

## 2008 ONION VARIETY TRIALS

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### Introduction

The objective of the onion variety trials was to evaluate yellow, white, and red onion varieties for disease, maturity, bolting, single centers, and bulb yield and grade out of storage. Four early-season yellow varieties were planted in March and were harvested and graded at the end of August. Forty-six full-season varieties and 4 early-maturing varieties (42 yellow, 4 red, and 4 white) were planted in March, harvested in September 2008, and graded out of storage in January 2009. Each year, growers and seed industry representatives have the opportunity to examine the varieties at our annual Onion Variety Field Day in late August and during onion grading in early January. Varieties are evaluated for yield, grade, internal quality, and storability.

### Methods

The onions were grown on an Greenleaf silt loam previously planted to wheat. In the fall of 2007 the wheat stubble was shredded and the field was irrigated and disked. Soil analysis indicated the need for 100 lb phosphate ( $P_2O_5$ )/acre, 109 lb sulfur (S)/acre, 7 lb manganese (Mn)/acre, and 5 lb zinc (Zn)/acre, which were broadcast in the fall of 2007 after disking. The field was then moldboard-plowed, groundhogged, roller-harrowed, fumigated with Telone<sup>®</sup> C-17 at 20 gal/acre, and bedded.

The full-season trial and the early-maturing trial were planted on March 18, adjacent to each other, and in plots 4 double rows wide and 27 ft long. The early maturing trial had 4 varieties from 2 seed companies (Table 1) and the full-season trial had 46 varieties from 8 seed companies (Table 3). The experimental designs for both trials were randomized complete blocks with five replicates. A sixth nonrandomized replicate was planted for demonstrating onion variety performance to growers and seed company representatives.

Seed was planted in double rows spaced 3 inches apart at 9 seeds/ft of single row. Each double row was planted on beds spaced 22 inches apart. Planting was done with

customized John Deere Flexi Planter units equipped with disc openers. The onion rows received 3.7 oz of Lorsban 15G<sup>®</sup> per 1,000 ft of row (0.82 lb ai/acre), and the soil surface was rolled on March 19. Onion emergence started on April 14. On May 21, alleys 4 ft wide were cut between plots, leaving plots 23 ft long. From May 22 through May 23, the seedlings were hand thinned to a plant population of 2 plants/ft of single row (6-inch spacing between individual onion plants, or 95,000 plants/acre).

The onions were managed to minimize yield reductions from weeds, pests, diseases, water stress, and nutrient deficiencies. Weeds were controlled with an application of Roundup<sup>®</sup> at 1 lb ai/acre on April 1 prior to onion emergence. On April 28, Prowl H<sub>2</sub>O<sup>®</sup> at 0.95 lb ai/acre and Select<sup>®</sup> at 0.125 lb ai/acre were applied for weed control. On May 13, Goal<sup>®</sup> at 0.16 lb ai/acre, Buctril<sup>®</sup> at 0.19 lb ai/acre, and Volunteer<sup>®</sup> at 0.25 lb ai/acre were applied for weed control. Goal at 0.16 lb ai/acre and Buctril at 0.19 lb ai/acre were again applied on May 16. On June 12, Aza-Direct<sup>®</sup> at 0.0062 lb ai/acre and Success<sup>®</sup> at 0.25 lb ai/acre were applied for thrips control, and Volunteer at 0.13 lb ai/acre was applied for weed control. On June 18, Goal at 0.22 lb ai/acre and Buctril at 0.19 lb ai/acre were applied for weed control. Aza-Direct at 0.0062 lb ai/acre and Success at 0.25 lb ai/acre were applied for thrips control on June 19 and on June 24. Subsequent insecticide applications for thrips control were done aerially: July 12, Lannate<sup>®</sup> at 0.9 lb ai/acre; July 19, Carzol<sup>®</sup> at 1.15 lb ai/acre; July 28 and August 3, Lannate at 0.9 lb ai/acre. On July 23, grass weeds were spot sprayed with a backpack sprayer containing a 1.5 percent v/v solution of Poast<sup>®</sup>.

The trial was furrow irrigated when the soil water tension at 8-inch depth reached 25 cb (1 cb = 1 kPa) (Shock et al. 2005). Starting in mid-June, 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 last irrigation was on August 27.

The field was sidedressed with urea at 100 lb nitrogen (N)/acre on June 4 and again on June 25.

