

## **2009 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. Three early-season yellow varieties were planted in March and were harvested and graded at the end of August. Forty-three full-season varieties (32 yellow, 6 red, and 5 white) were planted in March, harvested in September 2009, and graded out of storage in January 2010. 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 2009 onions were grown on an Owyhee silt loam previously planted to wheat. In the fall of 2008 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, 20 lb potassium ( $K_2O$ )/acre, 100 lb sulfur (S)/acre, 7 lb manganese (Mn)/acre, and 5 lb zinc (Zn). These products were broadcast in the fall of 2008 after disking. The field was then moldboard-plowed, groundhogged, roller-harrowed, fumigated with Telone<sup>®</sup> C-17 at 20 gal/acre, and bedded.

Both the full-season onion variety trial and the early-maturing onion variety 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 3 varieties from 2 seed companies (Table 1) and the full-season trial had 43 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. On April 9 the onions received a narrow band of Lorsban<sup>®</sup> 15G at 3.7 oz per 1,000 ft of row (0.82 lb ai/acre), and the soil surface was rolled. Onion emergence started on April 13. On May 20, alleys 4 ft wide were cut between plots, leaving plots 23 ft long. From May 21 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 7 prior to onion emergence. On April 27, 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 11, 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.

On June 9, 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. Aza-Direct at 0.0062 lb ai/acre and Success 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. The field received two aerial applications of Lannate<sup>®</sup> at 0.9 lb ai/acre for thrips control on July 10 and August 4. On July 22, 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 May 23 and again on June 24.

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 percentage of dry foliage. The early-maturing onion variety trial was evaluated for maturity on August 10 and the full-season onion variety trial was evaluated for maturity on August 10 and September 3. The number of bolted onion plants was counted in each plot.

Onions in each plot of the full-season onion variety trial were evaluated subjectively for severity of symptoms of iris yellow spot virus (IYSV) on July 29 and August 11. 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 2009.

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 17 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 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 September 10 these onions were graded.

The onions in the full-season trial were lifted on September 14 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 16. The bags were put in storage on September 17. The storage shed was 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 5 and 6, 2010.

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 Onion Variety Trial***

The percentage of single-centered bulbs averaged 71.2 percent and ranged from 56.0 percent for 'Spanish Medallion', to 97.6 percent for 'Montero' (Table 1). The percentage of onions that were functionally single centered averaged 85.3 percent and ranged from 76.0 percent for 'Ovation' to 100 percent for Montero.

Total yield averaged 514 cwt/acre and ranged from 441 cwt/acre for Montero to 609 cwt/acre for Ovation (Table 2). Ovation and Spanish Medallion were among the varieties with the highest total yield and marketable yield. Iris yellow spot virus affected bulb yield, grade, and decomposition as described below.

### ***Full-Season Onion Variety Trial***

The percentage of single-centered bulbs averaged 59.8 percent and ranged from 8.8 percent for 'Calibra', to 96.0 percent for 'Arcero' and 'NIZ 37-2020' (Table 3). The percentage of onions that were functionally single centered averaged 76.3 percent and ranged from 28.0 percent for Calibra to 98.4 percent for 'OLYS03-209' and NIZ 37-2020. Numerous varieties had 90 percent or higher functionally single-centered bulbs.

Total yield out of storage averaged 566 cwt/acre and ranged from 299 cwt/acre for 'Mercury' to 875 cwt/acre for 'Charismatic' (Table 4). Charismatic, 'Tequila', and 'OLYS05N5' were among the varieties with the highest total yield and marketable yield. Storage decomposition was high in 2009, ranging from 10.2 percent for 'Crockett' to 72.9 percent for 'Bello Blanco'. Crockett, Charismatic, 'Swale', OLYS05N5, and 'Delgado' had less than 15 percent decomposition.

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

Iris yellow spot virus severity in 2009 was similar to that observed in 2006, the most severe year at the Malheur Experiment Station. The average IYSV severity rating for 'Vaquero' in the variety trial has varied over the years; 1.1, 2.9, 0.6, 1.4, and 2.8 in 2005, 2006, 2007, 2008, and 2009, respectively. On August 11, 2009, the subjective ratings of IYSV symptom severity for the full-season varieties, on a scale from 0 to 5, ranged from 1.8 for Charismatic to 4.4 for 'Mercury' (Table 5) and averaged 2.8. Charismatic, 'Joaquin', OLYS03-209, and 'The Rock' had IYSV severity ratings of less than 2 on August 11. The impact of the virus in 2009 was more severe, because the disease started early. Symptoms became obvious in July and by early August many varieties had a substantial proportion of dead foliage. Subjective rating of leaf dryness on August 11 averaged 56 percent and ranged from 35 percent for Charismatic to 89 percent for Mercury (Table 5).

