

# 2010 ONION VARIETY TRIALS

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## Introduction

The objectives of the onion variety trials were to evaluate yellow, white, and red onion varieties for disease, maturity, bolting, single centers, and bulb yield and grade out of storage. Three early-season yellow varieties were planted in March and were harvested and graded at the end of August. Forty-four full-season varieties (36 yellow, 4 red, and 4 white) were planted in March, harvested in September 2010, and graded out of storage in January 2011. 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

In 2010, onions were grown on a Greenleaf silt loam previously planted to wheat. In the fall of 2009 the wheat stubble was shredded and the field was irrigated and disked. A soil sample taken in the fall of 2009 showed: pH 7.9, organic matter 1.8 percent, 40 ppm phosphorus (P), 416 ppm potassium (K), 17 ppm sulfate (SO<sub>4</sub>), 2,310 ppm calcium (Ca), 608 ppm magnesium (Mg), 60 ppm sodium (Na), 2.3 ppm zinc (Zn), 1.7 ppm copper (Cu), 6 ppm manganese (Mn), 11 ppm iron (Fe), and 0.9 ppm boron (B). The soil analysis indicated the need for 100 lb phosphate (P<sub>2</sub>O<sub>5</sub>)/acre, 24 lb sulfur (S)/acre, 2 lb Mn/acre, 4 lb Zn/acre, and 1 lb B/acre. These nutrients were broadcast in the fall of 2009 after disking. The field was then moldboard-plowed, groundhogged, roller-harrowed, and bedded at 22 inches. The field was not fumigated due to a shortage of product.

Both the full-season trial and the early-maturing trial were planted on March 16, adjacent to each other, and in plots 4 double rows wide and 27 ft long. The early-maturing trial had 3 varieties from 2 seed companies (Table 1) and the full-season trial had 44 varieties from 9 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. Immediately after planting, the onions received a narrow band of Lorsban 15G<sup>®</sup> at 3.7 oz per 1,000 ft of row (0.82 lb ai/acre), and the soil surface was rolled. Zeba<sup>®</sup> was applied at 5 lb/acre on April 5 to prevent soil crusting. Onion emergence

started on April 15. On May 20, alleys 4 ft wide were cut between plots, leaving plots 23 ft long. On May 24 and May 25, 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 field was sidedressed with 100 lb N/acre and cultivated on May 26. On July 7, 100 lb N/acre were water-run.

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® at 1 lb ai/acre on April 9 prior to onion emergence. On April 19, Prowl H<sub>2</sub>O® at 0.95 lb ai/acre was applied for weed control. On May 14, Goal® at 0.16 lb ai/acre, Buctril® at 0.19 lb ai/acre, and Volunteer® at 0.25 lb ai/acre were applied for weed control. On July 1, Prowl H<sub>2</sub>O® at 1 pt/acre was applied.

On May 25 and June 14, Movento® at 5 oz/acre was applied for thrips control. Volunteer at 0.13 lb ai/acre was applied for weed control on May 25. The field received three aerial applications of Lannate® at 0.9 lb ai/acre for thrips control on July 12, July 26, and August 23. On July 22 grass weeds were spot sprayed with a backpack sprayer containing a 1.5 percent v/v solution of Poast®.

A root tissue sample taken July 22, showed a slight deficiency of potassium and magnesium. Corrective measures were not taken.

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 26.

The early-maturing trial and the full-season trial were evaluated for maturity on September 1. 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 of dry foliage. 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 16. 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 2010.

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 August 25 to Hanu Pappu at Washington State University, Pullman for the IYSV analysis.

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 3½ to 4¼ 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 1½ inches, medium had diameters from 1½ to 2¼ inches, and large had diameters greater than 2¼ inches. Onions were considered "functionally single centered" for processing if they were single centered or had a small multiple center.

Onions from the middle two double rows in each plot in the early-maturity trial were topped by hand and bagged on September 1. On September 2 these onions were graded.