Onions in each plot were evaluated subjectively for maturity by visually rating the percentage of onions with the tops down and the percent dryness of the foliage. The percent maturity was calculated as the average percentage of onions with tops down and the percent dryness. The early-maturing trial was evaluated for maturity on August 18 and the full-season trial was evaluated on August 19. The number of bolted onion plants was counted in each plot.

Onions in each plot of the full-season trial were evaluated subjectively for severity of symptoms of iris yellow spot virus (IYSV) on August 19. Twenty consecutive plants in one of the two middle rows in each plot were rated. Each plant was given a rating on a scale of 0 to 5 of increasing severity of symptoms, where the rating was 0 if there were no symptoms, 1 if 1-25 percent of foliage was diseased, 2 if 26-50 percent of foliage was diseased, 3 if 51-75 percent of foliage was diseased, 4 if 76-99 percent of foliage

was diseased, and 5 if 100 percent of foliage was diseased. Powdery mildew (*Leveillula taurica*) was not observed in this trial in 2008.

The level of IYSV in each variety was determined by analysis of leaf tissue with the double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA, Agdia, Inc., Elkhart, IN). Three leaf samples consisting of the first fully developed leaf from each of three plants in each plot were collected and shipped on September 3 to Hanu Pappu at Washington State University, Pullman for the IYSV analysis.

Thrips populations were determined for each variety by counting the number of thrips in each of 15 consecutive plants in a row for each plot on August 5.

At harvest, bulbs from one of the border rows in each plot of both trials were rated for single centers. Twenty-five consecutive onions ranging in diameter from 3.5 to 4.25 inches were rated. The onions 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 had diameters less than 1.5 inches, medium had diameters from 1.5 to 2.25 inches, and large had diameters greater than 2.25 inches. Onions were considered "functionally single centered" for processing if they were single centered or had a small multiple center.

Onions in the early-maturity trial were lifted on August 19. Onions from the middle two double rows in each plot in the early maturity trial were topped by hand and bagged on August 20. On August 27 these onions were graded.

The onions in the full-season trial were lifted on September 12 to field cure. Onions from the middle two rows in each plot of the full-season trial were topped by hand and bagged on September 17. The bags were put in storage on September 30. Precipitation on September 20, 21, and 22 totaled 1.25 inches. To reduce the risk of disease in storage, a propane heater was used to raise the air temperature in the storage shed to 85°F. When the air temperature reached 85°F, the heat was turned off. The storage shed was subsequently ventilated to maintain air temperature as close to 34°F as possible. Onions from the full-season trial were graded out of storage on January 13 and 14, 2009.

During grading, 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 (<2.25 inches), medium (2.25-3 inches), jumbo (3-4 inches), colossal (4-4.25 inches), and supercolossal (>4.25 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.

Varietal differences were compared using analysis of variance. Means separation was determined using Fisher's least significant difference test at the 5 percent probability

level, LSD (0.05). The varieties from each of the early maturity and full season trials were compared for yield, grade, internal quality, and disease expression. Results are listed in tables 1-4 in alphabetical order by company. The least significant difference LSD (0.05) values in each table should be considered when comparisons are made between varieties for significant differences in performance characteristics. Differences between varieties equal to or greater than the LSD value for a characteristic should exist before any variety is considered different from any other variety in that characteristic. Variety performance will vary by year. Growers are encouraged to review performance over a number of years before choosing a variety to plant.

## **Results**

### ***Early-Maturing Trial***

The percentage of single-centered bulbs averaged 29.8 percent and ranged from 10.4 percent for 'Renegade', to 64 percent for 'Montero' (Table 1). The percentage of onions that were functionally single centered averaged 44.2 percent and ranged from 20 percent for Renegade to 76 percent for Montero.

Total yield averaged 621.1 cwt/acre and ranged from 550.2 cwt/acre for Montero to 674.4 cwt/acre for 'Ovation' (Table 2). Ovation and Renegade were among the varieties with the highest total yield and marketable yield.

### ***Full-Season Trial***

The percentage of single-centered bulbs averaged 45.2 percent and ranged from 0.8 percent for 'T-433', to 92 percent for 'Ringleader' (Table 3). The percentage of onions that were functionally single centered averaged 61.4 percent and ranged from 5.6 percent for T-433 to 94.4 percent for 'Ruby Ring' and Ringleader. Ringleader, Ruby Ring, 'NUN7015ON', 'OLYX06-25', and 'OLYX00-23', had 90 percent or higher functionally single-centered bulbs.

