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Project Title: Management of Sweet Corn Root and Crown Rot in the Pacific Northwest

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Background: Leaf-firing and an associated yield reduction has been observed on sweet corn plantings in the Willamette Valley. Sweet corn fields have been affected throughout the Pacific Northwest since the syndrome was first observed in the Willamette Valley in the early 1990's. Symptoms were originally observed on the widely-planted cultivar 'Golden Jubilee' but have since been observed on other cultivars. Root rot can be prevalent in symptomatic fields but in some affected fields crown rot is the primary symptom. Fungal complexes have been recovered from affected field samples, primarily *Fusarium* species and *Pythium* species. My lab has found a preponderance of *Fusarium* species in tissues sampled from sweet corn plants with root rot and/or crown rot as well as from necrotic stalk node tissue samples. Our observations are based on sampling 10 to 30 plants per field as follows:

- Isolations made from rotted roots during 1999 (7 fields) and 2000 (6 fields)
- Isolations made from symptomatic mesocotyl during 2000 (6 fields), 2001 (8 fields), and 2004 (15 fields).
- Isolations made from necrotic (rotted) stalk node tissues during 2001 (8 fields), 2003 (10 fields), and 2004 (15 fields).
- Crown ratings in 2002-2004 season; isolations made from crown node tissues with rot symptoms during 2002 (8 fields), 2003 (10 fields), 2004 (15 fields), and 2005 (3 fields).

We continued investigations into the pathogenicity of *Fusarium* species during 2004 and 2005 field, lab, and greenhouses studies. The investigations into pathogenicity in field settings were conducted in an experimental field on the OSU-Botany Farm. This work included evaluations of root rot (both primary and adventitious roots), crown rot, stalk node necrosis, and ear yield. We have evidence that there is a relationship between necrosis of the nodes and crown, ear weight, and flow of fluid through the stalk. Plants with darker nodes have lower

yields and reduced fluid flow through the stalk. This trend has been found with plants collected from growers' fields during 2002, 2003, and 2004. Perhaps a fungal toxin causes necrosis at the nodes, followed by colonization of the nodes by the *Fusarium* species or perhaps the pathogens colonize nodes prior to the development of necrosis. *Fusarium* species have been isolated from symptomatic stalk tissues from plants in growers' fields during past field seasons. In greenhouse studies conducted during the spring of 2006, *F. oxysporum* var. *redolens* was found to cause significant root rot of 'Jubliee' grown in 1-gal pots of sandy-loam. Our pathogenicity experiments that suggest *Fusarium* spp. have a negative impact on plant health and yield but other factors are probably involved as well. There is evidence to suggest that the Western Spotted Cucumber Beetle preferentially feeds on *Fusarium*-infected plants and possibly vectors *Fusarium* spp. to non-infected plants. Temperature and water levels also influence Fusarium root and crown rot.

Management of the pathogen factors that contribute to the sweet corn yield decline have been the major focus of my lab group efforts since 2000. We found root rot and crown rot to be generally decreased by soil fumigation in 2002 field experiments. Strip applications of fumigant granules (vapam) are promising for disease management. Rot of the primary root, adventitious root system, and the crown were significantly less severe in the vapam strip fumigation treatment than in the nonfumigated soil. Grower harvest showed approximately a 2 ton/acre increase in ear weight on plants grown in vapam fumigation strip, however the strip was not replicated and only sub-sampling could be done. Studies were conducted in grower fields and at the Botany and Plant Pathology Field Lab in 2002 with MC33 and vapam in tarped fumigation plots. These studies showed similar decrease in rot of the primary root and mesocotyl when plants were grown in soil after fumigation with either material. Fumigation treatments also resulted in lower rot severity of adventitious roots. The high cost of fumigation may preclude its use as a standard response to this problem. Only a large increase in ear yield, or a reduction in other inputs, would make fumigation a reasonable option.

Disease management through the application of materials such as fungicides, biocontrol agents (biofungicides), or other materials has been investigated by my lab group. Evaluation of labeled fungicides or experimental chemistries as seed treatments have not shown significant reduction in rot severity ratings but this is not surprising as fungicide seed treatments protect plants as germlings from seed rot, damping-off, and seedling blight, but not from later season root rot. In studies prior to 2006, Micro-AF (CMO-mix1) and T-22 both had significantly less rot in the adventitious root system than the conventional seed treatments, Maxim/Apron and Captan/Thiram. Companion, another biological control product, was associated with a reduced crown rot incidence while the crown rot incidence in the Maxim/Apron treatment was the highest. Mixtures of biopesticides with conventional fungicides were investigated during 2004 for control of crown rot and no treatment combination appeared to reduce crown rot incidence. The combination of the experimental Micro-AF with Maxim/Apron resulted in greater ear numbers and better tip fill, suggesting that plants from seeds receiving this treatment combination had a delay in disease onset or host reaction of the pathogens (host tolerance).

Host tolerance is another management tactic that shows promise for sweet corn root and crown rot and associated yield decline. However, the development of tolerance to root and crown rot requires a long term investment and a better understanding of the causal organisms for successful screenings. Collaborative studies on large plot (split fields on-farm) during 2002 and 2003 showed some promise for the varieties HMX7384 and Prelude but wider replication of large field screenings during 2004 showed Prelude to have lower yields. Some varieties

appeared to yield well in 2004 studies and included GH2298, Punch, and HMX7384. However, adventitious root rot was relatively less severe during 2004. Primary root rot and crown rot were variable among grower sites and sweet corn varieties. Discolored crowns and crown rot were relatively high in lowest yielding variety (WSS3681). A multivariate analyses of the 29 field plots from 2004 indicate that site has a strong association on the development of root and crown rot and that these two diseases, root rot and crown rot, develop without necessarily associating with each other. They may be separate disease syndromes. On-farm studies conducted during 2005 were done in small plots rather than split field trials and rot of the adventitious roots was again generally low. On-farm trials during 2005 showed that most of the varieties screened appear to have resistance to crown rot, with the exception of Enterprise, GSS2914, and Suregold.

During 2005, sweet corn germplasm and varieties were evaluated on the OSU Botany Farm. Columbus, Prelude, Punch, and UY0712OJ appear vigorous with lower disease level of the crown and adventitious root system in this field trial. Screenings of some inbreds showed that some inbred lines have greater tolerance to crown rot and root rot and that crown rot and stalk node rot may be a distinct syndrome from the classic stalk rot where the stalk internodes are decayed, rather than only at the stalk nodal plates as we're finding in sweet corn in the Willamette Valley.

Objectives for 2006 and Accomplishments:

Objective 1: Evaluation of commercial sweet corn varieties and inbred germplasm in small plots for susceptibility to seed rot/damping-off as well as root, stalk, and crown rot.

An experimental field site study on the OSU-Botany Farm has been found to have high pressure for crown rot of sweet corn and medium pressure for root rot. This experimental corn plot was originally infested during 2000 with pathogens via incorporation of truckloads of symptomatic corn crowns, roots, and lower stalk portions from severely affected plants collected from a grower's field. This experimental field was also infested during the springs of 2002-06 with a complex of *Fusarium* species by field application of colonized cornmeal-sand and/or oat kernel inoculum. Since 2001, we have used this experimental plot for sweet corn disease studies. Root and crown rot were evident in "mature" plants each year of our study and seed rot and damping-off were prominent during 2003. Sweet corn varieties evaluated this past season, during the 2006 growing season, are listed in Table 1.