The onions in the full-season trial were lifted on September 10 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. Bulbs infected with plate rot were evident at harvest. Infected bulbs were not harvested, but were counted in each plot. The bags were put in storage on September 24. The storage shed was ventilated and the temperature was slowly decreased to maintain air temperature as close to 34°F as possible. Onions from the full-season trial were graded out of storage on January 5 and 6, 2011.

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 (<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. Marketable yield consists of No.1 bulbs larger than 2¼ inches.

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

The 2010 season was cool, with lower heat units than normal. The crop developed slowly.

### Early-maturing Trial

The percentage of single-centered bulbs averaged 31.2 percent and ranged from 16 percent for 'Ovation' to 49.6 percent for 'Montero' (Table 1). The percentage of onions that were

functionally single centered averaged 49.8 percent and ranged from 33.6 percent for Ovation to 63.1 percent for Montero.

Total yield averaged 707.6 cwt/acre and ranged from 621.2 cwt/acre for Montero to 756.0 cwt/acre for Ovation (Table 2). Ovation and ‘Spanish Medallion’ were among the varieties with the highest total and marketable yields.

### **Full-season Trial**

The percentage of single-centered bulbs averaged 45.7 percent and ranged from 1.6 percent for ‘T-433’, to 92 percent for ‘NUN7015’ (Table 3). The percentage of functionally single-centered bulbs averaged 54.1 percent and ranged from 1.6 percent for T-433 to 92.8 percent for NUN7015.

Total yield out of storage averaged 629.4 cwt/acre and ranged from 292.1 cwt/acre for ‘Countach’ to 948.5 cwt/acre for ‘Charismatic’ (Table 4). Charismatic, ‘Advantage’, ‘Tequila’, and ‘Ranchero’ were among the varieties with the highest total yield. Charismatic, Ranchero, ‘Swale’, and Advantage were among the varieties with the highest marketable yield.

Plate rot incidence in the 2010 trial was higher than normal and could have been due to the lack of soil fumigation. Based on infected bulb counts, the percentage of bulbs with plate rot at harvest averaged 1.7 percent and ranged from 0.8 percent for ‘Oracle’ to 4.1 percent for ‘Maverick’ (Table 5). Plate rot after storage (% of total yield) averaged 2 percent and ranged from 0.2 percent for ‘The Rock’ to 4.3 percent for ‘White Cloud’ (Table 4). Neck rot averaged 1.8 percent and ranged from 0 percent for ‘Gunnison’ to 14.3 percent for White Cloud.

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

Iris yellow spot virus severity in 2010 was low (Table 5). The subjective ratings of IYSV symptom severity for the full-season varieties on August 16, on a scale from 0 to 5, ranged from 0.9 for ‘Morpheus’ and ‘Cometa’ to 1.6 for ‘Marenge’ (Table 5) and averaged 1.1.

### **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, 2009, and 2010 powdery mildew symptoms were not observed in any of the onion varieties in this trial.

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## 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 single- and multiple-center bulb ratings for early-maturing onion varieties, Malheur Experiment Station, Oregon State University, Ontario, OR, 2010.

Seed company	Variety	Tops down Sept. 1	Leaf dryness Sept. 1	Multiple center			Single center	
				large	medium	small	functional <sup>a</sup>	single
----- % -----								
Nunhems	Montero	86.0	56.0	5.5	31.4	13.5	63.1	49.6
Sakata	Ovation	78.0	46.0	17.6	48.8	17.6	33.6	16.0
	Spanish Medallion	90.0	54.0	7.2	40.0	24.8	52.8	28.0
average		84.7	52.0	10.1	40.1	18.6	49.8	31.2
LSD (0.05)		5.0	NS	8.8	NS	NS	10.9	7.0

<sup>a</sup>single + small multiple.

Table 2. Yield and grade performance of early-maturing onion varieties lifted and harvested September 1, 2010, Malheur Experiment Station, Oregon State University, Ontario, OR.

