

## 2010 Cultivar Evaluation for Control of Common Smut in Sweet Corn in the Columbia Basin.

**Principle Investigators:** George Clough and Philip Hamm, Hermiston Agricultural Research and Extension Center, Oregon State University, 2121 S. 1<sup>st</sup> St, Hermiston, OR 97838.

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### Materials & methods

Twenty-two sweet corn cultivars were evaluated for resistance to natural infection by common smut (Table 1). Four cultivars (Jubilee, Krispy King, Summer Sweet 610, and Supersweet Jubilee) have been included in all 12 years of these evaluations to gauge the relative severity of smut pressure over that time and in each trial season. Plots were seeded to ~27,000 plants/acre on May 11 and Jun 10 on the Hermiston Agricultural Research and Extension Center on Adkins fine sandy loam (pH 6.8, 0.8 organic matter). An additional cultivar (Basin) was added to the second planting. The four 30 ft rows/plot were spaced 30 inches apart. The experimental design was a randomized complete block, with four replications. 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. The relative disease pressure over the 12 years of the trials is displayed in Figure 1 and Table 2. Results of the 2010 trial are presented in Tables 3-5 with the most susceptible and resistant cultivars presented in Tables 6 and 7.

Table 1. Sweet corn cultivars evaluated for common smut resistance, Hermiston, OR. 2010.

Cultivar	Source
<i>su:</i>	
GH 1703	Syngenta
GH 2171	Syngenta
GH 6462	Syngenta
Jubilee <sup>1</sup>	Syngenta
Rocker	Syngenta
<i>sh<sub>2</sub>:</i>	
ACX 7189DW	Abbott & Cobb
ACX 7195MRY	Abbott & Cobb
ACX 7242MRY	Abbott & Cobb
Basin <sup>2</sup>	Seminis
Constellation	Abbott & Cobb
DMC21-05	Del Monte
DMC21-84	Del Monte
DMC22-85	Del Monte
Fortitude (CSHYP3-99)	Crookham
GSS 1477	Syngenta
GSS 2259	Syngenta
Krispy King <sup>1</sup>	Syngenta
Magnum II	Syngenta
Marvel	Crookham
Rana	Crookham
Samurai	Crookham
Summer Sweet 610 <sup>1</sup>	Abbott & Cobb
Supersweet Jubilee <sup>1</sup>	Syngenta

<sup>1</sup> Four cultivars in trial 1999-2010.

<sup>2</sup> Second (Jun 10) planting only.

## Results

*Disease pressure.* Using the data from the check cultivars evaluated in all 12 years of these trials, the percent plants with galls has decreased over time (Fig. 1, Table 2), possibly due to changes in cultivars grown in the Columbia basin. Two cultivars identified as extremely susceptible to common smut (Jubilee and Supersweet Jubilee) accounted for more than 70% of the planted acreage in 1999, but less than 10% in 2010, probably reducing the spore load and subsequent disease pressure. Also over the 12 years of this trial, the percentage of plants with smut infections at the different plant locations increased from the early to later planting (Table 2).

Figure 1. Average percent plants infected with common corn smut, check cultivars, Hermiston, Ore. 1999-2010.



*2010 trial: planting date.* The percent plants with galls at all locations increased from the early to the later planting date, but the difference on the upper stalk was not statistically significant (Table 3).

*2010 trial: cultivars.* As in past years, the different cultivars responded somewhat differently, depending on planting date. At the earlier planting date, most cultivars had similar percent gall infections at the base of the plant, but GSS 2259, Krispy King, and DMC21-05 had significantly more galls than several others (Table 4). Krispy King and Jubilee had the highest percent galls on the lower stalk. Super Sweet Jubilee had more infected ears than the other cultivars. DMC21-05 and Krispy King had the most galls on the upper stalk, while ACX7195 and Fortitude had the highest percent galls on the tassels. Although there were statistical differences between some cultivars for percent plants with galls at all locations, most of the cultivars evaluated did not differ from one another. When ranked for overall effect of gall and location on ear yield (reduction in fresh weight),

Supersweet Jubilee was impacted significantly more (4.5%) than any other cultivar (Table 6).