Kernels were treated with Apron Maxx RTA and then sown with a belt planter. Each corn line was replicated in four 40-foot long rows. A plot code was used so that treatments not known while evaluations of stand as well as root rot, crown rot, stalk node rot, and late-season "classic stalk rot" were made. Plants were irrigated weekly with 1.5" of water. Stand counts were made weekly for the first several weeks after sowing. Plants were evaluated pre- and post-silking for rot of roots, crown, and stalk nodes as well as Western Spotted Cucumber Beetle (*Diabrotica undecimpunctata undecimpunctata*) feeding on leaves and roots. For the pre-silking evaluations (41 days after sowing), five plants at the 6-leaf stage were dug from each plot (20 plants per treatment), soil was washed from the root balls of each plant, and disease severity ratings were done all in the same day. Ten plants from each plot (40 plants per treatment) were sampled post-silking, approximately 87 days after sowing, for evaluation of rot of roots, crown, and stalk nodes. Ear weights were also recorded. Crowns of post-silking plants were also digitally-captured on a flatbed scanner and analyzed for grayscale with ImageJ. Late season, approximately 119 days after sowing, plant stalks were longitudinally split in the field and the

number of stalk nodes with rot as well as the presence of “classic stalk rot” in stalk internodes was recorded.

The rot of the primary root (radicle), adventitious root system, and subcrown-internode (mesocotyl) was visually estimated on a percentage basis while rot in the crown and stalk nodes as well as rootworm feeding was rated as follows:

Nodal rating
0 = no discoloration of stalk nodes above crown
1 = node 1 above crown is discolored (dark brown)
2 = node 2 above crown is discolored (dark brown)
3 = node 3 above crown is discolored (dark brown)

Crown rot rating
0 = no discoloration of crown area (creamy-colored) or tan-light brown crown area (normal)
1 = crown rot

Root worm feeding
0 = no root worm feeding is evident
1 = root worm feeding is evident
2 = < 75 % of adventitious roots at a single whorl have root worm feeding
3 = $\geq$ 75 % of adventitious roots at a single whorl or $\geq$ 50 % of adventitious roots at two whorls have root worm feeding

Table 1. Sweet corn varieties/inbreds evaluated on the OSU-Botany Farm in 2006

Treatment code	Variety or inbreds	Year+1 of seed lot
1	Inbred Code 1	2006
2	Inbred Code 2	2006
3	Inbred Code 3	2006
4	Inbred Code 4	2006
5	Inbred Code 5	2006
6	Inbred Code 6	2006
7	Inbred Code 7	2006
8	Inbred Code 8	2006
9	Inbred Code 9	2006
10	Inbred Code 10	2006
11	Inbred Code 11	2006
12	Inbred Code 12	2006
13	GH-1861	2006
14	GH-2669	2006
15	GH-2684	2006
16	Jubilee	2006
17	GSS-1477	2006
18	Jubilee	2004
19	Jubilee	2003

Stand number varied among the hybrids and inbreds (Table 2), and Inbreds Code 11 and Code 12 had significantly reduced stands compared to the other corn lines. Leaf feeding on corn seedlings was examined and incidence of plants with no leaf feeding (insect0) was less in these two inbreds due to the fewer stand numbers. Little leaf-feeding damage was found among the treatments during the first few weeks after stand emergence.

In evaluations of root, mesocotyl, and stalk node rot at pre- and post-silking (Table 3), ample rot of the primary root was found, generally most of the primary root was decayed. The adventitious roots were rotted, ranging between 27 and 55 % of the total root ball rotted. The percent decay of the mesocotyl was very high in the post-silking samples and tended to be greater in the inbreds (62 to 99 %) compared to the hybrids (55 to 83 %). The number of stalk nodes above the crown that were discolored was variable among the lines examined. Since only three nodes were examined in the longitudinal cuts that were made through stalks, it is clear that some lines, especially among the inbreds, had considerable decay at the stalk nodes. Rootworm injury levels were quite low in this field this year, compared to previous years.

Incidence of crown rot and the grayscale measurement of crown tissue generally were similar (Table 4); lines with higher levels of crown rot tended to have a smaller, darker grayscale value and the exceptions were two of the inbreds; which does raise the question of comparing incidence of a visual assessment to the mean of all individuals analyzed digitally. Total ear weight was collected and presented per plant, and only done for the hybrids. Significant differences in mean weight per plant and ear number were found among the hybrids; 'Jubilee' tended to produce lower total ear weight per plant while GH1861 and GH2684 had higher ear yields. Some hybrids had a very high incidence of nodal plates being discolored at the ear. When plants were examined late season for internode stalk decay (classic stalk rot), some lines (inbreds Code 8, Code 11, and Code 12) had severe stalk rot, while generally most lines had low levels of internode stalk decay. The discoloration of the stalk nodes had generally progressed further up the stalk relative to the evaluations made post-silking at harvest.

All of these different measurements are difficult to interpret without correlation analysis. For that reason, root and mesocotyl rot were rated on the percentage of respective plant portion decayed rather than rot categories (1-4). In Table 6, the correlation of ear yield with disease measurements is presented on the left-side portion of the table. Squares that are shaded indicate the significant correlations and the P-value is the bottom-most number in each box. Ear size was divided into classes based on individual ear development and for the hybrid/inbred study, mesocotyl rot was the only variable significantly correlated with total ear yield while the weight of only fully-developed ears is significantly correlated with both mesocotyl and primary root rot. Crown grayscale and stalk node rot both strongly correlate with crown rot.

BIC analysis was done to determine which regression models and explanatory variables best explain ear yield; this technique scores regression models based on how well they explain variation as well as simplicity of the model. Adding variables to a model will increase the level of variation explained even if it is a poor explanatory variable so BIC technique gives a worse score to models when explanatory variables included don't sufficiently add to variation explained. Thus, less complex simple models do **not** lose favor to relatively gross, complex models. However, strong correlations among variables can result in misleading estimates. Regression models of all possible combinations of disease symptoms were included in the analysis with one exception; models that included both crown grayscale and crown rot were not evaluated since both of these variables are different ways of measuring the same symptom. Using BIC analysis, the best model included crown grayscale, rootworm injury, nodal root rot,

subcrown-internode (mesocotyl) rot, and the number of discolored nodes (Table 5). Crown grayscale stands out by having more highly significant P values. The estimate for the crown effect (0.0053) can be interpreted as a 5.3 g decrease in ear weight for every grayscale shade darker in the crown. Strong correlations among the disease variables measured in our studies can result in misleading estimates, and the correlation between crown grayscale and discolored stalk nodes appears to be affecting estimated ear yield reduction. When discolored stalk nodes are not included in the model, the crown effect is about a 2 g decrease per grayscale shade (data not shown). This is more consistent with results seen in other data sets. Rot of the adventitious roots (nodal root) is a poor indicator of ear weight in this data set since ear weight actually increased as rot increases, and this has been found in previous studies.

Objective #1 summary: There were significant differences in disease measurements made among the hybrids and inbreds evaluated during 2006. It does appear, when evaluating the responses of the inbreds that the rot of the crown and stalk node is separate from classic stalk rot (internode rot). BIC analyses indicate that crown grayscale is an important indicator of ear weight and the true relationship may about 2 g per shade based on this data set and previous studies. Correlation analyses indicates that rot of the adventitious roots or other tissues may not play as great of role in reducing total ear yield as does decay of the mesocotyl tissue. Crown grayscale and stalk nodes discolored both strongly correlate with incidence of crown rot. Greater numbers of plots evaluated at each sampling and greater frequency of sampling should be done with a couple of hybrids and corresponding inbreds in order to more fully understand the association of different symptoms with yield loss.