Total yield out of storage averaged 709.4 cwt/acre and ranged from 324.5 cwt/acre for Ruby Ring to 1025.8 cwt/acre for 'Tequila06' (Table 4). Tequila06 had the highest total yield, followed by 'XON-550Y', 'Joaquin', and 'OLYS03-209'. Tequila06 had the highest marketable yield, followed by Joaquin, OLYS03-209, and 'Ranchero'. Supercolossal yield averaged 8.4 cwt/acre and ranged from 0 for numerous varieties to 47 cwt/acre for Tequila06. Tequila06 had the highest supercolossal yield followed by 'Evolution', OLYS03-209, OLYS05N5, and XON-550Y.

### ***Iris Yellow Spot Virus (IYSV)***

Iris yellow spot virus severity in 2008 was lower than in 2006, but higher than in 2007 and 2005. The average IYSV severity rating for 'Vaquero' in the variety trial has varied over the years; 1.1, 2.9, 0.6, and 1.4 in 2005, 2006, 2007, and 2008, respectively. In 2008, the subjective ratings of IYSV symptom severity for the full-season varieties, on a scale from 0 to 5, ranged from 0.88 for 'OLYS03-209' to 1.81 for 'Mercury' (Table 3).

### Powdery Mildew

Powdery mildew is a relatively recently discovered onion disease caused by the fungus *Leveillula taurica*. The symptoms are necrotic lesions on the leaf surface with occasional white powdery patches with irregular margins. Powdery mildew is not currently thought to result in economic losses because infestations are occurring very late in the season. At the Malheur Experiment Station, powdery mildew on onions was first noticed in late August of 2006 at very low levels on a few varieties. In 2007, the disease was first observed in mid-August. In 2008, powdery mildew symptoms were not observed in any of the onion varieties in this trial, but did occur elsewhere on the experiment station.

### References

Shock, C.C., R. Flock, E. Feibert, C.A. Shock, A. Pereira, and L. Jensen. 2005. Irrigation monitoring using soil water tension. Oregon State University Extension Service EM 8900.

Table 1. Maturity and bulb multiple center ratings for early maturing varieties, Malheur Experiment Station, Oregon State University, Ontario, OR, 2008.

Seed company	Variety	Bulb color	Maturity Aug. 18	Multiple center			Single center	
				large	medium	small	functional*	bullet
				----- % -----				
Nunhems	Renegade	Y	54	48.8	31.2	9.6	20.0	10.4
	Montero	Y	31	7.2	16.8	12.0	76.0	64.0
Sakata	Ovation	Y	25	30.4	32.0	18.4	37.6	19.2
	Spanish Medallion	Y	30	24.8	32.0	17.6	43.2	25.6
average			35.0	27.8	28.0	14.4	44.2	29.8
LSD (0.05)			5.7	13.0	NS	NS	13.8	16.2

\*bullet single center + small multiple center.

Table 2. Yield and grade performance of early maturing varieties, Malheur Experiment Station, Oregon State University, Ontario, OR, 2008.

Seed company	Variety	Bulb color	Total yield	Marketable yield by grade			Non-marketable yield			
				Total	4-4¼ in	3-4 in	2¼-3 in	Total rot	No. 2s	Small
				----- cwt/acre -----				%	-- cwt/acre --	
Nunhems	Renegade	Y	648.9	630.9	65.0	531.2	34.6	0.4	11.8	3.2
	Montero	Y	550.2	545.4	4.7	483.1	57.6	0.2	0.0	3.8
Sakata	Ovation	Y	674.4	667.4	33.3	592.9	41.2	0.5	0.0	3.6
	Spanish Medallion	Y	610.7	597.1	49.7	520.6	26.9	0.5	4.4	6.2
average			621.1	610.2	38.2	532.0	40.1	0.4	4.1	4.2
LSD (0.05)			NS	NS	39.1	NS	17.2	NS	8.1	NS

Table 3. Bulb multiple-center rating, iris yellow spot virus (IYSV) rating, and maturity for full-season varieties. Malheur Experiment Station, Oregon State University, Ontario, OR, 2008. Continued on next page.