Seed company	Variety	Total yield	Marketable yield by grade				Bulb counts >4¼ in #/50 lb	Non-marketable yield			
			Total	>4¼ in	4-4¼ in	3-4 in		2¼-3 in	Plate rot	No. 2s	Small
----- cwt/acre -----											
Nunhems	Montero	621.2	577.7	11.6	82.2	460.8	23.1	16.3	5.2	0.0	11.2
Sakata	Ovation	756.0	733.8	24.2	192.9	494.5	22.3	16.3	1.4	0.6	11.4
	Spanish Medallion	745.7	721.8	12.6	188.6	500.1	20.6	15.2	1.4	0.0	13.5
average		707.6	677.8	16.1	154.6	485.1	22.0	15.9	2.7	0.2	12.0
LSD (0.05)		88.5	93.5	NS	62.6	NS	NS	NS	2.7	NS	NS

Table 3. Single- and multiple-centered bulb rating for full-season onion varieties. Malheur Experiment Station, Oregon State University, Ontario, OR, 2010.

Seed company	Variety	Bulb color	Multiple center			Single center	
			Large	Intermediate	Small	Functional single center <sup>a</sup>	Single center
			----- % -----				
A. Takii	Centerstone	Y	16.8	50.4	16.8	32.8	16.0
	T-433	Y	63.2	35.2	0.0	1.6	1.6
Bejo	Calibra	Y	38.4	51.2	3.2	10.4	7.2
	Crockett	Y	13.6	45.6	6.4	40.8	34.4
	Delgado	Y	37.3	42.2	9.5	20.5	11.0
	Desperado	Y	31.2	37.6	16.8	31.2	14.4
	Gunnison	Y	1.6	37.6	4.8	60.8	56.0
	Legend	Y	35.2	52.0	7.2	12.8	5.6
	Sedona	Y	19.2	48.0	8.8	32.8	24.0
Crookham	The Rock	Y	5.6	16.0	0.0	78.4	78.4
	White Cloud	W	28.0	44.0	8.0	28.0	20.0
	Morpheus	Y	6.4	14.2	3.9	79.4	75.4
	Oracle	Y	12.8	16.8	6.4	70.4	64.0
	Advantage	Y	4.0	16.0	10.4	80.0	69.6
	Esteem	Y	5.6	19.2	13.6	75.2	61.6
	OLYX06-25	Y	8.8	15.2	1.6	76.0	74.4
D. Palmer	Mesquite	Y	34.4	32.0	6.4	33.6	27.2
	Tequila	Y	25.6	32.0	8.8	42.4	33.6
	Sarape Café	Y	32.0	37.6	4.8	30.4	25.6
Nickerson-Zwaan	NIZ 7026	Y	5.6	22.1	4.8	72.4	67.6
	NIZ 7044	Y	12.0	35.2	6.4	52.8	46.4
	NIZ 37-64	Y	11.2	53.6	9.6	35.2	25.6
	NIZ 4012	Y	4.0	24.8	15.2	71.2	56.0
	Maverick	Y	32.8	22.4	7.2	44.8	37.6
Nippon Norin	NN65	Y	6.4	34.4	12.0	59.2	47.2
Nunhems	Arcero	Y	8.8	19.2	4.0	72.0	68.0
	Granero	Y	17.6	25.6	2.4	56.8	54.4
	Joaquin	Y	3.2	17.6	11.2	79.2	68.0
	Sabroso	Y	11.2	29.6	12.0	59.2	47.2
	Ranchero	Y	12.8	19.2	8.0	68.0	60.0
	Vaquero	Y	12.8	25.6	4.8	61.6	56.8
	NUN7015	Y	2.4	4.8	0.8	92.8	92.0
	Cometa	W	4.8	21.6	9.6	73.6	64.0
	Solstice	W	6.4	26.4	12.0	67.2	55.2
	Salsa	R	8.8	35.7	12.0	55.5	43.4
	Marengo	R	0.8	14.4	12.8	84.8	72.0
	Countach	R	7.2	31.2	24.8	61.6	36.8
Sakata	Bello Blanco	W	8.8	28.8	13.6	62.4	48.8
	Arruba	Y	16.8	30.4	4.0	52.8	48.8
Seminis	Barbaro	Y	5.6	16.0	8.8	78.4	69.6
	Belmar	Y	6.4	17.6	4.0	76.0	72.0
	Charismatic	Y	23.2	41.6	10.4	35.2	24.8
	Swale	Y	22.4	29.6	14.4	48.0	33.6
	Mercury	R	40.0	38.4	5.6	21.6	16.0
average			16.2	29.7	8.4	54.1	45.7
LSD (0.05)			11.7	16.3	9.8	16.6	14.1