Table 2. 2006 Stand count and insect leaf feeding injury in evaluations of sweet corn varieties/inbreds

		Mean stand count[x]						Mean incidence insect 0[y]						Mean incidence insect 1[y]						Mean incidence insect 2[y]					
Trt #	Variety or Inbred	29-Jun		6-Jul		13-Jul		29-Jun		6-Jul		13-Jul		29-Jun		6-Jul		13-Jul		29-Jun		6-Jul		13-Jul	
1	Code 1	15	BCDE	39	ABC	38	ABC	15	BCDE	39	AB	38	AB	0	A	0.3	A	0	A	0	A	0	B	0	A
2	Code 2	18	ABCDE	48	ABC	45	AB	18	ABCDE	47	AB	45	A	0	A	0	A	0.3	A	0	A	0	B	0.3	A
3	Code 3	9	DE	44	ABC	46	AB	9	DE	44	AB	45	A	0	A	0	A	0.3	A	0	A	0	B	0	A
4	Code 4	29	ABCDE	49	ABC	49	AB	29	ABCDE	48	AB	49	A	0	A	1.0	A	0.3	A	0	A	0.5	AB	0	A
5	Code 5	23	ABCDE	48	ABC	45	AB	23	ABCDE	48	AB	44	A	0	A	0	A	0.5	A	0	A	0.3	AB	0.3	A
6	Code 6	15	ABCDE	47	ABC	48	AB	15	ABCDE	47	AB	48	A	0	A	0	A	0.3	A	0	A	0	B	0	A
7	Code 7	11	DE	32	BCD	33	BC	11	DE	32	ABC	32	ABC	0	A	0	A	0.3	A	0	A	0	B	0.3	A
8	Code 8	14	CDE	41	ABC	39	ABC	14	CDE	41	AB	39	AB	0	A	0	A	0	A	0	A	0	B	0	A
9	Code 9	21	ABCDE	46	ABC	42	ABC	21	ABCDE	45	AB	40	AB	0	A	0.5	A	0	A	0	A	0.5	AB	0.5	A
10	Code 10	19	ABCDE	40	ABC	39	ABC	19	ABCDE	39	AB	39	AB	0	A	0	A	0.3	A	0	A	0.3	AB	0	A
11	Code 11	2	E	9	D	12	D	2	E	9	C	12	C	0	A	0.3	A	0	A	0	A	0	B	0	A
12	Code 12	9	DE	23	CD	22	CD	9	DE	22	BC	20	BC	0	A	0.5	A	0.3	A	0	A	0	B	0.8	A
13	GH-1861	31	ABCDE	46	ABC	40	ABC	31	ABCDE	46	AB	40	AB	0	A	0.5	A	0.5	A	0	A	0	B	0.3	A
14	GH-2669	37	ABCD	50	AB	48	AB	37	ABCD	49	A	47	A	0	A	0.5	A	0	A	0	A	0	B	0.8	A
15	GH-2684	44	A	60	A	55	A	44	A	58	A	53	A	0	A	0.5	A	0.8	A	0	A	1.3	A	1.0	A
16	Jubilee 2006	37	ABCD	54	AB	50	AB	37	ABCD	54	A	49	A	0	A	0	A	0.5	A	0	A	0	B	0.3	A
17	GSS-1477	25	ABCDE	44	ABC	40	ABC	25	ABCDE	43	AB	40	AB	0	A	0.8	A	0	A	0	A	0	B	0.3	A
18	Jubilee 2004	43	AB	57	AB	52	AB	43	AB	57	A	51	A	0	A	0.3	A	0.3	A	0	A	0	B	0	A
19	Jubilee 2003	41	ABC	59	A	53	AB	41	ABC	58	A	53	A	0	A	0.3	A	0	A	0	A	0.3	AB	0.3	A

[x]Means are based on the number of plants per plot, replicated four times, for a total four plots per treatment on each sampling date. Column numbers followed by the same letter are not significantly different at P=0.05 as determined by Tukey's multiple range test.

[y]Means are based on 10 plants per plot, replicated three times, for a total 30 plants per treatment. Insect feeding injury was based on the following scale: 1 = small bite or scrape, 2 = visibly missing tissue up to 2 mm in length, and 3 = any feeding region is larger than 2 mm in length

Table 3. 2006 Rot severity and root worm injury of plant parts in evaluations of sweet corn varieties/inbreds

		Mean % primary root with rot[x]				Mean % adventitious roots with rot[x]				Mean % mesocotyl with rot[x]				Mean stalk node # discolored[x, y]				Mean rootworm injury[x, z]			
Trt #	Variety or inbred	Pre-silking		Post-silking		Pre-silking		Post-silking		Pre-silking		Post-silking		Pre-silking		Post-silking		Pre-silking		Post-silking	
1	Code 1	71	ABCD	94	AB	29	AB	37	BCDE	36	ABCD	86	ABC	0.0	G	0.8	FGH	0	A	1.8	BC
2	Code 2	56	BCDE	94	AB	17	F	55	A	26	BCD	99	A	0.9	BCD	2.6	A	0	A	1.5	D
3	Code 3	71	ABC	99	A	17	F	32	DEFG	62	A	86	ABC	1.5	AB	2.1	ABC	0	A	1.3	DEF
4	Code 4	64	ABCD	94	AB	14	F	42	BC	31	ABCD	70	BCD	1.5	AB	2.1	ABC	0	A	2.1	A
5	Code 5	82	AB	96	AB	22	BCDEF	35	DEFG	51	ABC	94	AB	1.5	A	1.8	BCD	0.05	A	1.5	CD
6	Code 6	88	A	100	A	18	EF	42	B	51	ABC	79	ABCD	0.1	FG	0.0	I	0	A	1.6	BCD
7	Code 7	30	EF	83	ABC	21	CDEF	39	BCD	27	BCD	86	ABC	1.4	AB	1.8	BCD	0	A	1.8	BC
8	Code 8	69	ABCD	84	ABC	20	DEF	27	G	38	ABCD	95	AB	0.1	G	0.4	GHI	0	A	1.8	AB
9	Code 9	40	DEF	53	D	33	A	30	EFG	37	ABCD	79	ABCD	0.3	DEFG	1.0	EFG	0	A	1.1	EFG
10	Code 10	58	ABCDE	81	ABC	28	ABCD	35	DEFG	43	ABCD	62	CD	0.9	ABC	2.4	A	0	A	1.4	DE
11	Code 11	49	CDEF	68	CD	22	BCDEF	35	DEFG	55	AB	96	AB	0.7	CDEF	0.5	GHI	0	A	1.2	EFG
12	Code 12	54	BCDEF	96	AB	15	F	33	DEFG	34	ABCD	81	ABCD	0.1	G	0.5	GHI	0	A	1.8	BC
13	GH-1861	69	ABCD	85	ABC	20	DEF	38	BCD	25	BCD	72	BCD	0.6	CDEFG	0.9	FG	0	A	1.1	EFG
14	GH-2669	64	ABCD	88	ABC	19	DEF	29	FG	12	D	60	CD	0.7	CDE	0.2	HI	0	A	0.9	G
15	GH-2684	48	CDEF	76	BC	28	ABC	38	BCD	13	D	66	CD	1.4	AB	2.3	AB	0.05	A	1.1	FG
16	Jubilee 2006	61	ABCD	50	D	26	ABCDE	29	FG	25	BCD	55	D	1.5	A	0.6	FGH	0	A	1.4	DE
17	GSS-1477	25	F	88	ABC	17	F	37	BCD	15	D	79	ABCD	0.2	EFG	1.6	CDE	0	A	1.0	G
18	Jubilee 2004	66	ABCD	91	AB	17	F	34	DEFG	13	D	83	ABC	1.2	ABC	1.7	CD	0	A	1.1	FG
19	Jubilee 2003	62	ABCD	82	ABC	16	F	42	BC	20	CD	70	BCD	1.0	ABC	1.2	DEF	0	A	1.0	G

[x]Means are based on 10 plants per plot, replicated three times, for a total 30 plants per treatment. Column numbers followed by the same letter are not significantly different at P=0.05 as determined by Tukey's multiple range test.