Onion tops did not collapse as is normally observed at the end of the season. On September 3, the percentage of tops down averaged 34 percent with most varieties having less than 40 percent tops down (Table 5). With the early death of the onion foliage, new leaves might have been prevented from fully forming, which resulted in poorly developed leaf tissue in the neck. This poorly developed leaf tissue in the neck and the observed lack of neck collapse at harvest time apparently left the onion bulbs vulnerable to *Botrytis* neck rot infection in the field and decomposition in storage. Onion marketable yield following storage decreased with increasing IYSV severity (Fig. 1) and bulb decomposition in storage increased with increasing IYSV severity (Fig. 2).

### ***Powdery Mildew***

Powdery mildew is a relatively recently discovered onion disease. 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 and 2009, powdery mildew symptoms were not observed on any of the onions these trials, but did occur on onions elsewhere on the experiment station.

### **Acknowledgements**

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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. Iris yellow spot virus (IYSV) rating, maturity, and bulb multiple center ratings for early maturing onion varieties, Malheur Experiment Station, Oregon State University, Ontario, OR, 2009.

Seed company	Variety	IYSV <sup>a</sup> Aug. 10	Tops down Aug. 10	Leaf dryness Aug. 10	Multiple center			Single center	
					Large	Medium	Small	Functional <sup>b</sup>	Single
		0-5	----- % -----						
Nunhems	Montero	3.6	26.0	72.0	0.0	0.0	2.4	100.0	97.6
Sakata	Ovation	2.7	26.0	54.0	13.6	10.4	16.0	76.0	60.0
	Spanish Medallion	3.4	24.0	68.0	10.4	9.6	24.0	80.0	56.0
average		3.2	25.3	64.7	8.0	6.7	14.1	85.3	71.2
LSD (0.05)		0.6	NS	11.6	4.6	6.2	11.2	8.6	10.1

<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> bullet single center + small multiple center.

Table 2. Yield and grade performance of early maturing onion varieties lifted August 19, 2009, Malheur Experiment Station, Oregon State University, Ontario, OR.

Seed company	Variety	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	Montero	440.9	240.3	0.0	166.9	73.4	42.5	0.0	14.4
Sakata	Ovation	609.0	420.8	41.6	330.7	48.5	28.5	5.5	9.3
	Spanish Medallion	492.1	335.0	9.9	273.2	51.9	29.8	0.0	8.7
average		514.0	332.0	17.1	256.9	57.9	33.6	1.8	10.8
LSD (0.05)		128.2	98.4	28.3	86.8	19.0	8.7	NS	3.9

Table 3. Bulb multiple-center rating for full-season onion varieties. Malheur Experiment Station, Oregon State University, Ontario, OR, 2009.

