RESEARCH REPORT - OREGON PROCESSED VEGETABLE COMMISSION

Title: Control and Management of Common Smut on Corn in the Columbia Basin of Oregon and Washington

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Project Status: Continuation, February 1, 2000 to December 31, 2000

Project Funding: $5000

Objectives:

1) Screen sweet corn cultivars for resistance to common smut.
2) Investigate effect of planting date on development of common smut.
3) Evaluate fungicides for the control of common smut.
4) Investigate damaged or discolored kernels in what appears to be ears not infected with corn smut.
5) Investigate the effects of irrigation systems on incidence of common smut.

Progress Report

Objectives 1,2. *Planting date/cultivar evaluation:* Thirty sweet corn cultivars (Table 1), most grown commercially in the Columbia basin for processing, were evaluated for resistance to common smut. Plots were established on two planting dates (Apr 26 and May 29), with 4-30' rows/plot on the Hermiston Agricultural Research and Extension Center. 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 was noted for each plant. Some plants had more than one infection location. Data were analyzed with the SAS GLM procedure following arcsine transformation.

The percentage of plants with smut infections on the base, between base and ear, on the ear, between ear and tassel, on the tassel, and percentage of plants infected overall increased from the first to second planting (Table 3). The different cultivars,

however, responded somewhat differently to planting date. The varieties most susceptible to infection of the ear over both planting dates included Supersweet Jubilee, 1861, Jubilee, and Summer Sweet 8100 (Table 4). Varieties exhibiting the least percent infected ears were 2547, ACX232, Conquest, Dynamo, Eliminator, Legacy and Marvel. The two most commonly planted varieties in the basin, Jubilee and Supersweet Jubilee, were very susceptible. Data for percentage of plants of each cultivar with common smut infections are presented in Table 5.

Objective 3. *Fungicide evaluation:* Five fungicides were evaluated, alone and/or in combination, for control of common smut in commercial sweet corn fields (Table 2). Supersweet Jubilee was planted at the Benton Co., WA and Umatilla Co., OR locations, and Jubilee was seeded at the Morrow Co. OR site. All applications were made using an airblast sprayer (AgTec 3004), in 20 gpa, with COC at 1% v/v. First treatment application (Jun 27) was made when the corn was at ten leaves (approximately one week prior to silk emergence), with additional applications made two and four weeks later. 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 was noted for each plant. Some plants had more than one infection location. Each 30-ft long plot was 8 rows wide, with observations made on the interior 6 rows; plots were replicated four times. Data were analyzed with the SAS GLM procedure, with single degree of freedom orthogonal contrasts made to compare some treatments of interest.

The Umatilla and Benton Co data (identical treatments) were combined for analyses; the data for the Morrow Co site were analyzed separately (Table 6). There was no difference due to trial location and the overall incidence of infection was low at the Umatilla/Benton sites where all treatments reduced the percent infected Supersweet Jubilee plants as compared to the untreated check. Quadris, Quadris+Tilt, Folicur, and Stratego provided the best protection of the ear. At the Morrow Co site, all treatments except Dividend reduced the percent Jubilee plants with smut infections. The percent ears with smut galls was reduced by Folicur and Quadris, either alone or in combination with Tilt or Warrior. Orthogonal contrasts revealed that both Quadris at the low rate (6.1 oz/a) and Stratego also reduced percent ear infection as compared to the untreated check and that Quadris + Warrior further reduced the percent infected ears as compared to Quadris alone (data not shown). At all three locations, addition of Tilt to Quadris did not provide any additional protection over Quadris alone; however, addition of Quadris to Tilt improved control as compared to Tilt alone.

Objective 4. *Kernel Damage*: Isolations from discolored and/or

damaged kernels has been completed but identification of fungi recovered has not been accomplished due to inadequate funding.

Objective 5. *Irrigation systems*: Was not accomplished due to inadequate funding to complete this objective.

Discussion

The identification of resistant varieties may provide an effective tool to control this disease. Several of the varieties tested had significantly fewer infections than the cultivars most widely planted. However, use of these varieties alone may not provide adequate protection. Quadris, Folicur and Stratego appear to offer promise for chemical control; additional field trials to refine rates and timing are needed as well as looking at the cost effectiveness of their use. Also, residue tolerances have to be established prior to obtaining a label for use of these products in sweet corn. Ultimately the use of resistant varieties, combined with fungicide applications and/or different cultural practices may prove to be the best method to reduce disease levels. Because of the potential variation between years and the subsequent differences in disease pressure, and the continual release of new cultivars, this work needs to be repeated over several seasons.

With the identification of a new, significant problem of kernel discoloration/damage, possibly associated with corn smut or a smut-like pathogen, additional research is needed to identify the fungus, determine varietal susceptibility, and develop disease control strategies.