Seed company	Variety	Bulb color	Multiple center			Single center		IYSV rating <sup>b</sup>	Maturity Aug. 19
			large	medium	small	functional <sup>a</sup>	bullet		
			----- % -----					0-5	%
A. Takii	Centerstone	Y	18.4	51.2	19.2	30.4	11.2	1.41	30.0
	T-433	Y	59.2	35.2	4.8	5.6	0.8	1.34	17.5
	Milestone	Y	14.4	36.8	31.2	48.8	17.6	1.75	41.0
	Ruby Ring	R	0.0	5.6	32.0	94.4	62.4	1.78	42.0
Bejo	Calibra	Y	44.0	38.4	12.0	17.6	5.6	1.69	39.0
	Crocket	Y	30.4	27.2	24.0	42.4	18.4	1.37	19.5
	Desperado	Y	24.8	42.4	20.8	32.8	12.0	1.23	23.0
	Delgado	Y	38.4	31.2	24.0	30.4	6.4	1.18	25.5
	Red Bull	R	14.3	26.2	26.1	59.5	33.4	1.50	29.0
	Sedona	Y	20.8	31.2	22.4	48.0	25.6	1.20	21.0
	Legend	Y	24.5	42.7	20.7	32.8	12.1	1.04	21.5
Crookham	The Rock	Y	10.4	16.8	5.6	72.8	67.2	0.90	9.5
	White Cloud	W	24.0	32.8	19.2	43.2	24.0	1.10	18.5
	OLYX06-25	Y	4.8	4.0	6.4	91.2	84.8	1.10	10.0
	OLYS03-209	Y	4.7	12.7	11.9	82.6	70.6	0.88	12.0
	OLYS03-207	Y	16.0	12.8	11.2	71.2	60.0	1.09	12.0
	OLYS05N5	Y	9.6	14.4	9.6	76.0	66.4	1.01	10.0
	OLYX00-23	Y	4.8	4.8	19.2	90.4	71.2	1.64	31.0
D. Palmer	Evolution	Y	7.2	14.4	13.6	78.4	64.8	1.10	11.5
	Generation X	Y	4.0	11.2	9.6	84.8	75.2	1.52	28.0
	Mesquite06	Y	41.0	33.3	9.8	25.7	16.0	1.00	16.0
	Tequila06	Y	32.0	27.2	8.8	40.8	32.0	1.10	19.0
Global Genetics	Maverick	Y	31.2	33.6	17.6	35.2	17.6	1.29	18.0
	Ringleader	Y	0.0	5.6	2.4	94.4	92.0	1.35	30.0
	Outlaw	Y	8.8	30.4	21.6	60.8	39.2	1.62	35.0
	6093	Y	5.6	10.4	20.0	84.0	64.0	1.24	12.0
Nunhems	Arcero	Y	7.2	8.2	9.6	84.6	75.0	1.08	22.0

Seed company	Variety	Bulb color	Multiple center			Single center		IYSV rating <sup>b</sup>	Maturity Aug. 19
			large	medium	small	functional <sup>a</sup>	bullet		
			----- % -----					0-5	%
	Granero	Y	8.8	15.2	15.2	76.0	60.8	1.16	16.0
	Joaquin	Y	4.8	12.0	10.4	83.2	72.8	1.05	11.5
	Montero	Y	0.8	10.4	10.4	88.8	78.4	1.36	34.0
	Pandero	Y	19.2	29.6	16.0	51.2	35.2	1.00	14.5
	Ranchero	Y	12.0	33.6	20.8	54.4	33.6	1.07	16.5
	Sabroso	Y	2.4	14.4	12.0	83.2	71.2	1.46	26.0
	Vaquero	Y	9.6	18.9	10.4	71.5	61.1	1.41	23.5
	Salsa	R	15.2	32.8	31.2	52.0	20.8	1.61	37.0
	Cometa	W	4.0	23.2	10.4	72.8	62.4	1.02	11.0
	NUN7015ON	Y	1.6	7.2	6.4	91.2	84.8	1.37	28.0
Sakata	XON-550Y	Y	42.4	25.6	10.4	32.0	21.6	0.97	14.5
	XON-670W	W	12.0	24.0	20.0	64.0	44.0	1.05	13.0
Seminis	Abilene	Y	5.6	20.0	18.4	74.4	56.0	1.59	29.0
	Affirmed	Y	16.8	26.4	21.6	56.8	35.2	1.33	22.5
	Charismatic	Y	25.6	36.8	16.0	37.6	21.6	1.08	14.5
	Monarchos	Y	4.0	15.2	18.4	80.8	62.4	1.03	22.0
	Rainier	W	16.8	26.4	22.4	56.8	34.4	1.58	23.5
	Mercury	R	11.2	27.2	20.0	61.6	41.6	1.81	42.0
	Swale	Y	7.2	15.2	20.8	77.6	56.8	1.18	23.0
average			15.7	22.9	16.2	61.41	45.22	1.27	22.29
LSD (0.05)			11.9	14.4	11.5	14.9	12.5	0.34	5.1