[y]0 = no discoloration of stalk nodes above crown; and 1 = node 1 above crown, or 2 = node 2 above crown or 3 = node 3 above crown is discolored.

[z]0 = no root worm feeding is evident; 1 = root worm feeding is evident; 2 = < 75 % of adventitious roots at a single whorl have root worm feeding; and 3 = $\geq$ 75 % of adventitious roots at a single whorl or $\geq$ 50 % of adventitious roots at two whorls have root worm feeding.

Table 4. 2006 Crown rot and grayscale, ear yields, and post-harvest disease in evaluations of sweet corn varieties/inbreds

		Post-silking										Post-harvest			
Trt #	Variety or inbred	Incidence of crown rot [x, y]		Mean crown grayscale [y,z]		Mean wt (g) per mature ear [y]		Mean # of ears per plant [y]		Incidence of ear node discoloration [y]		Incidence of internode stalk rot [y]		Mean stalk node # discolored [y]	
1	Code 1	17	FGH	104	FGH							24	B	2.7	ABC
2	Code 2	62	BC	101	H							3	B	3.0	AB
3	Code 3	30	DEFG	111	BCDEF							0	B	2.1	DE
4	Code 4	23	EFGH	111	BCDEFG							7	B	2.4	BCD
5	Code 5	67	BC	108	CDEFGH							23	B	2.9	AB
6	Code 6	0	H	117	AB							10	B	0.6	F
7	Code 7	30	DEFG	113	ABCDE							4	B	2.4	ABCD
8	Code 8	17	FGH	106	DEFGH							100	A	3.0	A
9	Code 9	10	GH	116	ABC							28	B	3.0	A
10	Code 10	100	A	102	GH							8	B	2.9	AB
11	Code 11	0	H	114	ABCD							100	A	3.0	A
12	Code 12	0	H	123	A							71	A	3.0	A
13	GH-1861	29	DEFG	119	AB	273	A	1.8	AB	10	CD	20	B	3.0	A
14	GH-2669	0	H	121	A	192	BC	1.8	AB	5	D	8	B	1.5	E
15	GH-2684	80	AB	105	DEFGH	233	AB	1.8	AB	33	AB	13	B	2.8	ABC
16	Jubilee 2006	50	CDE	103	FGH	189	BC	1.6	AB	27	BC	0	B	2.1	D
17	GSS-1477	11	GH	118	AB	189	BC	1.9	A	10	CD	7	B	2.5	ABCD
18	Jubilee 2004	41	DEFG	104	EFGH	183	BC	1.9	AB	36	AB	13	B	2.6	ABCD
19	Jubilee 2003	53	BCD	103	FGH	163	C	1.6	B	54	A	3	B	2.2	CD

[x]0 = no discoloration of crown area (creamy-colored) or tan-light brown crown area (normal); 1 = crown rot.

[y]Means are based on 10 plants per plot, replicated three times, for a total 30 plants per treatment. Column numbers followed by the same letter are not significantly different at P=0.05 as determined by Tukey's multiple range test.

[z] Grayscale was determined by ImageJ analysis of digitized crown regions and **lower grayscale values indicate darker crowns**.

Table 5. Best models for the biofungicide study using BIC analysis of rot and rootworm injury

	BIC	Model[x]	Crown	RW	NRR	SCI	PR	Nodes
1	-63.8	RW Crown NRR SCI N1	0.0053[y]	-0.079	0.003	-0.001	.	0.042
			0.003[z]	0.036	0.018	0.028	.	0.012
2	-62	RW Crown N1	0.0054	-0.119	.	.	.	0.042
			0.008	0.005	.	.	.	0.031
3	-62	SCI	.	.	.	-0.001	.	.
			.	.	.	0.028	.	.
4	-61.6	RW Crown NRR N1	0.0060	-0.117	0.003	.	.	0.037
			0.003	0.004	0.093	.	.	0.038
5	-61.2	RW Crown SCI N1	0.0048	-0.098	.	-0.001	.	0.047
			0.016	0.021	.	0.152	.	0.016
6	-61	RW Crown NRR PR N1	0.0060	-0.112	0.003	.	-0.001	0.042
			0.002	0.004	0.056	.	0.132	0.018
7	-60.8	RW Crown NRR SCI PR N1	0.0052	-0.076	0.003	-0.002	0.000	0.041
			0.005	0.056	0.019	0.101	0.855	0.015
8	-60.5	RW Crown PR N1	0.0053	-0.116	.	.	-0.001	0.047
			0.008	0.005	.	.	0.237	0.018
9	-60.4	RW	.	-0.066	.	.	.	.
			.	0.081	.	.	.	.
10	-60.3	Null	.	.	.	.	.	.

[x]RW=rootworm injury, Crown=crown grayscale, NRR=adventitious root rot, SCI=mesocotyl rot, PR=primary root rot, and Nodes=stalk node discolored.

[y]Indicates the value of the slope of the variable's effect in the model. Example; a value of 0.0053 indicates that there is 5.3g increase in ear weight as crown grayscale increases one unit (lighter crown color indicates a healthier crown and a corresponding greater grayscale value). Crown grayscale is the only disease symptom we measured where a positive increase in the measurement indicates a healthier plant.

[z]Indicates the P-value for the slope and anything greater than 0.05 is considered nonsignificant.

Table 6. Correlations of rot, crown grayscale, rootworm injury, and ear yield for biofungicide and hybrids/inbreds evaluations

