

Title: Cultivar Evaluation for Control of Common Smut in Sweet Corn and High Plains Virus in the Columbia Basin of Oregon and Washington.

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2007 Common smut

Planting date/cultivar evaluation: Twenty-nine sweet corn cultivars were evaluated for resistance to natural infection by common smut (Table 1). Plots were seeded to 30,800 plants/acre on May 25 and Jun 22 on the Hermiston Agricultural Research and Extension Center on Adkins fine sandy loam (pH 6.8, 0.7% organic matter). The four 30 ft rows/plot were spaced 30 inches apart. The experimental design was a randomized complete block, with four replications.

An additional trial, planted on May 16 at the USDA Central Ferry Research Station, Pomeroy, WA., to assess twenty sweet corn cultivars for resistance to High Plains virus, was evaluated for incidence of common smut also.

Normal commercial production practices were followed. At ear maturity, plant stand was recorded, and the number and location (at base, between base and ear, on ear, between ear and tassel, on tassel) of smut galls were noted for each plant. Some plants had more than one infection location. Data were analyzed with the SAS GLM procedure following arcsine transformation. Duncans multiple range test was used for mean separation. Results are presented in Tables 3-6.

Results

Planting date/cultivar evaluations:

In general, disease pressure was light in 2007 as compared to the previous years (Table 2). Over the nine years of this trial, the percentage of plants with smut infections at the different plant locations generally increased from the early to later planting (Table 2). In 2007, however, the percent plants with infections on the ear decreased from 4.6 to 2.3% from the early to late

Table 1. Sweet corn cultivars evaluated for common smut resistance, Hermiston, OR. 2007.

Cultivar	Source
<u>su type</u>	
Evita	Crookham
GH 1703	Syngenta
GH 2690	Syngenta
GH 6462	Syngenta
Jubilee	Syngenta
Legacy	Harris Moran
Sockeye	Harris Moran
Tamarack	Crookham
<u>sh₂ type</u>	
CSHYP3-99	Crookham
170A	Illinois Foundation Seed
179A	Illinois Foundation Seed
1183	Illinois Foundation Seed
1377	Illinois Foundation Seed
1380	Illinois Foundation Seed
1382	Illinois Foundation Seed
1579	Illinois Foundation Seed
ACX 1011Y	Abbott & Cobb
ACX 1161Y	Abbott & Cobb
ACX 4032W	Abbott & Cobb
ACR ST 4098	Abbott & Cobb
Crisp n Sweet 710	Crookham
GSS 1477	Syngenta
Krispy King	Syngenta
Magnum	Syngenta
Marvel	Crookham
Max	Harris Moran
Summer Sweet #500	Abbott & Cobb
Summer Sweet #610	Abbott & Cobb
Supersweet Jubilee	Syngenta

planting date, and although the trend was for infection to increase, the differences were not significant for infections on the lower stalk or tassel.

As in past years, the different cultivars responded somewhat differently, depending on planting date. At the earlier planting date, there was no difference between cultivars for galls on the base (Table 3). Jubilee, followed by 1183, Supersweet Jubilee and Magnum, had the highest percent galls on the lower stalk. And Summer Sweet 500 and Jubilee had more infected ears than the other cultivars. Supersweet Jubilee had the most galls on the upper stalk, followed by Krispy King; all the other varieties

Table 2. Effect of year and planting date on development of common smut in sweet corn, Hermiston, OR, 1999-2007.