Table 1. Sweet corn cultivars evaluated for resistance to common smut, Hermiston, OR. 2000.

Cultivar	Source
su type:	
1703	Novartis
1861	Novartis
2547	Rogers
Chase	Asgrow
Conquest	Crookham
Dynamo (HMX 5372)	Harris Moran
Eliminator	Crookham
Elite	Novartis
Esquire	Asgrow
Jubilee	Novartis
Legacy	Harris Moran
Spirit	Rogers
Stylepak	Harris Moran
sh_2 type:	
ACX 232	Abbott & Cobb
ACX 429	Abbott & Cobb
Brigadier	Asgrow
Challenger	Asgrow
Crisp n Sweet 710	Crookham
Gallant	Crookham
GSS-5865	Rogers
HMX 83932	Harris Moran
Krispy King	Novartis
Marvel	Crookham
Sheba	Asgrow
Summer Sweet 500	Abbott & Cobb
Summer Sweet 610	Abbott & Cobb
Summer Sweet 8100	Abbott & Cobb
Supersweet Jubilee	Novartis
XP8414667	Asgrow
se type:	
2684	Novartis

Table 2. Fungicides evaluated for control of common smut, Benton Co, WA, and Morrow and Umatilla Co, OR, 2000.

Fungicide	Manufacturer	Rate (oz/a)
Dividend XL	Novartis Crop Protection	1.1
Folicur	Zeneca Ag Products	7.2
Quadris[1]	Zeneca Ag Products	12.3
Stratego	Novartis Crop Protection	10.0
Tilt	Novartis Crop Protection	4.0
Quadris+Tilt		12.3+4.0

[1] Quadris also applied at 6.13 and 9.2 oz/a, and in combination w/Warrior insecticide (Zeneca Ag Products) at 0.2 pt/a at the Morrow Co. location.

Table 3. Effect of planting date on development of common smut of sweet corn, Hermiston, OR., 2000.

Planting Date	Gall location					
	Base	Base-Ear	Ear	Ear-Tassel	Tassel	Plant
				Percent (%)		
Apr 26	0.8	2.9	1.4	2.4	8.9	15.9
May 29	9.6	31.5	5.8	5.3	30.9	61.3
	****	****	****	****	****	****

**** Means significantly different at P≤0.0001.

Table 4. Susceptibility of sweet corn cultivars to common smut infection of the ear, Hermiston, OR., 2000.

Cultivar	Planting date: Apr 26	Planting date: May 29	Average
	Infected ears (%)		
1703	0.7 c	4.5 efgh	2.6 ghi
1861	7.6ab	14.6abc	11.1ab
2547	0.0 c	1.3 h	0.6 i
2684	4.0 bc	9.1 cdef	6.5 cdefg
ACX 232	0.0 c	1.3 h	0.7 i
ACX 429	0.9 c	8.5 cdefg	4.6 defghi
Brigadier	3.7 bc	2.8 efgh	3.2 efghi
Challenger	0.5 c	13.7abc	7.1 cde
Chase	0.8 c	2.5 efgh	1.7 hi
Conquest	0.0 c	1.0 h	0.5 i
C&S 710	0.8 c	9.4 bcde	5.1 defgh
Dynamo	0.0 c	1.6 gh	0.8 i
Eliminator	0.1 c	1.1 h	0.6 i
Elite	0.4 c	1.7 gh	1.1 hi
Esquire	0.3 c	2.0 gh	1.2 hi
Gallant	0.1 c	3.8 efgh	2.0 hi
GSS-5865	0.0 c	5.4 efgh	2.7 ghi
HMX 83932	0.7 c	1.7 gh	1.2 hi
Jubilee	3.1 c	16.2a	9.7 bc
Krispy King	1.8 c	12.2abcd	7.0 cdef
Legacy	0.1 c	1.5 gh	0.8 i
Marvel	0.0 c	1.0 h	0.5 i
Sheba	0.6 c	5.4 efgh	3.0 fghi
Spirit	1.0 c	6.1 defgh	3.6 efghi
Stylepak	0.4 c	2.2 fgh	1.3 hi
SmrSwt 500	1.6 c	4.8 efgh	3.2 efghi
SmrSwt 610	0.0 c	2.7 efgh	1.3 hi
SmrSwt 8100	0.8 c	15.8ab	8.3 bcd
SprSwt Jubilee	11.3a	17.0a	14.1a
XP8414667	0.2 c	3.0 efgh	1.6 hi
	****	****	****

**** Variety means significantly different at P≤0.0001.
Means followed by different letters are significantly different at P≤0.01 (Duncans multiple range test).