With the later June 10 planting date, Tamarack and GH 6377 had significantly more galls on the base than the other cultivars (Table 5). DMC2285 and Jubilee had the most galls on the lower stalk, followed by Krispy King. The highest percent infected ears was found in Super Sweet Jubilee and Crisp n Sweet 710, followed by Summer Sweet 610 and Magnum. Upper stalk infection was greatest with Krispy King and Supersweet Jubilee. Fortitude had the highest tassel infection rating, followed by Rana, then Constellation and Magnum.

When ranked for overall effect of gall and location on ear yield for both the Jun 10 planting and the average for both plantings, Supersweet Jubilee had the greatest reduction in ear fresh weight, followed by Constellation, Krispy King, and Jubilee (Table 6). Marvel was impacted least, with an average ear fresh weight loss of only 0.4 percent.

Table 7 summarizes the most and least susceptible varieties for natural infection of the ear of the 40 cultivars included in at least 3 of the 12 years this trial has been conducted.

## **Discussion**

As the natural infection pressure has decreased significantly over the twelve years that these trials have been conducted and the differences between cultivars tested has decreased, it is becoming more difficult to identify susceptible/resistant cultivars among the newer releases (although the same check cultivars have consistently ranked most susceptible over the entire time period). It is possible that under more severe disease pressure, more cultivar differences would occur than are being observed under the current conditions.

Table 2. Effect of year and planting date on development of common smut in sweet corn control cultivars trialed from 1999-2010, Hermiston, OR.

Cultivar	Gall location				
	Base	Lower stalk	Ear	Upper stalk	Tassel
<u>Year</u>	<i>Percent plants w/gall(%)</i>				
1999	6.3 c	4.2 ef	15.3a	10.5a	24.7 b
2000	9.1 b	21.0ab	6.7 bcde	8.3 b	20.1 cd
2001	11.2a	23.4a	7.6 bcd	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 ef	5.8 c	13.8 e
2004	3.1 de	18.0 b	6.1 cdef	4.9 cd	17.6 d
2005	1.6 e	7.6 def	7.2 bcde	2.1 e	3.2 g
2006	3.4 de	8.0 de	3.6 fg	5.3 cd	7.0 f
2007	1.8 de	14.3 c	8.5 bc	5.1 cd	2.2 g
2008	1.4 e	9.3 d	5.8 cdef	3.6 de	10.8 e
2009	2.0 de	4.0 f	5.1 def	5.8 c	1.5 g
2010	3.8 d	6.9 def	1.8 g	2.8 e	1.9 g
	****	****	****	****	****
<u>Planting date 1999-2010</u>					
Apr/May	2.2	8.2	6.6	5.1	7.0
May/Jun	7.4	19.7	7.4	6.4	21.7
	****	****	**	***	****

NS, \*\*, \*\*\*, \*\*\*\* Effect of year or planting date not significant or significant at  $P \leq 0.01$ ,  $P \leq 0.001$  or  $P \leq 0.0001$ , respectively. Means followed by different letters significantly different at  $P=0.01$  (Duncans multiple range test).

Table 3. Effect of planting date on development of common smut in sweet corn, Hermiston, OR, 2010.

Planting Date	Gall location				
	Base	Lower stalk	Ear	Upper stalk	Tassel
	<i>Percent plants w/gall(%)</i>				
May 11	1.7	1.3	0.5	1.1	1.2
Jun 10	4.6	6.6	1.5	1.4	2.6
	****	****	****	NS	****

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

Table 4. Susceptibility of sweet corn cultivars to natural common smut infection, May 9 planting, Hermiston, OR., 2010.

