.05).

A subjective evaluation of exterior bulb quality (sprouting, bulb shape, softness, and appearance) was made soon after grading for bulbs from all plots. Ten randomly chosen bulbs from each plot from the July 22 harvest were shipped on August 1 via UPS ground to Vidalia Labs International in Collins, GA. The bulb samples were analyzed for pyruvic acid content on August 11. Bulb pyruvic acid content is a measure of pungency with the unit being micro mols pyruvic acid per gram of fresh weight. Onion bulbs having a pyruvate concentration of 5.5 or less are considered sweet according to Vidalia Labs sweet onion certification specifications.

On August 22 the onion bulbs were rated for single centers. The onions from each plot 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 double" had diameters <1½ inch, "intermediate double" had diameters from 1½ to 2¼ inches, and "blowout" had diameters >2¼ inches. Single-centered onions were classed as a "bullet". Onions were considered functionally single centered for processing if they were a "bullet" or "small double".

Results

Plant establishment was very good. There were no significant differences in plant population between varieties in 2003 (Tables 1 and 2). Plant population averaged 88,000 plants per acre at harvest.

On July 9, total yields ranged from 910 cwt/acre for 'XON-0101' to 523 cwt/acre for 'Everest' (Table 1). Variety XON-0101 had the highest total yield on July 9. The super colossal yields of varieties XON-0101, 'Candy', 'T-803', 'XON-0103', 'Stanza', 'EX6876', and 'Rumba' were among the highest on July 9. Varieties 'Electric', 'Alabaster', Rumba,

Stanza, and T-803 were among the best in total exterior bulb quality rating for the July 9 harvest (Table 3).

On July 23, total yields ranged from 1,186 cwt/acre for XON-0101 to 170 cwt/acre for Everest (Table 2). Varieties XON-0101 and 'Renegade' had the highest super colossal yields on July 23. Total exterior bulb quality rating for the July 23 harvest ranged from 5 for Rumba to 12 for 'Mesquite' (Table 3).

'Cometa' had the highest percentage of "bullet" single-centered bulbs (Table 4). Cometa and 'Ranchero' had the highest percentage of functionally single-centered bulbs.

Varieties Renegade, Rumba, Electric, Stanza, 'Golden Spike', and 'Dawn' had bulb pyruvate concentrations low enough (< 5.5) to be classified as sweet onions (Table 4). Renegade had the lowest pyruvate concentration.

Transplanted onions were more productive in 2003 than in 2002 (Table 5). Plant populations were lower in 2002, possibly because of very cold weather immediately after transplanting. Varieties Candy and Renegade were among the highest yielding of marketable bulbs and super colossal bulbs in both 2002 and 2003. The pyruvate concentration of Renegade was among the lowest in 2002 (Table 6) and was the lowest in 2003.

Discussion

Growing onions for transplant produced early high yields. Onion quality was adequate for marketing some of the varieties and lines tested. The costs and returns of transplanting for early harvest were not thoroughly examined, so the economic viability of the practice is unknown. Promising varieties such as Renegade might require special handling for successful harvest and packing. The ideal date to start seedlings in the greenhouse was not determined. An earlier date in January might be beneficial.

Vidalia Labs suggested that onions be shipped overnight as soon as harvest was completed, so that bulb pyruvate would not increase between harvest and analysis. Instead we chose to have the bulbs evaluated 2 weeks after harvest after shipping by ground, a realistic time interval between bulb harvest and delivery to a retail outlet or end user.

Table 1. Performance data for experimental and commercial onion varieties grown from transplants and harvested on July 9, 2003, Malheur Experiment Station, Oregon State University, Ontario, OR.