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

Table 4. Yield and grade of full-season experimental and commercial onion varieties graded out of storage in January 2011, Malheur Experiment Station, Oregon State University, Ontario, OR. Continued on next page.

Seed company	Variety	Bulb color	Total yield	Marketable yield by grade					No. 2s	Small	Total rot	Neck rot	Plate rot	Bulb counts >4¼ in	Thrips damage <sup>a</sup>
				Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in							
				----- cwt/acre -----					--- % of total yield ---			#/50 lb	0-10		
A. Takii	Centerstone	Y	402.9	376.6	0.0	2.5	280.7	93.3	0.0	12.8	3.4	0.4	2.9		
	T-433	Y	757.8	732.5	11.5	228.9	480.2	11.9	0.0	7.4	2.4	0.8	1.6	36.1	
Bejo	Calibra	Y	485.0	456.7	1.8	4.6	390.1	60.2	0.0	11.3	3.6	1.7	1.9	28.1	
	Crockett	Y	525.5	509.6	0.0	5.6	432.9	71.1	0.0	8.8	1.4	0.5	0.9		
	Delgado	Y	631.2	612.3	4.8	41.3	534.1	32.1	0.0	8.9	1.6	0.1	1.5	32.6	
	Desperado	Y	618.9	597.2	0.0	39.6	528.7	28.9	0.0	7.0	2.2	0.4	1.8		
	Gunnison	Y	383.5	353.9	0.0	0.0	227.6	126.3	0.0	15.3	3.7	0.0	3.7		
	Legend	Y	576.0	555.8	0.0	16.6	504.7	34.4	0.0	9.9	1.9	0.2	1.6		
	Sedona	Y	604.9	588.8	0.0	27.9	512.3	48.6	0.0	6.9	1.5	0.7	0.8		
Crookham	The Rock	Y	639.4	633.2	10.2	101.0	492.0	30.1	0.0	4.4	0.3	0.1	0.2	33.9	
	White Cloud	W	770.9	618.8	1.6	97.0	498.7	21.5	0.0	8.0	18.6	14.3	4.3	32.9	
	Morpheus	Y	725.5	702.2	1.6	104.0	572.9	23.8	0.0	8.0	2.1	1.3	0.8	32.9	
	Oracle	Y	736.3	706.1	12.6	119.0	556.3	18.2	0.0	5.0	3.3	1.3	2.0	37.3	
	Advantage	Y	803.2	744.3	23.3	160.9	533.3	26.8	0.0	17.4	4.3	2.3	2.1	37.6	
	Esteem	Y	528.9	500.9	0.0	6.6	435.2	59.2	0.0	9.6	3.5	1.2	2.3		
	OLYX06-25	Y	742.4	717.9	8.3	110.1	569.3	30.2	0.0	8.1	2.2	1.3	0.9	36.9	
D. Palmer	Mesquite	Y	689.0	626.1	6.7	121.7	470.3	27.4	0.0	6.6	8.1	6.2	1.9	40.6	
	Tequila	Y	792.7	718.8	12.1	138.8	535.0	32.9	0.0	8.8	8.2	4.7	3.5	32.6	
	Sarape Café	Y	620.1	597.0	2.9	45.2	504.3	44.6	0.0	7.1	2.5	1.4	1.0	35.5	
Nickerson-Zwaan	NIZ 7026	Y	702.4	659.5	3.5	117.0	512.3	26.7	0.0	9.5	4.7	2.5	2.2	29.6	
	NIZ 7044	Y	666.8	613.0	0.0	44.3	506.3	62.4	0.0	30.6	3.3	0.3	3.0		
	NIZ 37-64	Y	472.5	445.5	0.0	6.3	369.0	70.2	0.0	16.5	2.2	0.3	1.9		
	NIZ 4012	Y	440.2	413.0	0.0	9.3	334.9	68.8	0.0	8.9	4.0	0.6	3.4		
	Maverick	Y	753.1	715.2	10.5	152.7	534.7	17.3	0.0	5.7	4.4	1.4	2.9	34.5	
Nippon Norin	NN65	Y	668.3	638.7	4.2	54.4	553.7	26.3	0.0	10.7	2.9	1.2	1.7	36.8	