<sup>a</sup> bullet single center + small multiple center

<sup>b</sup> IYSV: 0 = no symptoms, 1 = 1-25% of foliage diseased, 2 = 26-50% of foliage diseased, 3 = 51-75% of foliage diseased, 4 = 76-99% of foliage diseased, and 5 = 100% of foliage diseased.

Table 4. Yield and grade of full-season experimental and commercial onion varieties graded out of storage in January 2009, Malheur Experiment Station, Oregon State University, Ontario, OR. Continued on next page.

Seed company	Variety	Bulb color	Total yield	Marketable yield by grade				Non-marketable yield				Bulb counts >4¼ in	Thrips damage <sup>a</sup>		
				Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	No. 2s	Small	Total rot			Neck rot	Plate rot
				--- cwt/acre ---				-- % of total yield --				#/50 lb	0-10		
A. Takii	Centerstone	Y	548.7	531.8	0.0	7.0	479.0	45.9	0.0	9.2	1.3	0.4	0.9		
	T-433	Y	783.5	750.9	0.0	125.8	613.5	11.6	13.5	1.4	2.1	1.5	0.7		
	Milestone	Y	462.6	452.0	0.0	10.7	337.2	104.1	0.0	5.3	1.1	0.7	0.4		
	Ruby Ring	R	324.5	305.5	0.0	22.5	126.3	156.7	0.0	17.5	0.4	0.4	0.1		0.4
Bejo	Calibra	Y	591.7	575.3	0.0	3.2	507.4	64.6	3.4	9.1	0.7	0.2	0.4		
	Crocket	Y	592.9	578.4	0.0	9.1	509.5	59.8	1.7	9.2	0.6	0.4	0.2		
	Desperado	Y	716.4	679.9	1.0	79.9	576.3	22.7	4.0	2.8	3.9	2.2	1.7	49.9	
	Delgado	Y	638.8	617.0	3.4	20.2	564.4	29.0	9.1	6.8	0.9	0.7	0.2	47.6	
	Red Bull	R	476.8	445.4	0.0	1.2	376.5	67.6	11.6	7.4	2.6	1.1	1.5		0.8
	Sedona	Y	675.6	654.5	2.5	44.1	573.1	34.9	6.3	10.3	0.7	0.2	0.5	42.6	
	Legend	Y	686.1	670.5	0.0	23.2	619.9	27.4	1.2	5.5	1.3	0.6	0.6		
Crookham	The Rock	Y	804.2	751.5	16.0	157.4	559.4	18.7	0.0	1.7	5.9	4.4	1.5	40.4	
	White Cloud	W	827.5	767.6	8.0	211.2	531.9	16.5	5.8	1.2	6.4	3.6	2.7	40.0	
	OLYX06-25	Y	757.3	747.5	13.8	110.9	589.4	33.4	0.7	5.4	0.4	0.4	0.0	47.6	
	OLYS03-209	Y	858.6	847.9	32.2	222.3	570.6	22.8	0.7	7.1	0.4	0.1	0.3	38.1	
	OLYS03-207	Y	814.5	782.7	17.8	135.5	611.8	17.5	0.0	3.0	3.2	3.1	0.2	44.0	
	OLYS05N5	Y	852.7	820.2	30.7	230.0	539.2	20.2	2.2	4.4	3.0	1.7	1.3	39.2	
	OLYX00-23	Y	638.0	626.3	1.1	24.6	559.2	41.5	0.0	4.1	1.2	0.5	0.7	46.2	
D. Palmer	Evolution	Y	800.4	781.6	41.9	254.9	471.5	13.3	1.4	1.5	1.8	0.8	1.1	30.4	
	Generation X	Y	706.1	693.9	1.2	29.9	639.0	23.8	0.0	4.9	1.1	0.6	0.5	42.3	
	Mesquite06	Y	824.7	793.7	28.5	194.5	550.6	20.2	10.1	5.3	1.9	1.5	0.4	32.3	
	Tequila06	Y	1025.8	995.0	47.0	303.3	462.5	182.2	11.9	5.2	1.0	0.6	0.4	35.3	
Global Genetics	Maverick	Y	823.6	797.1	6.2	226.6	552.8	11.6	2.4	2.7	2.6	2.1	0.5	42.5	
	Ringleader	Y	578.0	566.2	0.0	21.8	511.4	33.0	0.0	7.4	0.8	0.5	0.3		
	Outlaw	Y	562.1	536.3	1.2	4.4	450.5	80.3	3.3	17.7	0.8	0.5	0.3	44.6	
	6093	Y	801.4	786.3	0.0	138.0	628.9	19.4	4.5	2.3	1.0	1.0	0.1		