Pearson's correlations for biofungicide study														
		Ear yield	Mature ear	75% ear size	50 % ear size	25 % ear size	Primary root rot	Mesocotyl rot	Adventitious root rot	Rootworm injury	Crown grayscale	Stalk node discolored	Crown rot	Ear node discoloration
Pearson's correlations for hybrids and inbreds	Ear yield		0.873 <.0001	0.095 0.403	-0.256 0.022	-0.248 0.027	-0.197 0.080	-0.178 0.114	0.126 0.266	-0.012 0.916	0.259 0.021	0.098 0.387	0.085 0.456	0.253 0.024
	Mature ear			-0.143 0.207	-0.336 0.002	-0.160 0.157	-0.152 0.179	-0.164 0.147	0.096 0.398	-0.013 0.910	0.321 0.004	0.136 0.229	0.084 0.460	0.299 0.007
	75% ear size				-0.354 0.001	-0.176 0.118	-0.003 0.979	-0.072 0.524	-0.128 0.260	0.206 0.066	0.017 0.883	-0.123 0.276	-0.143 0.206	-0.094 0.408
	50 % ear size					-0.261 0.020	0.046 0.685	0.083 0.462	-0.073 0.522	-0.137 0.225	-0.069 0.542	-0.151 0.181	-0.060 0.599	-0.088 0.437
	25 % ear size						0.235 0.036	0.178 0.115	0.170 0.132	0.106 0.347	-0.255 0.022	0.422 <.0001	0.221 0.049	0.017 0.882
	Primary root rot	-0.294 0.195	-0.522 0.015					0.750 <.0001	0.172 0.128	0.086 0.446	-0.350 0.001	0.249 0.026	0.204 0.070	0.046 0.685
	Mesocotyl rot	-0.448 0.042	-0.634 0.002				0.486 0.000		0.005 0.966	-0.071 0.530	-0.422 <.0001	0.110 0.333	0.134 0.238	0.023 0.838
	Adventitious root rot	0.114 0.623	-0.282 0.216				0.362 0.007	0.261 0.052		0.031 0.788	-0.163 0.148	0.246 0.028	0.512 <.0001	-0.161 0.153
	Rootworm injury	-0.375 0.094	-0.345 0.126				0.244 0.075	0.210 0.121	0.171 0.204		0.100 0.380	0.086 0.449	0.059 0.602	0.165 0.143
	Crown grayscale	0.302 0.183	0.325 0.150				-0.284 0.037	-0.271 0.043	-0.375 0.004	-0.085 0.530		-0.330 0.003	-0.227 0.043	-0.210 0.061
	Stalk node discolored	-0.163 0.480	-0.298 0.189				0.374 0.005	0.293 0.029	0.430 0.001	0.137 0.310	-0.575 <.0001		0.491 <.0001	0.409 0.000
	Crown rot	-0.161 0.486	-0.388 0.082				0.350 0.009	0.264 0.049	0.360 0.006	0.076 0.575	-0.710 <.0001	0.883 <.0001		0.001 0.995
	Ear node discoloration	-0.260 0.254	-0.130 0.576				0.186 0.421	0.137 0.554	0.180 0.436	0.083 0.720	-0.595 0.004	0.536 0.012	0.470 0.032	

Objective 2: Evaluation of microbial and chemical treatments for suppression of sweet corn seed rot/damping-off, root rot, and crown rot.

Treatments that were included in the 2006 field evaluation are listed in Table 7. Two different years of 'Jubilee' seed lots were included. Disinfestation of corn kernels for removal of *Fusarium* species prior to seed treatments was also included as well non-disinfested seeds. The experimental design, sampling, and ratings were done in the same manner as described in Objective #1 with the following exceptions: presilking samples were collected at the 4-leaf stage and plant root and shoot weights were recorded on that date, 15 plants were sampled per plot (60 per treatment) on the post-silking sample date, and no internode stalk rot ratings of "classic stalk rot" were done late-season.

Table 7. Seed and soil biofungicides evaluated on the OSU-Botany Farm during 2006

Trt code	Kernel treatment and seed lot year (+1)	Seed or soil treatment	Application rate
1	disinfested Jubilee 2004	MicroAF soil trt	12.8 fl oz/A
2	disinfested Jubilee 2004	MicroAFD seed trt	2 % wt
3	disinfested Jubilee 2004	Companion GBO-3 (*Bacillus* sp.)	1 fl oz/60' row
4	disinfested Jubilee 2004	Mycostop (streptomycete)	5 g/kg seed
5	disinfested Jubilee 2004	T-22 Planter Box (*Trichoderma* sp.)	10 lb/A
6	disinfested Jubilee 2004	Maxim/Apron	5 fl oz/cwt
7	disinfested Jubilee 2004	Maxim/Apron/MicroAF 2% seed trt	
8	disinfested Jubilee 2003	MicroAF soil trt	12.8 fl oz/A
9	disinfested Jubilee 2003	MicroAFD seed trt	2 % wt
10	disinfested Jubilee 2003	Companion GBO-3	1 fl oz/60' row
11	disinfested Jubilee 2003	Mycostop	5 g/kg seed
12	disinfested Jubilee 2003	T-22 Planter Box	10 lb/A
13	disinfested Jubilee 2003	Maxim/Apron	5 fl oz/cwt
14	disinfested Jubilee 2003	Maxim/Apron/MicroAF 2% seed trt	
15	nondisinfested Jubilee 2004	MicroAFD seed trt	2 % wt
16	nondisinfested Jubilee 2004	Companion GBO-3	1 fl oz/60' row
17	nondisinfested Jubilee 2004	Mycostop	5 g/kg seed
18	nondisinfested Jubilee 2003	MicroAFD seed trt	2 % wt
19	nondisinfested Jubilee 2003	Companion GBO-3	1 fl. oz/60' row
20	nondisinfested Jubilee 2003	Mycostop	5 g/kg seed

Stand counts were very similar for all the treatments (Table 8). Maxim/Apron/MicroAF seed treatment had the greatest number of plants but there were virtually no significant differences among the various treatments. Some dramatic differences were found in plant weight when plots were sampled at the 4-leaf stage (Table 9); disinfestation followed by biofungicide treatments did not routinely improve the plant shoot or root weights early in the plant's development. By post-silking, rot of the primary root as well as the mesocotyl was severe (Table 10), nearly the entire mesocotyl or radical was rotted. Rot of the adventitious roots (nodal root

ball) ranged from 34 to 46 % of the root ball, a fairly narrow range. There were slight differences in the number of stalk nodes discolored as well as crown gray scale. Crown rot varied but there is no clear trend among the biofungicides nor seed lot nor disinfestation treatment when all twenty treatments were compared.

Total ear yield average per plant ranged from 228 to 316 grams but most treatments were not significantly different (Table 11). Both, the numbers of ears produced per plant (1 to 1.5) and average ear weight (181 to 249 grams) were very similar among the various treatments; there were few significant differences. There was more significance in the incidence of discolored ear nodes but no trend was readily apparent.

So then the data were examined by combining the seed lots and disinfestion/non-disinfestation sets of biofungicides products together (Table 12) (Figure 1). The seed treatment of the fungicide standard (Maxim+Apron) was used as control and using Dunnetts statistic, no significant differences were found among the biofungicide treatments. Block effects were significant for many variables. Seed year showed minor effects on crown grayscale (110.1 in 2004 lot and 112.1 in 2003 lot, $p = 0.015$) as well as 25%-size ears (0.38 for 2003 and 0.46 for 2004, $p=.017$), but these were the only variables seed year affected. Disinfestation had significant effects on crown grayscale but only 3 units (109 if not disinfested ;112 when disinfested). Disinfestation did improve earnode discoloration (0.55 if not disinfested; 0.389 when disinfested, $p < .0001$), but no other variables were found to be significantly effected by disinfestation.

Again, all of these different disease and yield measurements are difficult to interpret without correlation analysis. Back in Table 6, the correlation of ear yield from biofungicide treatments with disease measurements is presented on the top right-side portion of the table. Squares that are shaded indicate the significant correlations and the P-value is the bottom-most number in each box. Ear size was divided into classes based on individual ear development and for the biofungicide study, crown grayscale and discolored ear node were the only disease variables significantly correlated with total ear yield per plant or fully-developed ear weights. Incidence of crown rot and discolored ear nodes were both strongly correlated with stalk node discoloration.

Using BIC analysis as described previously, models were tested to determine which, if any, disease measurements best explained the variation in ear yield (total weight per plant). Trying to associate symptoms with yield was difficult because there were block effects (Figure 2). The crown grayscale gets darker (crowns more rotted) and ear weights are reduced the more further-west the plots are located, so the effect of crown grayscale on ear weight can be masked when block is included in a regression model. When block is put in the model, most of the ear weight variation is attributed to block, and then BIC analysis indicates that the best model consists of only stalk node rot, but the effect of stalk node rot is not significant. This is may be misleading due to the block effects mentioned. When block is removed from the model, then best model contains only crown grayscale and crown grayscale is significant (crown effect = 2.54 grams per grayscale unit, $P = 0.019$). None of the other models do better than the null model. This is the only symptom correlated with yield in this data set (Table 6).