Seed company	Variety	Bulb color	Multiple center			Single center	
			Large double	Intermediate double	Small double	Functional single center <sup>a</sup>	Single center
			----- % -----				
A. Takii	Centerstone	Y	14.4	25.6	27.2	60.0	32.8
	T-433	Y	31.2	32.8	18.4	36.0	17.6
Bejo	Calibra	Y	37.6	34.4	19.2	28.0	8.8
	Crockett	Y	10.4	13.6	21.6	76.0	54.4
	Delgado	Y	30.4	16.8	23.2	52.8	29.6
	Desperado	Y	13.6	11.2	24.8	75.2	50.4
	Legend	Y	18.4	17.6	35.2	64.0	28.8
	Red Bull	R	12.0	25.6	28.8	62.4	33.6
	Sedona	Y	12.8	11.2	24.0	76.0	52.0
Crookham	The Rock	Y	2.4	10.4	11.2	87.2	76.0
	White Cloud	W	22.4	23.2	14.4	54.4	40.0
	OLYS03-209	Y	0.8	0.8	6.4	98.4	92.0
	OLYS03-207	Y	8.0	8.0	4.8	84.0	79.2
	OLYS05N5	Y	3.2	10.4	8.8	86.4	77.6
	OLYX00-23	Y	2.4	6.4	10.4	91.2	80.8
	OLYX06-25	Y	0.8	7.2	7.2	92.0	84.8
	OLRH06-91	R	0.8	4.8	15.2	94.4	79.2
D. Palmer	Mesquite	Y	13.6	24.0	30.4	62.4	32.0
	Tequila	Y	17.4	12.7	19.1	69.8	50.7
	Sarape Café	Y	24.0	24.8	21.6	51.2	29.6
Nickerson-Zwaan	NIZ 37-2010	Y	4.8	8.0	12.0	87.2	75.2
	NIZ 37-2020	Y	0.8	0.8	2.4	98.4	96.0
	NIZ 37-2025	Y	8.8	11.2	17.6	80.0	62.4
Nippon Norin	NN65	Y	3.2	8.0	16.0	88.8	72.8
Nunhems	Arcero	Y	0.0	2.4	1.6	97.6	96.0
	Granero	Y	6.4	8.0	4.8	85.6	80.8
	Joaquin	Y	1.6	8.0	4.8	90.4	85.6
	Montero	Y	2.4	9.2	16.6	88.4	71.8
	Ranchero	Y	12.8	16.0	16.0	71.2	55.2
	Vaquero	Y	1.6	6.4	8.0	92.0	84.0
	Cometa	W	3.2	4.0	8.8	92.8	84.0
	Solstice	W	4.8	6.4	7.2	88.8	81.6
	Salsa	R	15.2	28.8	32.8	56.0	23.2
	NUN9002ON	R	14.4	14.4	40.8	71.2	30.4
NUN9003ON	R	1.6	14.4	27.2	84.0	56.8	
Sakata	Bello Blanco	W	8.0	9.6	15.2	82.4	67.2
Seminis	Barbaro	Y	5.6	3.2	15.2	91.2	76.0
	Charismatic	Y	18.4	21.6	15.2	60.0	44.8
	Monarchos	Y	3.2	9.6	10.4	87.2	76.8
	Swale	Y	8.8	16.8	6.4	74.4	68.0
	EX16529	Y	4.8	8.0	6.4	87.2	80.8
	Rainier	W	16.0	16.8	24.0	67.2	43.2
	Mercury	R	20.0	20.8	31.2	59.2	28.0
average			10.3	13.3	16.6	76.3	59.8
LSD (0.05)			9.1	9.5	11.0	12.3	13.9

<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 2010, Malheur Experiment Station, Oregon State University, Ontario, OR.