Cultivar	Gall location ^z					
	Base	Lower stalk	Ear	Upper stalk	Tassel	
<u>Year</u>	<i>Percent (%)</i>					
1999	6.3 c	4.2 d	15.3a	10.5a	24.7 b	
2000	9.1 b	21.0ab	6.7 bcd	8.3 b	20.1 c	
2001	11.2a	23.4a	7.6 bc	6.6 bc	40.4a	
2002	7.5 bc	22.7a	9.5 b	6.7 bc	21.5 bc	
2003	5.9 c	23.6a	4.6 de	5.8 c	13.8 d	
2004	3.1 d	18.0 b	6.1 cde	4.9 c	17.6 cd	
2005	1.4 d	7.6 d	7.2 bcd	2.1 d	3.2 ef	
2006	3.4 d	8.0 d	3.6 e	5.3 c	7.0 e	
2007	1.8 d	14.3 c	8.5 bc	5.1 c	2.2 f	
	****	****	****	**	****	
<u>Planting date</u>						
Apr/May	2.4	9.7	7.6	5.8	8.8	
May/Jun	8.6	22.0	7.8	6.7	24.7	
	****	****	NS	**	****	

^z Means of six cultivars trialed in all 9 years.

NS, ****, ** Effect of year or planting date not significant or significant at $P \leq 0.0001$ or $P \leq 0.01$, respectively.

Means followed by different letters significantly different at $P=0.05$ (Duncans multiple range test).

were similar. Sockeye and Legacy had the highest percent galls on the tassels; the percent tassel infection for the remaining cultivars was similar.

With the later June 22 planting date, GSS1477 had significantly more galls on the base than the other varieties (Table 4). Summer Sweet 610 had the most galls on the lower stalk, followed by 1183, Magnum, and Supersweet Jubilee. The highest percent infected ears was found in Jubilee and Summer Sweet 500, followed by Supersweet Jubilee, then ACX1011Y. Krispy King and Supersweet Jubilee had more than 14% upper stalk infection, followed by 1380, Summer Sweet 500 and Jubilee. 170A had the highest tassel infection rating, followed by 1377, then ACX4032W and ACR ST 4098.

Disease pressure was similar at the Central Ferry Research Station, Pomeroy, WA. to HAREC (Table 5). Base and tassel infections were similar among all the cultivars. Jubilee, Crisp n Sweet 710, and Supersweet Jubilee had the most plants with galls

Table 3. Susceptibility of sweet corn cultivars to natural common smut infection, May 25 planting, Hermiston, OR., 2007.

Cultivar	Gall location					
	Base	Lower stalk	Ear	Upper stalk	Tassel	
<u>su type</u>		Percent (%)				
Evita	0.0	5.1 e	1.8 b	0.7 b	1.9 bc	
GH 1703	0.5	7.3 cde	0.5 b	0.3 b	7.3abc	
GH 2690	1.2	4.0 e	1.8 b	0.3 b	4.7abc	
GH 6462	0.1	8.3 cde	0.4 b	0.7 b	0.8 c	
Jubilee	0.0	30.6a	21.8a	1.0 b	1.2 bc	
Legacy	0.0	7.3 cde	3.0 b	0.0 b	11.4ab	
Sockeye	0.0	5.5 de	4.8 b	0.2 b	13.7a	
Tamarack	0.0	3.1 e	2.1 b	0.3 b	4.0abc	
<u>sh₂ type</u>						
CSHYP3-99	0.0	1.2 e	1.0 b	0.0 b	9.6abc	
170A	0.0	0.0 e	2.3 b	0.7 b	6.3abc	
179A	0.2	0.9 e	3.2 b	0.8 b	0.3 c	
1183	0.1	22.5ab	2.9 b	0.0 b	3.3abc	
1377	0.0	1.4 e	1.3 b	1.2 b	4.0abc	
1380	0.0	4.0 e	0.5 b	2.4 b	4.1abc	
1382	0.3	0.7 e	1.4 b	0.2 b	3.1 bc	
1579	0.4	4.5 e	0.5 b	0.3 b	2.8 bc	
ACX 1011Y	0.2	1.7 e	7.9 b	0.0 b	1.0 bc	
ACX 1161Y	0.2	1.8 e	0.0 b	0.0 b	4.5abc	
ACX 4032W	0.2	1.2 e	4.6 b	0.4 b	5.2abc	
ACR ST 4098	0.2	0.5 e	1.8 b	1.2 b	8.8abc	
Crsp n Swt 710	0.0	8.5 cde	5.1 b	0.2 b	0.6 bc	
GSS 1477	0.3	11.6 bcde	2.0 b	3.8 b	1.6 bc	
Krispy King	0.0	8.2 cde	3.5 b	9.2a	1.7 bc	
Magnum	1.2	19.2abc	4.7 b	1.0 b	0.2 c	
Marvel	0.4	0.6 e	3.1 b	0.6 b	5.6abc	
Max	0.0	11.8 bcde	10.7 b	0.6 b	1.7 bc	
Smmr Swt #500	0.3	1.2 e	25.7a	1.4 b	5.0abc	
Smmr Swt #610	0.9	18.2 bcd	3.2 b	0.2 b	1.7 bc	
Sprswt Jubilee	0.0	19.4abc	10.8 b	9.3a	0.2 c	
	NS	****	****	****	**	