Seed company	Variety	Bulb color	Total yield	Marketable yield by grade						No. 2s	Small	Total rot	Neck rot	Plate rot	Bulb counts >4¼ in	Thrips damage <sup>a</sup>
				Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in								
				----- cwt/acre -----						--- % of total yield ---			#/50 lb	0-10		
Nunhems	Arcero	Y	672.1	657.8	0.0	62.8	575.4	19.6	0.0	6.3	1.2	0.2	1.0			
	Granero	Y	697.5	683.9	3.8	72.7	593.7	13.7	0.0	5.3	1.2	0.4	0.8	27.6		
	Joaquin	Y	751.8	730.6	10.7	189.2	505.2	25.6	0.0	7.2	2.0	0.5	1.5	38.7		
	Sabroso	Y	431.0	412.7	0.0	0.0	342.2	70.5	0.0	8.2	2.2	0.3	1.9			
	Ranchero	Y	790.2	771.1	27.0	179.7	546.4	18.0	0.0	6.5	1.8	0.7	1.1	32.8		
	Vaquero	Y	781.0	738.3	4.8	110.7	588.8	33.9	0.0	17.3	3.2	0.4	2.9	32.4		
	NUN7015	Y	656.4	616.2	1.2	35.6	544.3	35.0	0.0	16.3	3.6	0.7	2.9	41.7		
	Cometa	W	750.4	665.3	7.4	147.2	487.3	23.5	0.0	5.9	10.5	8.4	2.1	34.5		
	Solstice	W	617.3	595.7	1.7	42.3	522.8	29.1	0.0	6.5	2.4	1.4	1.0	31.3		
	Salsa	R	329.3	302.7	0.0	0.0	205.3	97.5	0.0	18.8	2.6	0.1	2.5		1.2	
	Marengo	R	296.6	259.7	0.0	0.0	91.1	168.7	0.0	30.0	2.3	1.0	1.3		1.2	
	Countach	R	292.1	251.1	0.0	0.0	109.8	141.3	0.0	28.1	4.5	2.3	2.2		1.0	
Sakata	Bello Blanco	W	733.5	681.1	6.5	95.4	542.7	36.5	0.0	10.6	5.9	4.1	1.8	32.3		
	Arruba	Y	743.8	698.3	10.1	148.0	515.4	24.7	0.0	16.1	3.7	2.7	1.0	30.3		
Seminis	Barbaro	Y	722.0	699.5	8.2	158.9	509.8	22.6	0.0	6.3	2.2	0.7	1.5	32.7		
	Belmar	Y	568.7	545.9	2.6	37.4	453.4	52.5	0.0	9.2	2.3	0.6	1.7	39.9		
	Charismatic	Y	948.5	845.5	18.0	173.0	612.5	42.0	0.0	11.2	8.4	4.7	3.8	31.3		
	Swale	Y	778.2	758.4	11.2	193.4	523.7	30.0	0.0	8.1	1.6	0.4	1.1	32.9		
	Mercury	R	395.2	336.6	0.0	0.0	204.7	131.8	0.0	27.7	6.4	2.8	3.6		1.8	
average			629.4	592.8	5.2	77.3	462.4	47.9	0.0	11.3	3.7	1.8	2.0	34.1	1.3	
LSD (0.05)			109.0	98.4	10.1	59.5	86.3	29.9	NS	11.8	4.4	3.5	2.0	3.9	NS	

<sup>a</sup> Thrips damage on the surface of red onions at the end of the storage January 5 and 6: 0 = least damage, 5 = most damage.



