

University of Illinois – Crop Sciences Department

**ASSESSING THE EFFECTS OF FUNGICIDES
ON CORN YIELD AND DISEASE**

Submitted by

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MATERIALS AND METHODS:

A study to evaluate the yield response of corn to the application of various fungicides and rates was established at the Northern Illinois Agronomy Research Center (NIARC), Shabbona, Illinois and the Kane County Corn Growers Association variety trial (KCCG) area in 2008. Part of the financial support for conducting this study was supplied by the Kane County Corn Growers Association.

The field at the NIARC was in a field with Elpaso silty clay loam with the previous crop of soybeans. There were two KCCG fields. One of the fields had a previous crop of soybeans and the soil types were Thorp silt loam, Brenton silt loam and Kaneville silt loam. The other field had been in corn for the previous two years and the soil types were Thorp silt loam and Brenton silt loam.

The field at NIARC was mulch finished before planting. Two DeKalb varieties were used, DKC 60-18 RR2/YGPL, a 110 day maturity Round-up Ready BT corn borer and corn rootworm resistant corn and DKC 54-49, a 104 day maturity Round-up Ready BT corn borer and corn rootworm resistant corn. The variety DKC 60-18 is described as having fair resistance to gray leaf spot while the variety DKC 54-49 is listed as having good resistance to gray leaf spot. The corn crop was then planted on May 10 at 38,000 plants per acre and on May 21 in the fields at KCCG. At the NIARC field Degree Xtra at 4 quarts and atrazine at 2/3 pounds were applied pre-emergent to the area for weed control. Also nitrogen was applied as UAN at 150 pounds of nitrogen per acre on June 20 using an injection system.

The study area at NIARC was set up with a plot size of 10' X 43'. There were five replications in the study in a randomized complete block design. All applications were made with a ten foot hand boom using CO₂ as the pressure source. The boom, with an extended handle, was kept approximately 15" above the crop canopy. Headline, Quilt and Stratego fungicides were applied in mixtures at 20 gallon per acre using 8002 nozzles with pressure at 34 PSI. The applications were made on August 5 and the corn was at the R-1 to R-2 growth stage.

The study areas at KCCG was set up with a plot size of 10' X 40'. There were four replications in both fields at KCCG in a randomized complete block design. All applications were made with the same boom and application measures as NIARC. The applications were made on August 7 and the corn was at the R-1 to R-2 growth stage.

Disease severity ratings were taken on September 18 and 20, 2008. The trials were harvested on November 19, 2008 on NIARC and November 26, 2008 on KCCG. The center 2 rows of each 4 – 30" row plot were harvested. At harvest time, moisture and test weights were taken.

RESULTS AND DISCUSSION

The early growing season in 2008 was cooler than normal and the planting dates were also later than normal, but the stands were good. The temperatures and rainfall data shown are from the Northern Illinois Agronomy Research Center. The 2008 rainfall pattern (Table 2) was heavier than normal. Rainfall following the fungicide application is listed in Tables 1. The 2008 total rainfall of 44.55 inches was higher than the rainfall in 2007 of 43.41 inches. The rainfall patterns in August were different with only 1.63 inches of rain in 2008 compared with the total of 14.08 inches in 2007. The drier weather during August was reflected in lower disease levels during 2008. The corn yield and disease levels for 2008 are listed in Table 3-6. All of the yields were good in all locations of this study. There was only one average yield in an untreated check that was less than 200 bushels per acre.

Table 3 is the data from the Northern Illinois Agronomy Research Center. In this rotated corn soybean study, there were significant differences in the disease control levels, but the overall disease levels were low. There were significant differences in the yields between the two hybrids, but there were no significant yield differences for any of the fungicide treatments from the untreated check.

Table 4 contains the data from the Kane County trial site for the rotated corn crop. The disease levels were higher and there were significant differences among the fungicide treatments. There were significant differences in yield between the two varieties and significant yield differences due to the fungicide treatments.

Table 5 contains the data from the Kane County trial site for the third year of continuous corn. Again, there were significant differences in the disease levels, between the varieties and due to fungicide treatments. The biggest differences due to fungicide treatments were in this part of the study.