Seed company	Variety	Bulb color	Marketable yield by grade						Non-marketable yield					Bulb counts >4¼ in #/50 lb	Thrips damage <sup>a</sup> 0-10
			Total yield	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 ---						
A. Takii	Centerstone	Y	503.7	373.9	0.0	1.3	300.1	72.4	1.0	16.9	23.0	22.7	0.3		
	T-433	Y	650.1	489.0	9.3	106.6	351.5	21.7	36.1	7.1	19.9	19.2	0.0	24.2	
Bejo	Calibra	Y	451.7	322.2	0.0	2.0	241.2	79.0	17.7	21.9	20.7	19.5	1.0		
	Crockett	Y	487.1	415.6	0.0	6.4	319.8	89.4	8.0	17.5	10.2	10.2	0.0		
	Delgado	Y	546.0	444.9	0.0	8.4	383.4	53.1	11.7	14.3	14.2	13.4	0.9		
	Desperado	Y	552.5	337.7	1.8	20.6	271.6	43.7	13.9	10.1	37.3	37.3	0.0	29.1	
	Legend	Y	459.3	371.0	0.0	0.8	280.7	89.5	6.4	16.1	15.3	15.1	0.0		
	Red Bull	R	320.5	203.8	0.0	0.0	90.0	113.7	0.0	18.0	31.5	31.5	0.0		3
	Sedona	Y	511.6	412.7	0.0	14.1	340.2	58.4	9.0	20.7	16.9	16.7	0.2		
Crookham	The Rock	Y	693.1	549.1	26.4	176.5	325.8	20.4	4.1	9.2	19.9	19.9	0.0	23.6	
	White Cloud	W	649.2	184.0	5.8	35.3	131.5	11.3	2.1	4.9	71.2	71.2	0.0	20.2	
	OLYS03-209	Y	771.1	635.7	13.7	182.6	414.4	25.1	3.2	9.6	15.9	15.9	0.0	30.2	
	OLYS03-207	Y	730.6	597.2	25.9	103.2	386.9	81.1	1.1	10.9	16.7	10.5	6.0	15.7	
	OLYS05N5	Y	838.8	731.6	56.3	236.1	415.4	23.7	0.0	11.3	12.8	11.8	0.0	13.6	
	OLYX00-23	Y	492.6	294.6	1.6	26.3	219.1	47.5	0.0	10.7	42.7	41.6	1.0	32.5	
	OLYX06-25	Y	630.2	439.0	3.8	51.2	349.6	34.4	4.0	12.0	28.8	28.5	0.3	42.1	
	OLRH06-91	R	366.0	220.5	0.0	1.1	125.8	93.6	0.7	27.6	35.0	35.0	0.0		2
D. Palmer	Mesquite	Y	662.5	451.3	17.4	93.4	307.9	32.6	23.4	9.2	30.1	30.1	0.0	14.8	
	Tequila	Y	841.0	658.3	40.8	218.1	380.7	18.7	28.8	7.4	17.7	17.6	0.1	16.6	
	Sarape Café	Y	597.8	401.9	0.0	28.6	338.1	35.2	10.2	9.4	30.3	29.0	1.0		
Nickerson-Zwaan	NIZ 37-2010	Y	385.8	231.0	0.0	3.5	163.5	64.0	3.1	15.9	36.9	36.6	0.4		
	NIZ 37-2020	Y	490.8	295.6	1.6	8.9	243.3	41.9	0.8	13.5	40.3	40.3	0.0	32.9	
	NIZ 37-2025	Y	645.5	433.9	2.8	45.6	338.7	46.8	4.8	18.0	29.0	29.0	0.1	14.7	



Table 4. Yield and grade of full-season experimental and commercial onion varieties graded out of storage in January 2010, Malheur Experiment Station, Oregon State University, Ontario, OR.

Seed company	Variety	Bulb color	Marketable yield by grade						Non-marketable yield					Bulb counts >4¼ in #/50 lb	Thrips damage <sup>a</sup> 0-10
			Total yield	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 ---						
Nippon Norin	NN65	Y	561.2	447.9	1.5	13.0	384.5	48.9	11.8	8.9	16.6	16.6	0.0	35.2	
Nunhems	Arcero	Y	490.0	334.2	0.0	8.8	275.7	49.7	1.0	9.4	30.2	30.2	0.0		
	Granero	Y	686.4	505.9	0.0	58.1	427.5	20.3	1.4	6.7	25.6	25.6	0.0		
	Joaquin	Y	630.0	479.9	16.0	114.2	322.0	27.8	1.8	9.4	22.5	21.9	0.5	22.5	
	Montero	Y	367.9	137.3	0.0	10.0	89.6	37.7	0.0	16.4	62.6	49.6	11.8		
	Ranchero	Y	664.2	356.9	4.5	60.2	266.6	25.5	3.8	9.6	45.1	44.6	0.0	25.5	
	Vaquero	Y	602.8	424.2	0.0	44.8	354.8	24.5	1.1	6.8	30.0	29.8	0.0		
	Cometa	W	692.5	386.4	9.4	127.4	238.5	11.1	0.0	6.3	44.9	44.0	0.8	20.9	
	Solstice	W	593.4	349.4	3.5	59.6	265.1	21.2	1.1	7.5	42.1	40.3	1.8	14.9	
	Salsa	R	310.9	131.3	0.0	0.0	79.5	51.8	2.1	12.7	56.8	56.8	0.0		3
	NUN9002ON	R	301.3	151.9	0.0	0.0	59.5	92.5	4.2	29.5	39.7	39.7	0.0		2
	NUN9003ON	R	325.6	171.5	0.0	0.0	90.3	81.3	0.0	16.4	47.7	47.5	0.2		3
Sakata	Bello Blanco	W	612.7	157.4	7.7	19.5	120.1	10.0	7.1	3.2	72.9	72.9	0.0	27.3	
Seminis	Barbaro	Y	658.5	504.1	11.6	83.9	384.1	24.4	1.9	6.2	22.7	22.0	0.3	21.7	
	Charismatic	Y	875.2	763.6	65.5	274.4	319.3	104.5	7.1	10.0	11.7	6.4	5.0	8.5	
	Monarchos	Y	591.8	432.7	0.0	38.1	359.9	34.8	0.0	11.4	25.8	25.5	0.2		
	Swale	Y	678.5	590.9	6.4	139.7	425.5	19.2	3.8	6.5	11.6	11.1	0.5	27.2	
	EX16529	Y	626.8	501.5	1.8	71.5	397.4	30.8	2.8	8.3	19.2	18.3	0.9	29.4	
	Rainier	W	484.8	156.4	0.0	7.3	114.9	34.2	2.4	9.8	66.2	65.8	0.4		
	Mercury	R	299.2	86.1	0.0	0.0	39.9	46.2	0.0	21.2	69.4	59.9	8.8		5
	average		565.8	385.2	7.8	58.2	272.9	46.4	5.7	12.3	32.1	31.0	1.0	23.6	3.0
	LSD (0.05)		93.2	135.3	16.7	58.7	111.5	51.8	9.3	11.7	18.7	20.2	NS	12.1	1.1