			Total	Marketable yield by grade							Plant
		Bulb	yield	Total	>4¼ in	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	Small	population
Company	Variety	color	--- cwt/acre ---		#/50 lb	---------- cwt/acre ----------					plants/acre
American Takii	T-803	Y	819.4	817.5	40	49.4	203.9	553.9	10.3	2.0	89,613
Bejo	Electric	R	574.0	573.6	0	0.0	11.0	513.8	48.8	0.4	82,274
	Stanza	Y	811.2	809.5	34	40.8	316.0	440.3	12.4	1.7	84,652
Crookham	XPH97H27	Y	638.4	632.7	52	14.8	38.3	559.1	15.9	4.7	88,993
D. Palmer	Mesquite	Y	579.3	573.0	46	16.9	23.5	480.4	52.2	6.2	89,303
	Tequila	Y	557.5	553.0	44	3.5	7.1	496.2	46.2	4.5	86,822
Sakata	XON-0101	Y	910.3	905.5	46	63.9	391.3	442.1	8.1	4.9	91,784
	XON-0103	Y	765.6	765.4	54	48.4	212.9	496.8	7.3	0.1	87,442
Shamrock	Dawn F1	Y	797.7	797.7	43	26.5	246.3	514.1	10.9	0.0	86,202
Seminis	Candy	Y	833.3	830.5	45	57.9	312.1	457.1	3.4	2.8	87,132
	Golden Spike	Y	740.3	738.2	54	29.2	92.0	589.9	27.1	2.2	92,714
	Santa Fe	Y	663.3	661.9	73	2.8	73.0	561.2	24.9	1.4	88,476
	EX 6876	Y	781.9	780.5	44	35.1	210.5	530.4	4.4	1.4	87,753
Sunseeds	Alabaster	W	667.2	664.4	55	5.9	99.1	547.1	12.2	2.9	83,411
	Cometa	W	552.5	538.8	151	1.0	15.3	476.4	46.1	13.6	87,132
	Ranchero	Y	622.3	614.5	56	8.3	48.4	513.1	44.6	7.8	90,233
	Renegade	Y	744.4	741.4	51	29.8	228.5	474.8	8.2	3.1	85,272
	Rumba	R	660.4	654.7	47	34.6	63.4	510.1	46.8	5.7	90,543
US Agriseeds	Everest	W	523.2	513.4	0	0.0	13.4	461.4	38.7	9.8	83,928
Average			697.0	693.0	49.3	24.7	137.2	506.2	24.7	4.0	87,562
LSD (0.05)			70.7	72.3	13	33.4	77.0	83.9	18.4	5.9	ns

Table 2. Performance data for experimental and commercial onion varieties grown from transplants and harvested on July 22, 2003, Malheur Experiment Station, Oregon State University, Ontario, OR.

		Total	Marketable yield by grade								Plant
		yield	Total	>4¼ in	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	Small	Rot	population
Company	Variety	--- cwt/acre ---		#/50 lb	---------- cwt/acre ----------						plants/acre
American Takii	T-803	909.8	908.4	31	50.8	355.7	490.5	11.3	0.0	1.4	91,669
Bejo	Electric	645.5	639.7	0	0.0	69.5	543.4	26.8	2.6	3.2	91,018
	Stanza	1,007.7	1,004.7	30	190.7	511.6	298.9	3.5	1.1	1.9	86,517
Crookham	XPH97H27	871.5	867.0	29	47.2	354.6	457.1	8.1	2.3	2.2	94,176
D. Palmer	Mesquite	762.2	756.0	29	51.5	295.8	398.7	10.1	1.4	4.8	91,627
	Tequila	835.2	828.1	36	20.9	325.2	471.0	10.9	4.3	2.8	91,836
Sakata	XON-0101	1,186.5	1,183.8	30	347.4	629.9	201.6	4.9	1.0	1.7	91,780
	XON-0103	1,089.0	1,087.8	31	255.9	511.9	315.8	4.2	0.0	1.2	88,393
Shamrock	Dawn F1	1,016.1	1,012.4	29	98.7	497.3	408.0	8.5	1.9	1.8	91,998
Seminis	Candy	1,112.6	1,109.1	30	200.3	565.1	339.5	4.1	1.4	2.1	92,920
	Golden Spike	966.4	962.7	32	93.7	433.6	430.2	5.2	2.4	1.3	91,540
	Santa Fe	865.6	863.0	33	109.7	463.4	285.1	4.9	0.1	2.5	78,218
	EX 6876	985.8	980.1	32	200.2	517.6	258.8	3.5	2.9	2.8	86,213
Sunseeds	Alabaster	771.4	763.2	30	17.2	251.2	480.9	14.0	4.7	3.5	88,973
	Cometa	806.9	802.1	34	35.5	281.8	470.8	13.9	1.9	2.9	91,844
	Ranchero	944.9	942.4	32	70.7	459.3	400.3	12.1	0.2	2.3	92,072
	Renegade	1,027.2	1,023.5	30	269.8	504.8	239.8	9.2	1.0	2.6	89,833
	Rumba	853.9	845.0	30	16.1	319.9	501.5	7.5	8.2	0.7	87,193
US Agriseeds	Everest	169.5	158.3	0	0.0	12.1	134.5	11.7	0.0	11.3	77,467
Average		885.7	880.9	28	109.3	387.4	375.1	9.2	2.0	3.0	89,226
LSD (0.05)		120.7	122.0	3	88.8	120.1	113.7	ns	ns	2.6	ns