Table 5. Susceptibility of sweet corn cultivars to common smut infection, Hermiston, OR., 2000.

Cultivar	Planting date: Apr 26	Planting date: May 29	Average
	Infected plants (%)		
1703	30.8abc	89.0a	59.9ab
1861	29.8abcd	79.5abcd	54.7abcd
2547	4.0 fg	22.8 mn	13.4 op
2684	17.6 bcdefg	79.8abcd	48.7 bcdef
ACX 232	5.4 efg	54.5 efghij	31.9 ijklm
ACX 429	14.2 bcdefg	79.2abcd	46.7 cdefgh
Brigadier	34.1ab	86.6ab	60.3ab
Challenger	4.3 fg	50.0 ghij	27.1 lmn
Chase	24.8abcdefg	70.6 bcdef	47.7 bcdefg
Conquest	7.3 defg	26.6 mn	17.0 nop
Crsp n Swt 710	7.6 defg	54.8 fghij	31.2 jklm
Dynamo	14.9 bcdefg	42.0 jkl	28.5 klmn
Eliminator	19.2 bcdefg	60.0 efghi	39.5 fghijkl
Elite	10.1 cdefg	43.4 ijk	26.7 lmn
Esquire	4.3 fg	30.0 klm	17.6 nop
Gallant	16.5 bcdefg	89.0a	52.7abcde
GSS-5865	9.0 cdefg	74.8abcde	41.9 defghij
HMX 83932	20.5 bcdefg	79.5abcd	50.0abcdef
Jubilee	27.5abcde	83.2ab	55.3abc
Krispy King	29.3abcd	91.0a	60.2ab
Legacy	24.0abcdefg	65.4 cdefg	44.7 cdefghi
Marvel	2.2 g	12.6 n	7.4 p
Sheba	17.1 bcdefg	65.6 cdefg	41.4 efghijk
Spirit	2.6 fg	47.3 hij	24.9 mno
Stylepak	25.1abcdef	53.0 ghij	39.0 fghijkl
Smmr Swt 500	8.3 defg	50.1 ghij	29.2 jklmn
Smmr Swt 610	11.5 cdefg	56.0 fghij	33.8 hijklm
Smmr Swt 8100	5.6 efg	63.5 defgh	34.6 ghijklm
SprSwt Jubilee	42.5a	82.3abc	62.4a
XP8414667	7.8 defg	50.7 ghij	29.3 jklmn
	****	****	****

**** Cultivar effect significant at P≤0.0001.
Means followed by different letters are significantly different from one other at P≤0.01 (Duncans multiple range test).

Table 6. Effect of fungicides on development of common smut of corn.

Treatment	Gall location					
	None	Base	Base-Ear	Ear	Ear-Tassel	Tassel
	Percent plants (%)					
Supersweet Jubilee[1]						
Dividend	92.8 c	0.5	2.2 b	1.1ab	2.9 b	0.5a
Folicur	99.4a	0	0.1 c	0.3 b	0.1 c	0 b
Stratego	97.1ab	0.1	0.2 c	0.2 b	2.3 b	0.2ab
Quadris	99.1a	0	0.1 c	0.5 b	0.2 c	0.1 b
Tilt	95.4 bc	0.2	0.8 c	1.7ab	1.6 bc	0.3ab
Quadris+Tilt	99.0a	0.1	0.1 c	0.5 b	0.2 c	0.2ab
Check	88.5 d	0.6	3.5a	2.3a	5.1a	0 b
	****	NS	****	*	****	*
Jubilee[1]						
Dividend	72.3 d	0.4	17.1a	8.7a	1.5	0
Folicur	97.9a	0	0.9 d	1.1 c	0.2	0
Stratego	87.2 c	0.2	8.4 b	3.9 bc	0.3	0.1
Quadris 6.1	91.7 bc	0.2	3.0 cd	3.2 bc	0.6	0
Quadris 9.2	96.4ab	0	6.1 bc	2.1 c	0.2	0
Quadris 12.3	94.3ab	0.4	1.d d	1.2 c	0.4	0
Tilt	86.4 c	0.2	6.2 bc	6.7ab	0.6	0
Quadris+Tilt	94.3ab	0	2.3 cd	2.6 c	0.7	0.2
Quad+Warrior	99.1a	0	0.5 d	0.2 c	0.3	0
Check	71.8 d	0	20.1a	6.6ab	1.5	0
	***	NS	****	***	NS	NS

NS,*,***,**** Treatment effect not significant or significant at P≤0.05, P≤0.001, or P≤0.0001, respectively. Means followed by different letters are significantly different at P≤0.05 (Duncans multiple range test).

[1] Supersweet Jubilee trial sites in Benton County, WA and Umatilla County, OR; Jubilee site was located in Morrow County, OR.