The combined data for all three study areas is contained in table 6. The DKC 54-49 is listed as more disease resistant and has slightly lower levels of disease in the untreated checks and under fungicide treatments than the DKC 60-18. All of the fungicide treatments significantly decreased the average levels of disease. The overall averages show that all of the fungicides gave a significant yield increase and were not significantly different from each other in the yield response. The average cost of a fungicide treatment is about the same as the value of six bushels of corn. The differences between the yields of the fungicide treatments and the untreated check were at least seven bushel per acre. This would indicate that on average, all fungicides would have at least paid for their application and have given at least a small profit.

The moistures and test weights for each part of the study are reported in the results for each of the study areas. There were significant differences between the various treatments, but the difference within the same variety was never more than one percent of moisture or one pound of test weight at any location. The differences between the varieties were greater than the differences due to the fungicide treatments. If harvest had occurred earlier, the differences due to treatments may have been greater.

In graph 1, the values of each of the differences in corn yield of the untreated check compared with the fungicide treatments of the same variety in that study. The approximate cost of the treatments was about the same as the value of six bushels of corn. Of the thirty comparisons, 13 of the yield differences were less than six bushels per acre and 17 of the yield differences were six bushels per acre or more. This 57% positive response at or above the cost of application is higher than most of the other research studies conducted. The average difference of the yields from the all fungicide sprayed plots was 12 bushel per acre increase over the untreated checks.

The results of these combined locations show the value of looking at research in more than a single location. At the single location of NIARC, the best fungicide only had an average yield increase of 1 bushel per acre. The best fungicide treatments at Kane County sites had yield increases of 17 and 41 bushels per acre. The average responses with the fungicide treatments from the rotated site were about 8 bushels per acre and about 22 ½ bushels per acre in the continuous corn site. The 110 day variety that had a lower disease resistance rating out yielded the 104 day variety with a higher disease resistance rating by an average of 17 bushels per acre. The decision on the use of a fungicide needs to be based on the likelihood of a positive yield response due to the disease resistance of the variety, expected weather conditions, and other economic factors.

Table 1: Rainfall received and daily high temperature after fungicide application 2008 NIARC

Date	Rainfall	High Temperature
August 4	1.08"	83.9
August 5		84.6
August 6	Trace	79.5
August 7		78.0
August 8		76.8
August 9	0.01"	77.5
August 10		72.4
August 11		77.2
August 12	Trace	75.4
August 13		78.1
August 14		78.1
August 15		76.5
August 16		79.1
August 17		80.9
August 18		80.4
August 19	Trace	82.7
August 20		81.2
August 21	0.34"	74.1

Table 2: 2008 Rainfall at the Northern Illinois Agronomy Research Center

Month	Monthly Rainfall	25 year average	Departure from average
May	4.96"	4.14"	+0.82"
June	3.88"	3.68"	+0.20"
July	6.99"	3.87"	+3.12"
August	1.63"	4.22"	-2.59"
September	11.45"	2.90"	+8.55"

Table 3: 2008 NIARC Yields and disease response to fungicides.