NS, **, **** Cultivar effect not significant or significant at $P \leq 0.01$ or $P \leq 0.0001$, respectively.

Means followed by different letters significantly different at $P=0.01$ (Duncans multiple range test).

located on the lower stalk, while Supersweet Jubilee, Legacy, Jubilee and Crisp n Sweet 710 exhibited the highest percentage of infected ears. Supersweet Jubilee, Krispy King and Magnum had the most infections on the upper stalk.

Table 4. Susceptibility of sweet corn cultivars to natural common smut infection, Jun 22 planting, Hermiston, OR., 2007.

Cultivar	Gall location									
	Base		Lower stalk		Ear		Upper stalk		Tassel	
	Percent (%)									
<i>su</i> type										
Evita	0.5	ef	3.5	cde	0.2	d	0.0	e	0.0	g
GH 2690	0.4	ef	1.6	e	0.2	d	0.2	e	0.2	g
GH 6462	6.9	bcde	7.4	cde	0.9	d	0.3	e	0.2	g
Jubilee	1.0	ef	9.1	cde	10.8a		3.7	bcd	0.0	g
Legacy	0.2	f	5.9	cde	1.2	cd	0.2	e	1.3	fg
Sockeye	1.5	def	3.1	cde	0.3	d	0.3	e	5.1	defg
Tamarack	1.0	ef	3.7	cde	0.7	d	0.0	e	0.0	g
<i>sh₂</i> type										
CSHYP3-99	5.3	bcdef	8.2	cde	0.7	d	0.8	de	8.4	def
170A	1.0	ef	4.7	cde	1.1	d	2.5	cde	33.0a	
179A	2.8	def	2.0	de	1.5	cd	1.0	de	1.0	fg
1183	10.0	b	32.5	b	1.0	d	0.9	de	4.5	efg
1377	2.9	def	5.0	cde	1.3	cd	1.9	cde	24.9	b
1380	5.3	bcdef	14.4	cd	1.2	cd	6.3	b	0.0	g
1382	4.9	bcdef	5.3	cde	0.8	d	0.0	e	0.3	g
1579	9.7	bc	9.0	cde	0.5	d	2.2	cde	1.0	fg
ACX 1011Y	0.8	ef	1.6	e	5.1	bc	0.8	de	1.7	fg
ACX 1161Y	3.7	cdef	5.8	cde	0.5	d	0.5	e	5.0	defg
ACX 4032W	1.8	def	1.1	e	4.1	bcd	2.2	cde	17.2	c
ACR ST 4098	2.6	def	1.4	e	0.7	d	0.6	e	11.9	cd
Crsp n Swt 710	0.8	ef	3.5	cde	3.5	bcd	1.3	de	1.4	fg
GSS 1477	18.0a		10.3	cde	0.4	d	0.4	e	0.0	g
Krispy King	3.7	cdef	6.0	cde	1.1	d	14.3a		1.4	fg
Magnum	3.3	def	15.1	c	3.8	bcd	0.9	de	0.0	g
Marvel	0.0	f	1.5	e	0.6	d	0.5	e	0.3	g
Max	3.3	def	10.1	cde	4.1	bcd	0.4	e	0.4	g
Smmr Swt #500	2.9	def	8.6	cde	10.4a		4.6	bc	10.3	de
Smmr Swt #610	7.9	bcd	43.3a		0.0	d	1.6	de	1.5	fg
Sprswt Jubilee	3.7	cdef	14.8	c	6.0	b	14.5a		0.4	g
	****		****		****		****		****	