Seed company	Variety	Bulb color	Total yield	Marketable yield by grade				Non-marketable yield			Bulb counts >4¼ in	Thrips damage <sup>a</sup>			
				Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	No. 2s	Small			Total rot	Neck rot	Plate rot
				cwt/acre				-- % of total yield --			#/50 lb	0-10			
Nunhems	Arcero	Y	767.4	759.4	2.9	74.3	668.8	13.4	1.2	2.1	0.6	0.6	0.1	35.2	
	Granero	Y	748.9	733.5	1.8	88.1	627.4	16.2	0.4	6.0	1.2	0.7	0.5	29.0	
	Joaquin	Y	864.3	858.4	26.5	241.6	512.9	77.4	1.7	2.1	0.3	0.2	0.1	37.8	
	Montero	Y	630.2	616.5	0.0	19.6	556.3	40.7	1.4	4.7	1.2	0.4	0.8		
	Pandero	Y	754.6	740.8	6.9	125.2	596.1	12.7	4.6	3.4	0.7	0.4	0.3	38.7	
	Ranchero	Y	851.3	827.7	23.4	256.6	531.8	16.0	2.3	4.8	2.0	1.5	0.5	34.2	
	Sabroso	Y	601.9	583.7	0.0	43.0	501.3	39.4	0.5	4.1	1.7	1.2	0.5		
	Vaquero	Y	798.2	771.3	2.5	114.3	638.9	15.6	3.6	4.0	2.2	1.6	0.6	42.4	
	Salsa	R	540.9	501.6	0.0	4.5	433.3	63.7	17.6	12.3	1.7	1.1	0.7		0.4
	Cometa	W	825.7	805.4	3.1	150.7	638.1	13.5	0.0	3.4	2.1	1.2	0.9	49.2	
	NUN7015ON	Y	712.4	703.2	0.0	51.0	628.6	23.6	0.8	2.6	0.8	0.2	0.6		
Sakata	XON-550Y	Y	883.8	799.8	28.9	265.9	492.2	12.7	3.6	5.2	8.1	5.3	2.8	36.1	
	XON-670W	W	813.0	732.9	15.5	188.1	508.5	20.8	1.8	4.0	9.0	5.2	3.7	33.7	
Seminis	Abilene	Y	555.2	543.8	0.0	4.8	475.0	64.0	0.7	6.6	0.7	0.1	0.6		
	Affirmed	Y	807.0	796.0	8.1	191.9	581.5	14.4	1.1	4.0	0.8	0.4	0.3	40.7	
	Charismatic	Y	746.3	734.6	7.7	162.7	533.1	31.1	0.0	4.8	1.0	0.2	0.8	38.4	
	Monarchos	Y	745.4	730.7	3.5	82.7	626.7	17.9	1.5	4.3	1.2	0.5	0.7	30.2	
	Rainier	W	599.7	571.6	0.0	3.1	496.1	72.3	4.3	10.8	2.2	2.0	0.2		
	Mercury	R	482.1	448.4	0.0	0.0	291.3	157.1	11.5	12.3	2.0	0.9	1.1		1.4
	Swale	Y	731.8	721.9	1.5	84.3	607.2	29.0	0.0	5.3	0.6	0.2	0.5	35.2	
average			709.4	685.6	8.4	103.6	531.7	42.0	3.3	5.8	1.9	1.2	0.7	39.4	0.8
LSD (0.05)			114.4	112.7	16.1	78.8	84.1	77.9	6.0	6.6	NS	NS	NS	NS	0.7

<sup>a</sup> Thrips damage on the surface of red onions at the end of the storage January 13 and 14: 0 = least damage, 10 = most damage.