Hybrid	Material	Rate ounces/acre	% Plant Disease	% Leaf Disease	% Moisture	Test Weight Pounds	Yield @ 15% Moisture
DKC 54-49	Untreated Check		5 A	4.9 A	15.9 EFG	57.4 A	227 CD
DKC 54-49	Headline	6	1.4 EF	1.5 FG	16.3 DE	57.3 AB	234 BC
DKC 54-49	Headline	9	1.6 DEF	1.3 FG	16.7 D	56.9 B	232 C
DKC 54-49	Quilt	14	2.2 CDEF	2.4 CDEFG	15.6 FG	57.2 AB	222 D
DKC 54-49	Stratego	10	4.2 AB	4.1 AB	15.4 G	57.6 A	228 CD
DKC 54-49	Stratego	12	3.0 BCD	2.7 BCDEF	16.1 DEF	57.5 A	222 D
DKC 60-18	Untreated Check		2.8 BCDE	3.1 BCDE	18.4 AB	54.6 DE	246 A
DKC 60-18	Headline	6	2.2 CDEF	2.2 DEFG	18.0 BC	54.9 CDE	242 A
DKC 60-18	Headline	9	1.0 F	1.1 G	18.9 A	54.5 E	244 A
DKC 60-18	Quilt	14	2.2 CDEF	1.8 EFG	18.4 AB	54.7 DE	240 A
DKC 60-18	Stratego	10	4.0 AB	3.8 ABC	17.8 BC	55.3 C	241 A
DKC 60-18	Stratego	12	3.6 ABC	3.6 ABCD	17.7 C	55.0 CD	242 A
	CV		73.8%	71.7%	4.7%	1.1%	3.9%
	LSD 0.10		1.5	1.5	0.61	0.45	7.0
DKC 54-49			2.9	2.8	16.0 B	57.3 A	227 B
DKC 60-18			2.6	2.6	18.2 A	54.8 B	242 A
	LSD 0.10		0.89-NS	0.84-NS	0.35	0.26	4.0
	Untreated check		3.9 A	4.0 A	17.1 B	56.0 ABC	237 AB
	Headline	6	1.8 BC	1.8 BC	17.2 B	56.1 ABC	238 AB
	Headline	9	1.3 C	1.2 BC	17.8 A	55.7 C	238 A
	Quilt	14	2.2 BC	2.1 BC	17.0 BC	56.0 BC	231 B
	Stratego	10	4.1 A	4.0 A	16.4 C	56.5 A	234 AB
	Stratego	12	3.3 AB	3.2 AB	16.9 BC	56.2 AB	232 AB
	LSD 0.10		1.5	1.5	0.61	0.45	7.0

Yields and disease ratings followed by the same letter are not significantly different.

Table 4: 2008 KCCG Rotated corn yields and disease response to fungicides.

Hybrid	Material	Rate ounces/ acre	% Leaf Disease	% Mois- ture	Test Weight Pounds	Yield @ 15% Mois- ture
DKC 54-49	Untreated Check		9.4 B	15.5 DE	58.5 BC	226 C
DKC 54-49	Headline	6	3.6 DE	15.3 E	58.7 B	229 C
DKC 54-49	Headline	9	2.6 E	15.3 E	58.2 BC	232 BC
DKC 54-49	Quilt	14	6.6 BCD	15.7 D	58.7 B	252 A
DKC 54-49	Stratego	10	5.5 CDE	15.5 DE	58.7 B	228 C
DKC 54-49	Stratego	12	6.6 BCD	15.5 DE	59.2 A	247 A
DKC 60-18	Untreated Check		15.6 A	16.5 B	54.7 D	243 A
DKC 60-18	Headline	6	3.5 DE	16.2 C	54.6 D	251 A
DKC 60-18	Headline	9	4.6 CDE	16.9 A	53.9 E	246 A
DKC 60-18	Quilt	14	6.6 BCD	16.4 BC	53.9 E	251 A
DKC 60-18	Stratego	10	6.1 CDE	16.8 A	53.8 E	231 BC
DKC 60-18	Stratego	12	7.6 BC	16.3 BC	54.3 D	250 A
	CV		70.4%	1.9%	0.8%	6.3%
	LSD 0.10		3.9	0.3	0.4	12.8
DKC 54-49			7.4	15.5 B	58.7 A	236 B
DKC 60-18			5.7	16.5 A	54.2 B	245 A
	LSD 0.10		2.3-NS	0.15	0.23	3.9
	Untreated check		12.5 A	16.0 AB	56.6 AB	234 B
	Headline	6	3.6 B	15.8 B	56.6 AB	240 AB
	Headline	9	3.6 B	15.1 A	56.1 C	239 AB
	Quilt	14	6.6 B	16.1 A	56.3 BC	251 A
	Stratego	10	5.8 B	16.1 A	56.2 BC	230 B
	Stratego	12	7.1 B	15.9 AB	56.8 A	249 A
	LSD 0.10		3.9			12.8

Yields and disease ratings followed by the same letter are not significantly different.

Table 5: 2008 KCCG Continuous corn yields and disease response to fungicides.