Table 3. Subjective rating of exterior bulb quality: 0-10, 1 = least and 10 = most for sprouting, torpedo shape, and softness; 1 = best and 10 = worst for appearance; 1 = best and 10 = worst for total subjective rating; Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

	July 9 harvest					July 22 harvest				
Variety	Sprouting	Torpedo shape	Softness	Appear.	Total	Sprouting	Torpedo shape	Softness	Appear.	Total
T-803	1.0	4.0	2.0	2.8	9.8	1.0	2.5	1.3	1.8	6.5
Electric	1.0	2.0	1.0	2.0	6.0	1.0	1.0	1.3	2.0	5.3
Stanza	1.0	2.8	2.8	2.5	9.0	1.0	1.5	1.3	1.5	5.3
XPH97H27	5.5	6.8	5.0	6.3	23.5	2.5	3.3	1.7	3.3	11.0
Mesquite	6.5	7.3	5.8	7.0	26.5	3.3	3.5	2.0	3.5	12.3
Tequila	5.3	5.8	5.0	6.0	22.0	2.5	3.0	1.8	3.0	10.3
XON-0101	1.3	3.5	2.5	3.0	10.3	1.0	2.0	1.5	1.5	6.0
XON-0103	2.8	5.5	4.5	4.8	17.5	1.3	3.3	1.8	2.5	8.8
Dawn F1	2.0	3.5	2.0	2.8	10.3	1.5	2.5	1.5	2.0	7.5
Candy	1.0	3.0	5.5	3.8	13.3	1.0	1.3	2.5	1.0	5.8
Golden Spike	2.3	5.3	4.8	4.8	17.0	1.0	3.0	1.3	2.3	7.5
Santa Fe	4.3	4.7	5.7	4.7	19.3	2.7	2.7	2.3	3.0	10.7
EX 6876	2.0	4.0	3.3	3.5	12.8	1.3	2.0	2.0	1.5	6.8
Alabaster	1.3	3.0	2.0	2.3	8.5	1.3	2.0	1.0	2.0	6.3
Cometa	2.5	5.0	3.5	4.0	15.0	1.3	2.3	1.3	2.5	7.3
Ranchero	5.0	6.0	4.5	5.3	20.8	1.3	2.5	2.0	2.3	8.0
Renegade	1.0	3.3	3.5	3.3	11.0	1.0	2.0	2.3	2.0	7.3
Rumba	1.0	2.7	2.3	2.7	8.7	1.0	1.3	1.0	1.7	5.0
Everest	1.0	3.0	1.7	3.7	9.3	1.0	1.7	1.3	5.7	9.7
Average	2.5	4.3	3.5	3.9	14.2	1.5	2.3	1.6	2.4	7.7
LSD (0.05)	1.5	1.6	1.5	1.4	4.3	0.9	1.2	ns	1.2	2.5

Table 4. Pyruvate concentration on August 11, 2003 in bulbs from July 22 harvest, and multiple center rating, Malheur Experiment Station, Oregon State University, Ontario, OR.

Company	Entry name	Pyruvate concentration	"Blowout"	"Intermediate double"	"Small double"	"Bullet"	Functionally single centered "small double + bullet"
		µmoles/g FW	---------- % ----------				
American Takii	T-803	5.7	5.0	36.0	55.0	4.0	59.0
Bejo	Electric	5.0	70.7	24.0	4.0	1.3	5.3
	Stanza	5.3	59.0	28.0	12.0	1.0	13.0
Crookham	XPH97H27	5.8	27.0	33.0	21.0	19.0	40.0
D. Palmer	Mesquite		24.0	48.0	11.0	17.0	28.0
	Tequila		15.0	33.0	17.0	35.0	52.0
Sakata	XON-0101	5.9	27.0	39.0	33.0	1.0	34.0
	XON-0103	5.7	31.0	41.0	17.0	11.0	28.0
Shamrock	Dawn F1	5.4	34.0	34.0	29.0	3.0	32.0
Seminis	Candy	6.0	18.0	47.0	28.0	7.0	35.0
	Golden Spike	5.3	22.0	22.0	38.0	18.0	56.0
	Santa Fe	6.0	10.7	26.7	28.0	34.7	62.7
	EX 6876		17.0	39.0	26.0	18.0	44.0
Sunseeds	Alabaster	6.1	27.0	44.0	28.0	1.0	29.0
	Cometa	5.6	2.0	2.0	11.0	85.0	96.0
	Ranchero	5.7	6.0	12.0	47.0	35.0	82.0
	Renegade	3.9	17.0	51.0	28.0	4.0	32.0
	Rumba	4.8	25.3	36.0	32.0	6.7	38.7
US Agriseeds	Everest		38.7	21.3	29.3	10.7	40.0
Average		5.5	25.1	32.5	26.0	16.4	42.5
LSD (0.05)		0.6	14.1	19.2	16.4	9.4	14.6

Table 5. Performance data for experimental and commercial onion varieties grown from transplants and harvested on July 23, 2002 and July 22, 2003, Malheur Experiment Station, Oregon State University, Ontario, OR.