<sup>a</sup> Thrips damage on the surface of red onions at the end of the storage January 5 and 6: 0 = least damage, 10 = most damage.

Table 5. Iris yellow spot virus (IYSV) and maturity ratings for full-season onion varieties. Malheur Experiment Station, Oregon State University, Ontario, OR, 2009.

Seed company	Variety	Bulb color	Iris yellow spot virus <sup>a</sup>		Maturity Aug. 11		Maturity Sept. 3		Bolters
			29-Jul	11-Aug	Tops down	Leaf dryness	Tops down	Leaf dryness	
			----- 0-5 -----		----- % -----				
A. Takii	Centerstone	Y	1.5	3.1	20	63	40	92	0.0
	T-433	Y	1.3	2.4	12	49	22	76	0.0
Bejo	Calibra	Y	1.7	3.3	14	65	38	100	0.0
	Crockett	Y	1.3	2.9	12	58	34	86	0.0
	Delgado	Y	1.2	2.9	20	58	38	90	0.0
	Desperado	Y	1.4	3.0	12	60	32	88	0.0
	Legend	Y	1.4	3.1	14	62	36	92	0.0
	Red Bull	R	2.3	3.9	16	78	34	100	0.0
	Sedona	Y	1.2	2.8	16	55	34	84	0.0
Crookham	The Rock	Y	1.4	1.9	10	37	18	48	0.2
	White Cloud	W	1.3	2.3	20	46	42	84	0.1
	OLYS03-209	Y	1.1	1.9	18	38	28	58	0.1
	OLYS03-207	Y	1.1	2.1	14	42	20	62	0.0
	OLYS05N5	Y	1.1	2.1	10	41	24	50	0.7
	OLYX00-23	Y	1.4	2.9	20	57	40	90	0.0
	OLYX06-25	Y	1.2	2.4	20	49	24	76	0.0
	OLRH06-91	R	1.8	3.4	26	67	46	92	0.0
D. Palmer	Mesquite	Y	1.2	2.1	10	42	20	68	0.2
	Tequila	Y	1.1	2.0	22	40	32	56	0.4
	Sarape Café	Y	1.5	3.0	28	61	50	90	0.0
Nickerson-Zwaan	NIZ 37-2010	Y	2.0	3.6	20	72	36	96	0.0
	NIZ 37-2020	Y	1.2	3.0	16	61	30	99	0.0
	NIZ 37-2025	Y	1.3	2.8	10	56	22	88	0.1
Nippon Norin	NN65	Y	1.2	2.8	12	57	22	88	0.0
Nunhems	Arcero	Y	1.4	3.1	12	62	30	92	0.0
	Granero	Y	1.1	2.6	16	53	36	84	0.2
	Joaquin	Y	1.1	1.9	16	38	20	58	0.0
	Montero	Y	1.8	3.5	28	70	56	98	0.0
	Ranchero	Y	1.2	2.9	20	57	34	88	0.1
	Vaquero	Y	1.2	2.8	18	55	32	92	0.0
	Cometa	W	1.1	2.4	12	47	22	72	0.2
	Solstice	W	1.3	2.6	16	51	36	88	0.1
	Salsa	R	1.9	3.7	18	74	36	100	0.0
	NUN9002ON	R	2.2	4.0	30	80	38	100	0.0
	NUN9003ON	R	1.7	3.8	38	76	56	100	0.0
Sakata	Bello Blanco	W	1.1	2.3	14	47	24	76	0.5
Seminis	Barbaro	Y	1.2	2.6	12	51	32	78	0.0
	Charismatic	Y	1.0	1.8	10	35	32	58	0.1
	Monarchos	Y	1.2	2.6	18	51	38	81	0.0
	Swale	Y	1.0	2.4	20	47	40	74	0.0
	EX16529	Y	1.3	2.6	14	52	44	74	0.1
	Rainier	W	1.4	3.0	14	59	28	88	0.0
	Mercury	R	2.7	4.4	78	89	82	100	0.0
average			1.4	2.8	19	56	34	82.7	0.1
LSD (0.05)			0.3	0.4	9	8	10	5	0.2