Cultivar	Gall location				
	Base	Lower stalk	Ear	Upper stalk	Tassel
	<i>Percent plants w/gall (%)</i>				
<i>su:</i>					
GH 1703	0.5 cde	0 c	0 b	0 c	0.3 c
GH 2171	0 e	0 c	0 b	0 c	0 c
GH 6462	0.5 cde	0 c	0 b	0.2 c	0 c
Jubilee	0.6 cde	4.7ab	0.3 b	0.6 bc	0.5 c
Rocker	0.3 de	0.3 c	0 b	0.5 c	0.3 c
<i>sh<sub>2</sub>:</i>					
ACX 7189DW	3.2abcd	0.3 c	0.7 b	1.6 bc	0.5 c
ACX 7195MRY	3.2abcd	1.2abc	0.0 b	0.0 c	8.4a
ACX 7242MRY	3.5abc	0.7 bc	0.0 b	0.0 c	1.0 c
Constellation	1.3 bcde	0.6 bc	0.6 b	0.8 bc	0.7 c
DMC21-05	4.0ab	0.2 c	0 b	5.1a	1.7 c
DMC21-84	1.5 bcde	0.6 bc	0.8 b	0.9 bc	2.3 bc
DMC22-85	2.1abcde	2.6abc	0.3 b	0.9 bc	1.0 c
Fortitude	2.1abcde	1.4abc	0 b	0.4 c	4.3 b
GSS 1477	0.7 cde	1.7abc	0.2 b	1.4 bc	0.2 c
GSS 2259	4.6a	1.6abc	0.3 b	0.4 c	0.3 c
Krispy King	4.1ab	4.9a	0.7 b	4.1ab	1.1 c
Magnum II	1.9abcde	2.5abc	0.7 b	1.5 bc	0 c
Marvel	0.5 cde	0.1 c	0.3 b	0.1 c	0.6 c
Rana	0.9 bcde	0 c	0.5 b	1.2 bc	0.8 c
Samurai	0 e	1.4abc	1.2 b	0.1 c	0.4 c
Summer Sweet #610	1.0 bcde	0.2 c	0 b	1.0 bc	2.5 bc
Supersweet Jubilee	1.0 bcde	3.7abc	3.5a	3.5abc	0.2 c
	****	**	****	***	****
average ( $\bar{x}$ )	1.7	1.3	0.5	1.1	1.2

\*\* , \*\*\* , \*\*\*\* Cultivar effect significant at  $P \leq 0.01$ ,  $P \leq 0.001$ , or  $P \leq 0.0001$ , respectively.

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

Table 5. Susceptibility of sweet corn cultivars to natural common smut infection, Jun 10 planting, Hermiston, OR., 2010.

Cultivar	Gall location				
	Base	Lower stalk	Ear	Upper stalk	Tassel
	<i>Percent plants w/gall (%)</i>				
<i>su:</i>					
GH 1703	4.2 cde	4.2 def	0.3 d	2.0 b	5.4abcd
GH 2171	6.4 bcde	7.2 bcdef	0.1 d	1.4 b	5.7abcd
GH 6462	0.8 e	0.9 f	1.4 cd	0.9 b	0 d
Jubilee	6.0 bcde	13.4ab	3.0 bcd	1.7 b	2.2 bcd
Rocker	4.7 bcde	9.0 bcde	2.8 bcd	1.2 b	0 d
<i>sh<sub>2</sub>:</i>					
ACX 7189DW	2.5 de	5.7 cdef	2.2 cd	1.6 b	9.1a
ACX 7195MRY	10.0abc	16.9a	0 d	0 b	7.4ab
ACX 7242MRY	4.3 bcde	5.2 cdef	3.6abc	0.2 b	0.5 cd
Basin	3.7 cde	4.1 def	0.7 cd	2.3 b	5.5abcd
Constellation	1.6 de	2.6 def	6.0a	0.2 b	0.2 cd
DMC21-05	6.8 bcde	6.9 bcdef	0.5 d	1.9 b	0.4 cd
DMC21-84	0.8 e	4.6 def	1.2 cd	1.1 b	0.2 cd
DMC22-85	1.3 de	6.9 bcdef	0.2 d	0.9 b	1.2 cd
Fortitude	0.3 e	3.1 def	0 d	0 b	6.0abc
GSS 1477	6.6 bcde	4.5 def	0 d	0.6 b	0.2 cd
GSS 2259	11.3ab	6.9 bcdef	0 d	0.2 b	0 d
Krispy King	16.1a	12.6abc	2.2 cd	6.5a	4.3abcd
Magnum II	8.4 bcd	8.1 bcdef	3.1 bcd	0.8 b	0.7 cd
Marvel	1.6 de	1.5 ef	0 d	0.4 b	0.7 cd
Rana	0.7 e	0.9 f	0.5 d	2.1 b	1.4 cd
Samurai	2.8 cde	9.9abcd	1.6 cd	0.2 b	4.7abcd
Summer Swt #610	2.3 de	6.6 bcdef	0 d	0.6 b	2.6 bcd
Superswt Jubilee	2.3 de	9.0 bcde	5.1ab	4.7a	1.8 cd
	****	****	****	****	****
average ( $\bar{x}$ )	4.6	6.6	1.5	1.4	2.6