		Marketable yield by grade								
	Total yield	Total	>4¼ in	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	Small	Rot	Plant population
Variety	--- cwt/acre ---		#/50 lb	---------- cwt/acre ----------						plants/acre
2002										
XPH97H27	748.5	719.9	33.0	74.2	286.8	320.7	38.2	28.6		68,310
Candy	982.1	973.8	25.7	251.9	424.4	293.8	3.7	8.3		76,230
Santa Fe	794.2	794.2	30.4	196.7	322.6	222.2	52.6	0.0		63,360
Alabaster	549.9	549.9	0.0	0.0	186.2	352.8	10.9	0.0		73,920
Cometa	709.5	677.6	35.7	55.7	201.7	368.3	52.0	31.9		66,330
Ranchero	921.4	921.4	29.1	102.4	327.9	417.2	74.0	0.0		79,200
Renegade	962.5	955.5	27.3	234.0	422.4	285.5	13.5	7.0		72,270
Rumba	742.2	582.2	23.4	42.3	241.7	424.4	33.8	0.0		73,260
Average	801.3	771.8	29.2	136.8	301.7	335.6	34.8	9.5		71,610
LSD (0.05) Variety	ns	ns	16.2	117.3	ns	173.0	48.2	ns		ns
2003										
XPH97H27	871.5	867.0	29.0	47.2	354.6	457.1	8.1	2.3	2.2	94,176
Candy	1,112.6	1,109.1	30.0	200.3	565.1	339.5	4.1	1.4	2.1	92,920
Santa Fe	865.6	863.0	33.0	109.7	463.4	285.1	4.9	0.1	2.5	78,218
Alabaster	771.4	763.2	30.0	17.2	251.2	480.9	14.0	4.7	3.5	88,973
Cometa	806.9	802.1	34.0	35.5	281.8	470.8	13.9	1.9	2.9	91,844
Ranchero	944.9	942.4	32.0	70.7	459.3	400.3	12.1	0.2	2.3	92,072
Renegade	1,027.2	1,023.5	30.0	269.8	504.8	239.8	9.2	1.0	2.6	89,833
Rumba	853.9	845.0	30.0	16.1	319.9	501.5	7.5	8.2	0.7	87,193
Average	906.8	901.9	30.9	95.8	400.0	396.9	9.2	2.5	2.3	89,403
LSD (0.05) Variety	120.7	122.0	3.0	88.8	120.1	113.7	ns	ns	2.6	ns
LSD (0.05) Year	84.1	82.0	4.3	ns	54.9	ns	12.3	ns		8,149

Table 6. Bulb pyruvate concentration on August 7, 2002 in bulbs from July 23, 2002 harvest and multiple center rating, Malheur Experiment Station, Oregon State University, Ontario, OR.

			Onion multiple center rating				
Company	Variety	Pyruvate concentration	"Blowout"	"Intermediate double"	"Small double"	"Bullet"	Functionally single centered "small double + bullet"
		µmoles/g FW	---------- % ----------				
Petoseed	Candy	6.3	9.7	32.7	31.4	26.1	57.6
Sunseeds	SR4000ON	7.1	1.8	9.1	52.1	37.1	89.1
	Renegade	5.4	7.3	34.4	20.8	37.5	58.3
	Ranchero	6.2	0.0	0.0	0.0	100.0	100.0
	Alabaster	7.2	3.0	41.1	47.8	8.0	55.8
	La Nina	7.9	1.6	23.1	33.0	42.3	75.3
	SRO-1403	5.9	0.0	3.6	15.5	81.0	96.4
	Cometa	5.4	0.0	0.0	0.0	100.0	100.0
	Rumba	4.7	2.3	35.7	38.9	23.1	62.0
Average		6.2	2.9	20.0	26.6	50.6	77.2
LSD (0.05)		1.1	9.2	14.9	14.8	14.0	17.3