Table 5. Iris yellow spot virus incidence, maturity ratings, and percentage of plate rot for full-season onion varieties. Malheur Experiment Station, Oregon State University, Ontario, OR, 2010.

Seed company	Variety	Bulb color	Iris yellow spot virus rating <sup>a</sup>	Maturity Sept. 1			Plate rot at harvest <sup>b</sup>
				Tops down	Leaf dryness	Bolters Sept. 1	
			-- 0-5 --	----- % -----			
A. Takii	Centerstone	Y	1.2	78	68	0.0	3.0
	T-433	Y	1.0	32	38	0.0	1.5
Bejo	Calibra	Y	1.1	78	66	0.0	1.6
	Crockett	Y	1.0	38	44	0.0	1.3
	Delgado	Y	1.0	58	46	0.0	1.1
	Desperado	Y	1.0	68	46	0.1	1.1
	Gunnison	Y	1.2	88	84	0.0	1.4
	Legend	Y	1.0	54	48	0.0	1.4
	Sedona	Y	1.0	60	44	0.1	1.8
Crookham	The Rock	Y	1.0	34	32	0.6	1.7
	White Cloud	W	1.0	54	36	0.2	1.3
	Morpheus	Y	0.9	58	36	0.1	1.5
	Oracle	Y	1.0	44	38	0.8	0.8
	Advantage	Y	1.0	36	38	2.1	1.4
	Esteem	Y	1.1	78	64	0.0	1.7
	OLYX06-25	Y	1.0	34	32	0.1	1.4
D. Palmer	Mesquite	Y	1.1	36	38	1.2	2.4
	Tequila	Y	1.0	48	40	0.5	1.5
	Sarape Café	Y	1.1	74	56	0.1	1.6
Nickerson-Zwaan	NIZ 7026	Y	1.1	54	46	0.1	2.9
	NIZ 7044	Y	1.0	70	64	0.1	3.6
	NIZ 37-64	Y	1.1	70	66	0.0	2.4
	NIZ 4012	Y	1.1	78	70	0.0	2.6
	Maverick	Y	1.1	34	44	1.0	4.1
Nippon Norin	NN65	Y	1.0	28	42	0.0	1.5
Nunhems	Arcero	Y	1.0	40	50	0.0	1.7
	Granero	Y	1.1	38	42	0.4	1.4
	Joaquin	Y	1.0	28	32	0.4	1.4
	Sabroso	Y	1.1	68	62	0.0	2.5
	Ranchero	Y	1.0	50	40	0.1	1.3
	Vaquero	Y	1.1	52	44	0.1	2.3
	NUN7015	Y	1.1	48	48	0.0	2.7
	Cometa	W	0.9	32	34	2.3	0.9
	Solstice	W	1.0	62	42	0.3	1.3
	Salsa	R	1.3	82	78	0.0	1.7
	Marengo	R	1.6	94	90	0.0	1.0
	Countach	R	1.4	88	86	0.0	2.0
Sakata	Bello Blanco	W	1.0	46	40	1.1	0.4
	Arruba	Y	1.0	54	38	0.4	0.9
Seminis	Barbaro	Y	1.0	38	44	0.2	2.3
	Belmar	Y	1.1	50	46	0.1	1.3
	Charismatic	Y	1.1	48	42	1.8	2.1
	Swale	Y	1.0	42	40	0.2	0.9
	Mercury	R	1.4	88	86	0.0	2.7
average			1.1	55	50	0.3	1.7
LSD (0.05)			0.2	9	7	0.6	1.8

<sup>a</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.

<sup>b</sup> percent of total number of bulbs that had plate rot.