**** Cultivar effect significant at $P \leq 0.0001$.
Means followed by different letters significantly different at $P=0.01$ (Duncans multiple range test).

Table 6 summarizes the most and least susceptible varieties of those included in at least 3 of the 9 years this trial has been conducted.

Table 5. Susceptibility of sweet corn cultivars to common smut, Central Ferry Research Station, Pomeroy, WA., 2007.

Cultivar	Gall location				
	Base	Lower stalk	Ear	Upper stalk	Tassel
<u>su</u>					
	Percent (%)				
Elite	0.6	1.7 cde	4.4 cd	0.3 c	0.0
Evita	0.3	0.3 e	0.3 d	0.3 c	1.0
GH 1703	0.0	2.1 cde	3.5 cd	0.3 c	0.0
GH 2547	1.4	2.3 cde	4.0 cd	0.9 bc	0.6
GH 2690	0.3	0.4 e	3.0 cd	0.3 c	0.0
GH 6462	0.8	1.6 de	1.4 d	0.5 c	0.0
Intrigue	0.2	2.0 cde	0.5 d	0.9 bc	0.6
Jubilee	1.8	8.2a	10.7 bc	3.1 bc	0.3
Legacy	0.3	6.1abcd	15.9ab	0.4 c	0.0
Sockeye	0.0	0.4 e	1.1 d	0.6 c	0.4
Tamarack	0.5	2.3 cde	2.7 cd	1.6 bc	1.6
<u>sh₂</u> :					
Basin	0.0	3.5abcde	2.6 cd	0.0 c	0.3
Crsp n Swt 710	0.3	7.9ab	9.6 bc	0.0 c	0.0
Krispy King	0.9	1.5 de	4.7 cd	3.9 b	0.4
Magnum	2.0	2.8 bcde	5.7 cd	1.1 b	0.4
Marvel	0.9	1.5 de	3.6 cd	0.6 c	2.0
Max	0.3	2.1 cde	4.2 cd	0.3 c	0.7
Smmr Swt #500	0.7	4.6abcde	7.2 cd	2.8 bc	2.0
Smmr Swt #610	0.9	1.6 de	1.0 d	0.3 c	1.0
Sprswt Jubilee	0.9	7.1abc	22.4a	8.0a	1.0
	NS	****	****	****	NS

NS, **** Cultivar effect not significant or significant at $P \leq 0.0001$, respectively.

Means followed by different letters significantly different at $P=0.01$ (Duncans multiple range test).

Table 6. Susceptibility of sweet corn cultivars^z to natural common smut infection of the ear, Hermiston, OR., 1999-2007.

Cultivar	Ears infected	Years tested
	(%)	(No.)
<i>Most susceptible</i>		
1861	16.1	3
Jubilee	13.7	9
2684	12.5	3
Challenger	11.0	3
Supersweet Jubilee	9.5	9
Accession	9.4	3
Krispy King	7.4	9
Summer Sweet 8100	7.3	5
Summer Sweet 500	7.0	9
<i>Least susceptible</i>		
Cinch	1.2	5
ACX232	1.1	5
Intrigue	1.0	3
Eliminator	0.9	3
GH2547	0.9	7
Sockeye	0.9	7
Marvel	0.8	8
GH6462	0.7	3
Conquest	0.6	3

^z Of the 36 cultivars evaluated in at least 3 of the 9 trial years.