Hybrid	Material	Rate ounces/ acre	% Disease severity	% Mois- ture	Test Weight Pounds	Yield @ 15% Moisture
DKC 54-49	Untreated Check		9.8ABC	14.2 F	58.9 BC	196 F
DKC 54-49	Headline	6	2.8 G	15.0 D	58.7 BC	229 BC
DKC 54-49	Headline	9	4.8 EFG	14.8 DE	58.5 C	218 CDE
DKC 54-49	Quilt	14	3.5 FG	14.8 DE	59.4 A	223 CD
DKC 54-49	Stratego	10	3.0 G	15.0 D	59.0 ABC	233 BC
DKC 54-49	Stratego	12	6.5 DEF	14.6 F	59.1 AB	210 DEF
DKC 60-18	Untreated Check		12.0 A	16.0 C	55.2D	206 EF
DKC 60-18	Headline	6	5.5 EFG	16.6 A	54.8 D	241 AB
DKC 60-18	Headline	9	10.0 AB	16.4 AB	54.9 D	253 A
DKC 60-18	Quilt	14	6.8 CDE	16.4 AB	54.8 D	230 BC
DKC 60-18	Stratego	10	8.8 BCD	16.2 BC	55.0 D	252 A
DKC 60-18	Stratego	12	4.5 EFG	16.5 AB	55.1 D	224 BCD
	CV		57.1%	2.2%	0.9%	8.5%
	LSD 0.10		3.1	0.3	0.5	16.4
DKC 54-49			5.0 B	14.7 B	58.9 A	218 B
DKC 60-18			7.9 A	16.3	55.0 B	234 A
	LSD 0.10		1.8	0.4	0.8	9.5
	Untreated check		10.9 A	15.1 B	57.0 A	201 C
	Headline	6	4.1 C	15.8 A	56.8 A	235 A
	Headline	9	7.4 B	15.6 A	56.7 A	236 A
	Quilt	14	5.1 BC	15.6 A	57.1 A	227 AB
	Stratego	10	5.9 BC	15.6 A	57.0 A	242 A
	Stratego	12	5.5 BC	15.5 A	57.1 A	217 BC
	LSD 0.10		3.1	0.3	.5 – NS	12.8

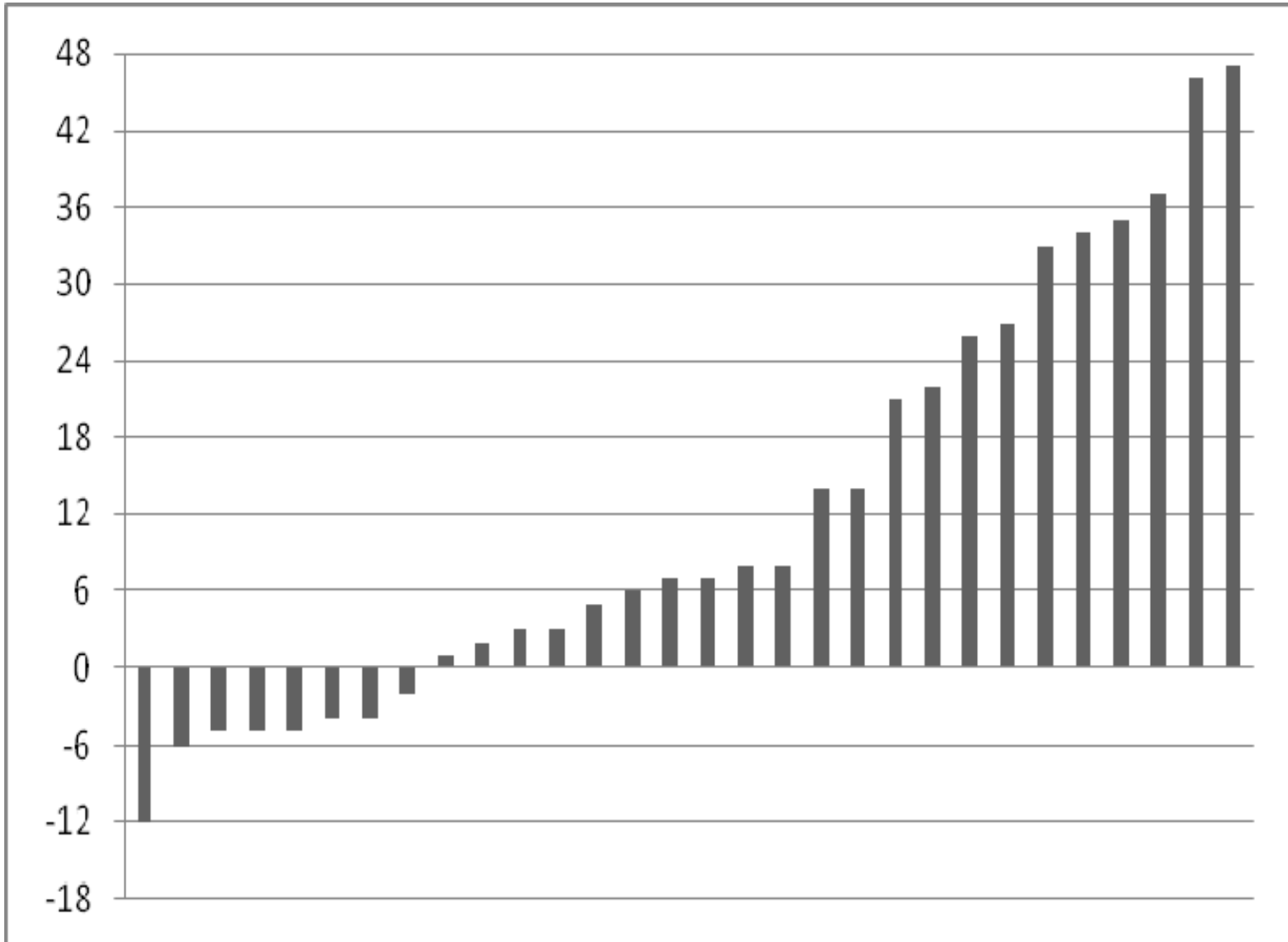
Yields and diseased ratings followed by the same letter are not significantly different.