Objective #2 summary: There were significant differences in disease measurements made among the various biofungicides evaluated during 2006; however, general trends are unclear when comparing the 20 different treatments. Correlation analyses indicate that crown grayscale and discolored ear node were significantly correlated with ear yield. Crown grayscale and stalk

nodes discolored both strongly correlate with incidence of crown rot while incidence of crown rot and discolored ear nodes were both strongly correlated with stalk node discoloration. It does appear, when data are combined to represent the biofungicide and chemical treatments, that year of seed lot and disinfestation may have a slight effect on crown grayscale. Greater numbers of plots should be evaluated and may help to discern in small plot studies whether any of the biofungicides can concretely improve crown health. Past studies in grower fields on a large scale showed definitive improvements in ear quality with MicroAF, and we should try to incorporate ear quality assessments in our small plot studies.

Objective 3: Cooperate with other sweet corn projects (cultivar screenings, irrigation studies, etc.) within and outside of OSU programs.

I rated corn plants for rot of primary roots, adventitious roots, mesocotyl, crown, and stalk nodes in three different field studies conducted by Dr. Jim Myers, OSU-Horticulture. In collaboration with Rodgers Seeds, my lab group also evaluated 443 entries of a quantitative trait loci (QTL) mapping population (Jubilee cross) for susceptibility to root rot, stalk node necrosis, and crown rot at the 6-leaf stage as well as overall health at maturity.

Table 8. 2006 Stand count in evaluation of seed and soil biofungicides

			Mean stand count[x]					
Trt #	**Kernel treatment and seed lot year (+1)**	**Seed or soil treatment**	**29-Jun**		**6-Jul**		**13-Jul**	
1	disinfested Jubilee 2004	MicroAF soil trt	30	AB	44	B	41	B
2	disinfested Jubilee 2004	MicroAFD seed trt	27	B	46	AB	46	AB
3	disinfested Jubilee 2004	Companion GBO-3	34	AB	50	AB	48	AB
4	disinfested Jubilee 2004	Mycostop	40	AB	56	AB	50	AB
5	disinfested Jubilee 2004	T-22 Planter Box	36	AB	56	AB	48	AB
6	disinfested Jubilee 2004	Maxim/Apron	40	AB	55	AB	53	AB
7	disinfested Jubilee 2004	Maxim/Apron/MicroAF seed trt	37	AB	56	AB	54	A
8	disinfested Jubilee 2003	MicroAF soil trt	27	B	46	AB	45	AB
9	disinfested Jubilee 2003	MicroAFD seed trt	28	AB	46	AB	47	AB
10	disinfested Jubilee 2003	Companion GBO-3	31	AB	52	AB	50	AB
11	disinfested Jubilee 2003	Mycostop	29	AB	52	AB	50	AB
12	disinfested Jubilee 2003	T-22 Planter Box	27	AB	48	AB	47	AB
13	disinfested Jubilee 2003	Maxim/Apron	35	AB	53	AB	52	AB
14	disinfested Jubilee 2003	Maxim/Apron/MicroAF seed trt	42	AB	58	A	54	A
15	nondisinfested Jubilee 2004	MicroAFD seed trt	43	AB	55	AB	52	AB
16	nondisinfested Jubilee 2004	Companion GBO-3	41	AB	56	AB	53	AB
17	nondisinfested Jubilee 2004	Mycostop	45	A	57	A	50	AB
18	nondisinfested Jubilee 2003	MicroAFD seed trt	38	AB	56	AB	52	AB
19	nondisinfested Jubilee 2003	Companion GBO-3	39	AB	54	AB	51	AB
20	nondisinfested Jubilee 2003	Mycostop	35	AB	51	AB	49	AB

[x]Means are based on the number of plants per plot, replicated four times, for a total four plots per treatment on each sampling date. Column numbers followed by the same letter are not significantly different at P=0.05 as determined by Tukey's multiple range test.

Table 9. 2006 Shoot and root dry weights of young 'Jubilee' sweet corn plant parts in evaluation of seed and soil biofungicides

Trt #	Kernel treatment and seed lot year (+1)	Seed or soil treatment	Pre-silking ~ 4-leaf stage			
			Mean[x] shoot wt (g)		Mean[x] root wt (g)	
15	nondisinfested Jubilee 2004	MicroAFD seed trt	30	A	6	AB
16	nondisinfested Jubilee 2004	Companion GBO-3	29	A	6	A
17	nondisinfested Jubilee 2004	Mycostop	26	AB	5	ABC
6	disinfested Jubilee 2004	Maxim/Apron	24	ABC	5	ABC
7	disinfested Jubilee 2004	Maxim/Apron/MicroAF seed trt	23	ABCD	5	ABCD
20	nondisinfested Jubilee 2003	Mycostop (streptomycete)	21	ABCDE	4	ABCD
5	disinfested Jubilee 2004	T-22 Planter Box	21	ABCDE	6	AB
18	nondisinfested Jubilee 2003	MicroAFD seed trt	21	ABCDE	4	ABCD
13	disinfested Jubilee 2003	Maxim/Apron	20	ABCDE	4	ABCD
19	nondisinfested Jubilee 2003	Companion GBO-3	20	ABCDE	4	ABCD
2	disinfested Jubilee 2004	MicroAFD seed trt	19	ABCDE	5	ABCD
4	disinfested Jubilee 2004	Mycostop	18	ABCDE	4	ABCD
14	disinfested Jubilee 2003	Maxim/Apron/MicroAF seed trt	17	ABCDE	4	ABCD
1	disinfested Jubilee 2004	MicroAF soil trt	15	BCDE	4	ABCD
9	disinfested Jubilee 2003	MicroAFD seed trt	15	BCDE	3	BCD
3	disinfested Jubilee 2004	Companion GBO-3	14	BCDE	3	BCD
8	disinfested Jubilee 2003	MicroAF soil trt	12	CDE	3	CD
12	disinfested Jubilee 2003	T-22 Planter Box	11	DE	3	CD
11	disinfested Jubilee 2003	Mycostop	9	E	2	D
10	disinfested Jubilee 2003	Companion GBO-3	8	E	2	D

[x]Means are based on the 6 plants per plot, replicated four times, for a 24 plants per treatment. Column numbers followed by the same letter are not significantly different at P=0.05 as determined by Tukey's multiple range test.