<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.

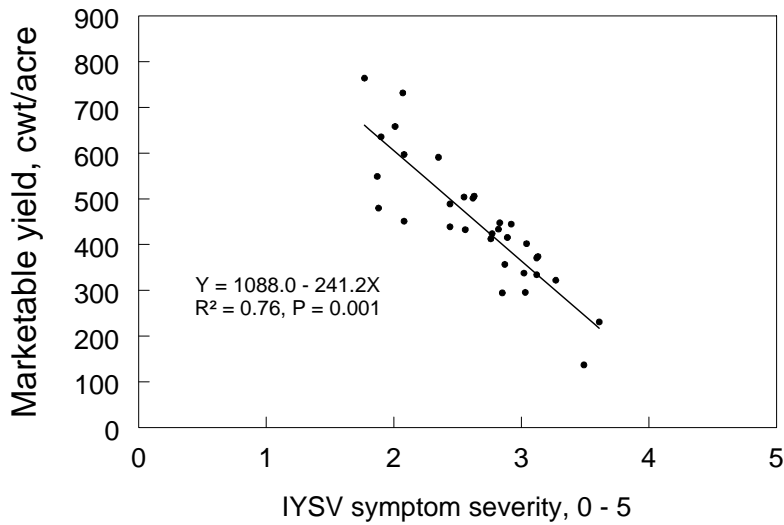


Figure 1. Average onion marketable yield out of storage for yellow varieties as a function of the average observed Iris yellow spot virus symptoms in 2009. Virus ratings were based on subjective evaluations (0 = no symptoms, 5 = highest damage). Each data point is the average for each variety of five plots of yield compared with the average five IYSV observations. Malheur Experiment Station, Oregon State University, Ontario, OR, 2009.

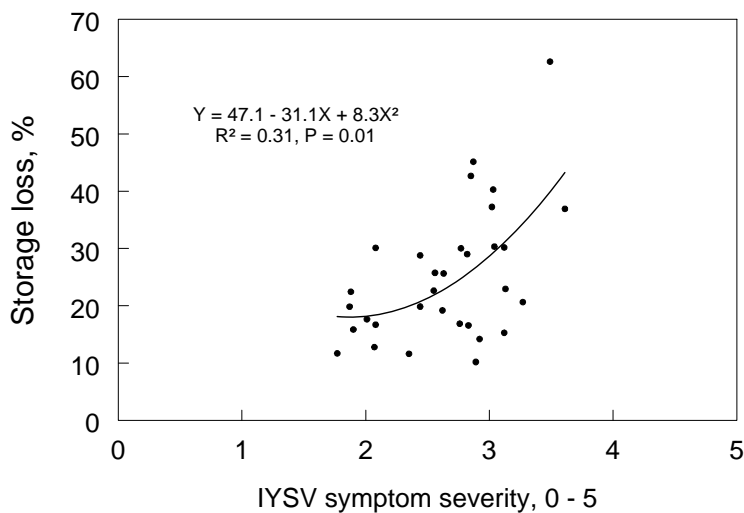


Figure 2. Average yellow onion decomposition during storage as a function of the average observed Iris yellow spot virus symptoms in 2009. Each data point is the average of the yield of five plots of each variety compared with the average observed IYSV symptoms. Malheur Experiment Station, Oregon State University, Ontario, OR, 2009.