\*\*\*\* 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. Impact of common smut galls on ear fresh weight loss<sup>1</sup>, Hermiston, OR., 2010.

Cultivar	Planting		
	May 11	Jun 10	Average
<i>su:</i>	<i>Fresh Weight Loss(%)</i>		
GH 1703	0.1 b	1.6 def	0.8 fg
GH 2171	0 b	1.9 def	0.9 fg
GH 6462	0.1 b	1.7 def	0.9 fg
Jubilee	1.0 b	5.3abc	3.2 bcd
Rocker	0.1 b	4.4abcde	2.3 bcdefg
<i>sh<sub>2</sub>:</i>			
ACX 7189DW	1.2 b	3.4 bcdef	2.3 bcdefg
ACX 7195MRY	0.7 b	3.2 cdef	2.0 cdefg
ACX 7242MRY	0.4 b	4.6abcd	2.5 bcdef
Basin	-	2.0 def	2.0 cdefg
Constellation	0.9 b	6.4ab	3.6 bc
DMC21-05	1.2 b	2.1 def	1.6 efg
DMC21-84	1.2 b	2.0 def	1.6 defg
DMC22-85	0.9 b	1.4 ef	1.1 efg
Fortitude	0.6 b	0.6 f	0.6 fg
GSS 1477	0.6 b	1.1 f	0.9 fg
GSS 2259	0.8 b	1.6 def	1.2 efg
Krispy King	2.2 b	6.0abc	4.1 b
Magnum II	1.4 b	4.7abcd	3.0 bcde
Marvel	0.4 b	0.4 f	0.4 g
Rana	0.8 b	1.0 f	0.9 fg
Samurai	1.5 b	3.2 cdef	2.3 bcdefg
Summer Swt #610	0.4 b	1.1 f	0.7 fg
Suprswt Jubilee	4.5a	7.2a	5.9a
	****	****	****
average ( $\bar{x}$ )	1.0	2.9	1.9

<sup>1</sup> Calculations based on data from Blatchford, S. 2004. The effect of common corn smut (*Ustilago maydis*) on sweet corn (*Zea mays* L.) in the Columbia basin. Ore. State Univ., Corvallis, Ore. M.S. Thesis.

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



Table 7. Susceptibility of sweet corn cultivars<sup>z</sup> to natural common smut infection of the ear, Hermiston, OR., 1999-2010.

Cultivar	Ears infected	Years tested	Source
	(%)	(No.)	
<u>Most susceptible</u>			
1861	16.1	3	Rogers
2684	12.5	3	Rogers
Jubilee	11.4	12	Rogers
Challenger	11.0	3	Seminis
Supersweet Jubilee	8.5	12	Rogers
Summer Sweet 8100	7.3	5	Abbott & Cobb
Summer Sweet 500	7.0	10	Abbott & Cobb
ACX429	7.0	3	Abbott & Cobb
Crisp n Sweet 710	6.4	11	Crookham
Krispy King	6.2	12	Rogers
<u>Least susceptible</u>			
Conquest	0.6	3	Crookham
Marvel	0.7	11	Crookham
Sockeye	0.9	7	Harris Moran
GH2547	0.9	7	Syngenta
Eliminator	0.9	3	Crookham
GH6462	0.9	6	Syngenta
Intrigue	1.0	3	Crookham
Fortitude	1.0	4	Crookham
Tamarack	1.0	3	Crookham
GSS1477	1.1	5	Syngenta
ACX232	1.1	5	Abbott & Cobb

<sup>z</sup> Of 40 cultivars evaluated in at least 3 of 12 trial years.