Table 10. 2006 Post-silking rot severity of 'Jubilee' sweet corn plant parts and crown grayscale in evaluation of seed and soil biofungicides

Trt #	Kernel treatment and seed lot year (+1)	Seed or soil treatment	Mean[x] % primary root with rot		Mean[x] % adventitious roots with rot		Mean[x] % mesocotyl with rot		Mean[x] stalk node # discolored		Mean[x,y] Incidence of Crown Rot		Mean[x,z] Grayscale Pixel Count of Crown	
1	disinfested Jubilee 2004	MicroAF soil trt	96	ABC	36	DEF	94	AB	1.6	E	46	E	112.1	AB
2	disinfested Jubilee 2004	MicroAFD seed trt	98	AB	37	DEF	96	AB	2.2	AB	78	AB	114.2	A
3	disinfested Jubilee 2004	Companion GBO-3	98	AB	39	BCDEF	99	A	2.3	A	77	ABC	113.4	AB
4	disinfested Jubilee 2004	Mycostop	91	C	41	ABCD	94	AB	2.0	ABCDE	85	A	110.7	AB
5	disinfested Jubilee 2004	T-22 Planter Box	98	AB	39	BCDEF	98	AB	1.7	DE	68	ABCDE	112.1	AB
6	disinfested Jubilee 2004	Maxim/Apron	97	AB	40	BCD	98	AB	2.0	ABCDE	82	AB	110.4	AB
7	disinfested Jubilee 2004	Maxim/Apron/MicroAF seed trt	96	ABC	41	ABCD	94	AB	1.8	BCDE	67	ABCDE	112.6	AB
8	disinfested Jubilee 2003	MicroAF soil trt	97	AB	37	DEF	98	AB	1.8	BCDE	65	ABCDE	113.2	AB
9	disinfested Jubilee 2003	MicroAFD seed trt	93	BC	40	BCDE	91	B	1.9	ABCDE	56	BCDE	112.9	AB
10	disinfested Jubilee 2003	Companion GBO-3	96	ABC	37	DEF	95	AB	1.8	BCDE	50	CDE	110.9	AB
11	disinfested Jubilee 2003	Mycostop	97	AB	34	F	96	AB	1.7	CDE	47	DE	113.2	AB
12	disinfested Jubilee 2003	T-22 Planter Box	98	AB	35	EF	98	AB	1.8	BCDE	62	ABCDE	113.2	AB
13	disinfested Jubilee 2003	Maxim/Apron	98	AB	44	AB	96	AB	1.7	CDE	73	ABCD	112.1	AB
14	disinfested Jubilee 2003	Maxim/Apron/MicroAF seed trt	94	ABC	38	CDEF	95	AB	1.9	ABCDE	78	AB	113.8	AB
15	nondisinfested Jubilee 2004	MicroAFD seed trt	98	AB	46	A	98	AB	2.2	ABC	87	A	102.8	C
16	nondisinfested Jubilee 2004	Companion GBO-3	99	A	43	ABC	99	A	2.4	A	87	A	108.0	BC
17	nondisinfested Jubilee 2004	Mycostop	97	AB	39	CDEF	95	AB	2.3	A	78	AB	109.0	AB
18	nondisinfested Jubilee 2003	MicroAFD seed trt	97	AB	38	CDEF	97	AB	2.1	ABCD	75	ABCD	111.0	AB
19	nondisinfested Jubilee 2003	Companion GBO-3	99	AB	40	BCDE	96	AB	2.4	A	70	ABCDE	112.5	AB
20	nondisinfested Jubilee 2003	Mycostop	99	AB	37	DEF	100	A	2.2	ABC	71	ABCDE	109.3	AB

[x]Means are based on the 15 plants per plot, replicated four times, for a 60 plants per treatment. Column numbers followed by the same letter are not significantly different at P=0.05 as determined by Tukey's multiple range test.

[y]0 = no discoloration of crown area (creamy-colored) or tan-light brown crown area (normal); 1 = crown rot.

[z]Grayscale was determined by ImageJ analysis of digitized crown regions and lower grayscale values indicate darker crowns.

Table 11. 2006 'Jubilee' sweet corn yield and ear node discoloration in evaluation of seed and soil biofungicides

Trt #	Kernel treatment and seed lot year (+1)	Seed or soil treatment	Total ear wt per plant (g)[x]		Mean # of ears (fully developed)[x]		Mean wt (g) per ear[x]		Incidence of ear node discoloration[x]	
1	disinfested Jubilee 2004	MicroAF soil trt	268	AB	1.5	A	181	C	55	ABC
2	disinfested Jubilee 2004	MicroAFD seed trt	263	AB	1.2	AB	221	ABC	47	ABC
3	disinfested Jubilee 2004	Companion GBO-3	228	B	1.1	AB	198	ABC	29	C
4	disinfested Jubilee 2004	Mycostop	248	AB	1.1	AB	223	ABC	39	ABC
5	disinfested Jubilee 2004	T-22 Planter Box	249	AB	1.1	AB	237	AB	31	BC
6	disinfested Jubilee 2004	Maxim/Apron	251	AB	1.1	AB	230	ABC	29	C
7	disinfested Jubilee 2004	Maxim/Apron/MicroAF seed trt	228	B	1.2	AB	202	ABC	52	ABC
8	disinfested Jubilee 2003	MicroAF soil trt	231	AB	1.1	AB	202	ABC	36	ABC
9	disinfested Jubilee 2003	MicroAFD seed trt	316	A	1.3	AB	226	ABC	38	ABC
10	disinfested Jubilee 2003	Companion GBO-3	233	AB	1.0	AB	219	ABC	28	C
11	disinfested Jubilee 2003	Mycostop	238	AB	1.1	AB	210	ABC	40	ABC
12	disinfested Jubilee 2003	T-22 Planter Box	248	AB	1.2	AB	209	ABC	29	C
13	disinfested Jubilee 2003	Maxim/Apron	255	AB	1.2	AB	222	ABC	42	ABC
14	disinfested Jubilee 2003	Maxim/Apron/MicroAF seed trt	290	AB	1.2	AB	229	ABC	38	ABC
15	nondisinfested Jubilee 2004	MicroAFD seed trt	259	AB	1.0	B	249	A	51	ABC
16	nondisinfested Jubilee 2004	Companion GBO-3	260	AB	1.2	AB	225	ABC	53	ABC
17	nondisinfested Jubilee 2004	Mycostop	264	AB	1.2	AB	224	ABC	67	A
18	nondisinfested Jubilee 2003	MicroAFD seed trt	282	AB	1.4	AB	197	ABC	57	ABC
19	nondisinfested Jubilee 2003	Companion GBO-3	267	AB	1.1	AB	215	ABC	53	ABC
20	nondisinfested Jubilee 2003	Mycostop	281	AB	1.3	AB	195	BC	66	AB

[x]Means are based on the 15 plants per plot, replicated four times, for a 60 plants per treatment. Column numbers followed by the same letter are not significantly different at P=0.05 as determined by Tukey's multiple range test.

Table 12. 2006 'Jubilee' sweet corn overall means -- ear weight and rot measurements in evaluation seed and soil biofungicides

	Ear yield	Ear number	% primary root with rot	% mesocotyl with rot	% adventitious roots with rot	rootworm injury	Grayscale Pixel Count of Crown	stalk node # discolored	Incidence of Crown Rot (1.0 = 100 %)
Maxim/Apron	0.237	1.069	98.368	97.637	42.125	1.025	109.720	1.926	0.907
Companion GBO-3	0.242	1.104	98.210	97.168	39.708	1.021	111.870	2.208	0.850
MicroAF soil trt	0.239	1.223	97.536	96.874	36.158	1.025	111.310	1.751	0.796
Maxim/Apron/MicroAF seed trt	0.232	1.038	95.413	94.276	39.435	1.008	113.120	1.854	0.867
MicroAFD seed trt	0.259	1.135	96.818	95.444	40.204	1.021	110.640	2.107	0.855
Mycostop	0.241	1.081	96.194	96.426	37.752	1.025	110.440	2.056	0.850
T-22 Planter Box	0.254	1.142	98.537	99.112	36.875	1.008	111.120	1.810	0.844