Table 6: 2008 Kane County Corn Growers Variety X Fungicide Summary of corn yields and disease response to fungicides.

Hybrid	Material	Rate ounces/ acre	% Disease severity	% Mois- ture	Test Weight Pounds	Yield @ 15% Moisture
DKC 54-49	Untreated Check		7.8 B	15.2 B	58.2 A	217 E
DKC 54-49	Headline	6	2.5 HI	15.6 B	58.1 A	231 CD
DKC 54-49	Headline	9	2.9 HI	15.6 B	57.8 A	228 CD
DKC 54-49	Quilt	14	4.0 FGH	15.4 B	58.4 A	231 C
DKC 54-49	Stratego	10	4.2 EFG	15.3 B	58.4 A	229 CD
DKC 54-49	Stratego	12	5.2 D	15.5 B	58.5 A	226 D
DKC 60-18	Untreated Check		9.6 A	17.1 A	54.8 B	233 C
DKC 60-18	Headline	6	3.6 GHI	17.0 A	54.8 B	244 AB
DKC 60-18	Headline	9	4.9 EF	17.5 A	54.4 B	247 A
DKC 60-18	Quilt	14	5.0 DEF	17.2 A	54.5 B	240 B
DKC 60-18	Stratego	10	6.1 C	16.9 A	54.8 B	241 B
DKC 60-18	Stratego	12	5.1 DE	16.9 A	54.8 B	239 B
	CV		75.0%	6.7%	2.2%	8.4%
	LSD 0.10		1.1	0.6	0.7	5.2
DKC 54-49			4.4 A	15.4 B	58.2 A	227 B
DKC 60-18			5.7 A	17.1 A	54.7 B	241 A
	LSD 0.10		1.4	0.3	0.4	5.3
	Untreated check		8.7 A	16.1 A	56.5 A	225 B
	Headline	6	3.1 D	16.3 A	56.5 A	238 A
	Headline	9	3.9 CD	16.6 A	56.1 A	238 A
	Quilt	14	4.5 BC	16.3 A	56.3 A	236 A
	Stratego	10	5.2 B	16.1 A	56.6 A	235 A
	Stratego	12	5.2 B	16.2 A	56.7 A	232 A
	LSD 0.10		1.1	0.6 - NS	0.7 - NS	5.2

Yields and disease ratings followed by the same letter are not significantly different.

Graph 1: Corn yield differences between untreated check and fungicide treated corn.



The cost of the fungicide applications is about the same as the value of six bushels of corn. In this study, 57% of all of the fungicide treatments in this study yielded six bushels or more than the untreated check.