High Plains Virus

To determine if there is High Plains virus (HPV) resistance in commercial processing sweet corn cultivars, trials were conducted at the Hermiston Agricultural Research & Extension Center, and the USDA Central Ferry Research Station, Pomeroy, WA. At each location, twenty cultivars (Table 7) currently in production across the Columbia basin were evaluated. Four 30'rows/plot, 30" apart, with 9" between plants, were seeded on May 26 and Jul 27 with overhead irrigation at the Pomeroy (sprinkler) and HAREC (center pivot) sites, respectively. The HAREC plots were adjacent to a perennial wheat field which had been planted to provide a "green bridge" from a 2006 sweet corn planting to the 2007 virus trial. Normal commercial production practices were followed. The experimental design was a randomized complete block, with four replications.

Table 7. Cultivars evaluated for High Plains virus susceptibility, 2007.

Cultivar	Source
<u>su:</u>	
Elite	Syngenta
Evita	Crookham
GH 1703	Syngenta
GH 2547	Syngenta
GH 2690	Syngenta
GH 6462	Syngenta
Intrigue	Crookham
Jubilee	Syngenta
Legacy	Harris Moran
Sockeye	Harris Moran
Tamarack	Crookham
<u>sh₂:</u>	
Basin	Seminis
Crisp n Sweet 710	Crookham
Krispy King	Syngenta
Magnum	Syngenta
Marvel	Crookham
Max	Harris Moran
Summer Sweet #500	Abbott & Cobb
Summer Sweet #610	Abbott & Cobb
Supersweet Jubilee	Syngenta

Plants were observed for symptom development during the growing season. Off-station plots were visually evaluated for HPV symptoms in Aug. While no visual indication of HPV infection was noted for this location, leaf samples were taken for PCR analyses, and MDMV was found in GH 6464 and Legacy (only in one rep of each variety, less than 1%). The late planted sweet corn at HAREC frosted on Oct 26, prior to ear maturity. Plots had been observed weekly for symptom development. No symptoms were noted at any time, with the final observation on Oct 19. As a result, conclusions on HPV resistance within the varieties tested can not be drawn.

Additional virus data

Several commercial sweet corn fields in the southern Columbia basin exhibited virus symptoms. Mid- and late-season 'Legacy' fields, which had 14 and 7 percent infected plants, respectively, and mid- and late-season 'Sockeye' fields with 84 and 14 percent infected plants, respectively, were evaluated. Ears and leaves were sampled from 25 symptomatic and 25 non-symptomatic

plants/field, and analyzed for HPV, maize dwarf mosaic virus (MDMV), and wheat streak mosaic virus. Ears were husked and fresh weight, length, and diameter measured. All symptomatic samples tested positive for MDMV. Impact of the virus on ear characteristics is presented in Table 8. Maize dwarf mosaic virus had not been a serious problem in the basin prior to this year.

Table 8. Effect of maize dwarf mosaic virus virus on sweet corn ear characteristics, Plymouth, WA., 2007.

	Fresh weight (oz)	Length (in)	Diameter (in)
<i>Infected</i>			
Yes	7.9	6.78	1.87
No	10.9	8.21	2.02
	****	****	****

**** Effect significant at $P \leq 0.0001$.

Also, a limited number of plants grown in other commercial fields with the following varieties: Basin, Chase, Crisp n Sweet 710, Evita, GH 2547, GH 6464, Intrigue, Jubilee, Kokanee, Krispy King, Legacy, Magnum, Max, Marvel, Prelude, Sheba, Summer Sweet 610, SS Jubilee, Tamarack, 1477, and 4396 were tested. While both Prelude and Chase tested positive for MDMV, the incidence of virus in these fields was less than 1%.