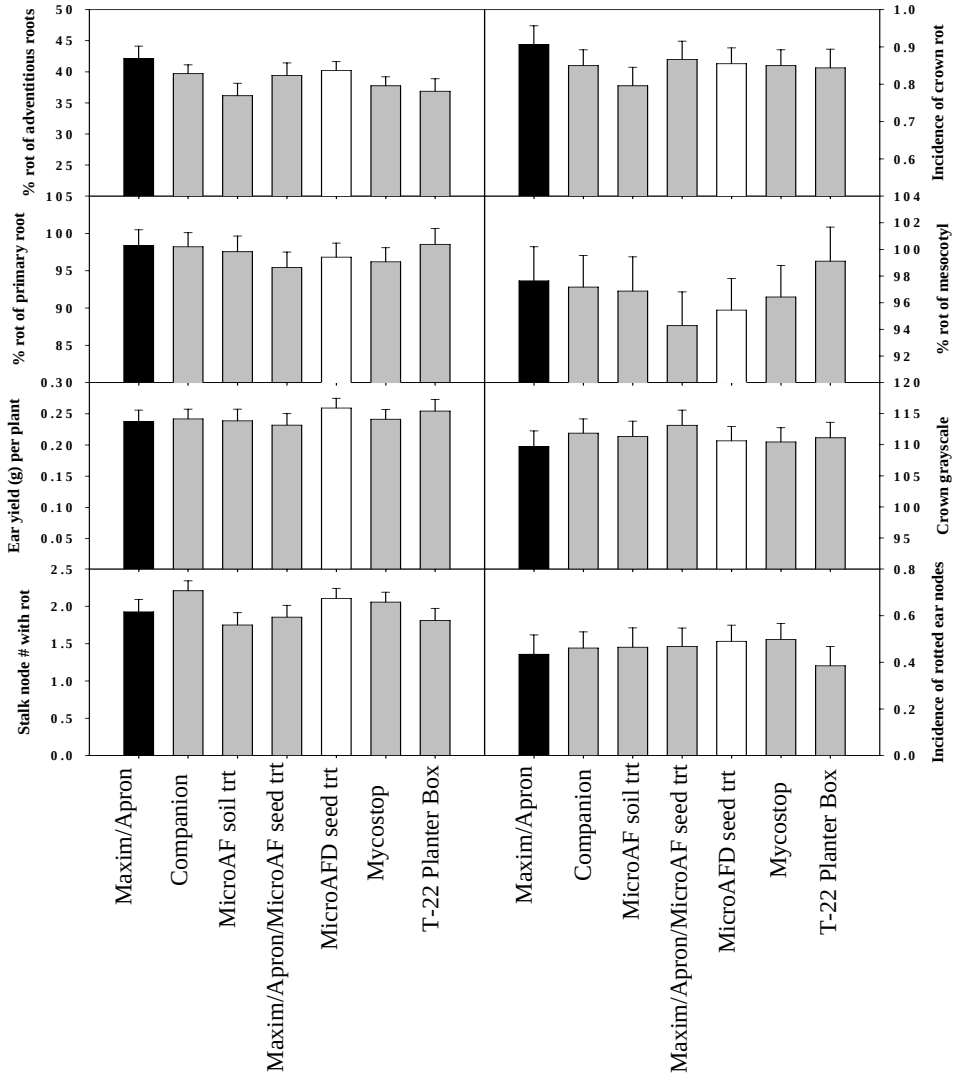

Figure 1. Sweet corn 'Jubilee' ear yield, crown grayscale, and rot of roots, mesocotyl, stalk nodes, and crown of plants after seed or soil biofungicide treatments during 2006 evaluations on the OSU-Botany Farm

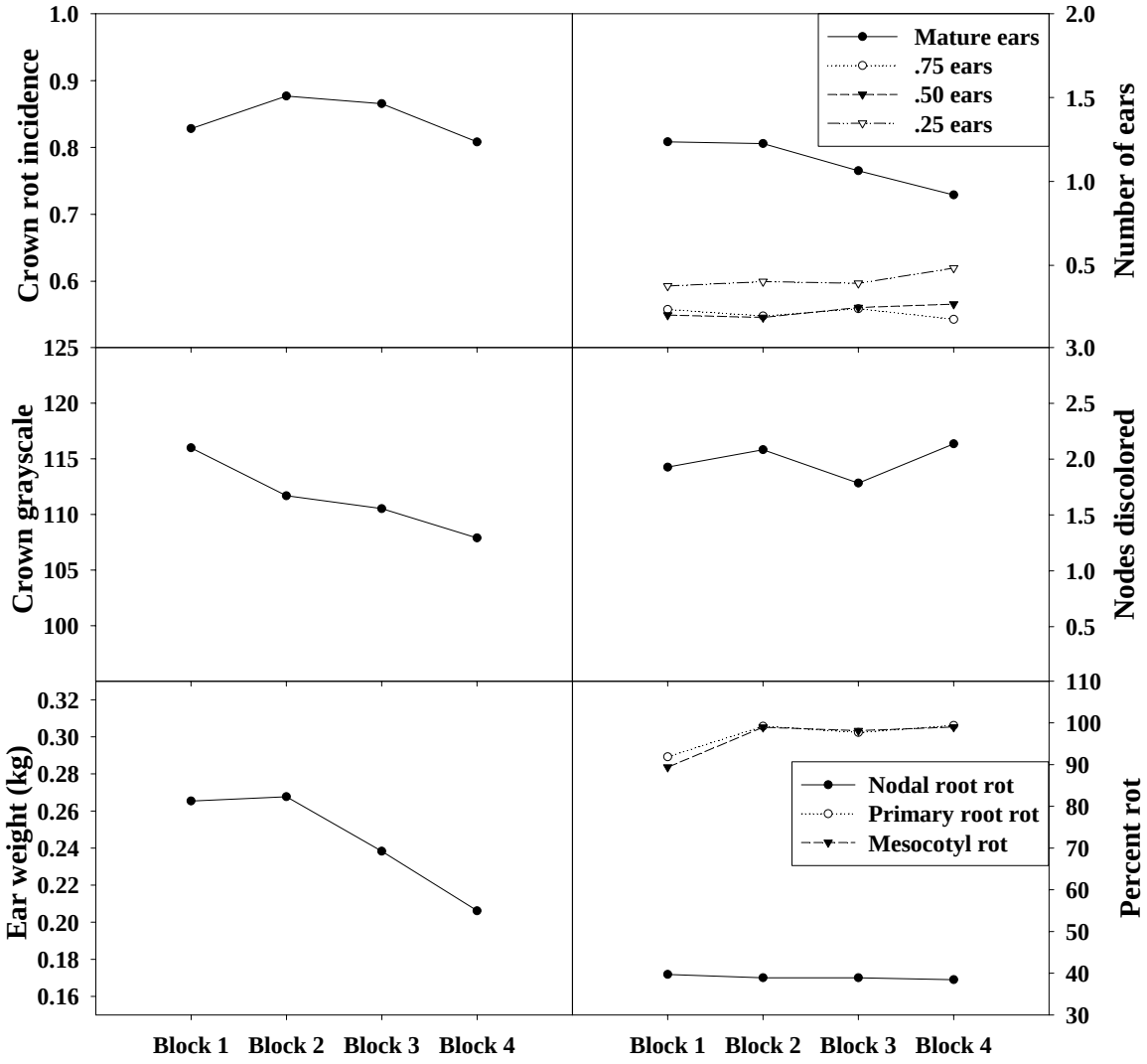

Figure 2. Ear weight and disease measurements from biofungicide study by block.