CORN INSECTICIDE SEED TREATMENT AND FOLIAR FUNGICIDE EFFECTS ON CORN RESPONSE TO FERTILIZER NITROGEN

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INTRODUCTION

The current nitrogen use efficiency numbers for corn in Illinois ranges from 0.8 to 1.2 lb N/bu based on yield goal, previous crop, manure credits and other incidentals. Recent studies have enhanced the process of identifying optimum N needs based on N prices and value of corn (Nafziger et al, 2005). As N prices continue to escalate, further fine tuning of the nitrogen rate equation will be needed.

Changes in yield potential associated with technological advances such as insecticide seed treatments (IST) and foliar fungicides should increase the need for additional fertilizer N. However, there are increased efficiencies of N use expected as plant roots are protected from insect damage. Improving photosynthetic capacities may extend and enhance grain filling but would also be effective in prolonging root efficacy to take up soil nutrients, including N.

As N prices continue to climb, reduction in N rates associated with increased N use efficiency becomes more of an economical consideration. These gains in efficiency could be combined with potential increases in yield to more than offset the costs of IST and/or foliar fungicide treatments.

The objectives of this study are to 1) evaluate the effects of corn insecticide seed treatment (IST) on plant stand, yield and fertilizer N response of corn, 2) determine the interactions of foliar fungicide, IST, and N rates on corn health, diseases, and grain yields, and 3) determine the economics of the use of IST and foliar fungicides in corn production in southern IL

MATERIALS AND METHODS

A field study was established at two locations in southern Illinois – the University of Illinois Dixon Springs Ag. Center (DSAC) and the Southern Illinois University Belleville Research Center (BRC). Corn (DeKalb DKC 61-69 hybrid) was treated with either Poncho 250 or 1250 insecticide seed treatment (IST) for comparison and planted at 32,000 seed/acre in conventionally tilled soil. Details of the study are presented in Table 1 below. The study design was a split-split-plot design with foliar fungicide treatment as whole plot, insecticide seed treatment as subplots and N rates as sub-subplots. Fungicide treatments consisted of +/- Headline foliar applied to corn at tasseling (VT). Nitrogen (N) rates were 0, 60, 120, 180 and 240 lb N/acre applied as liquid UAN (32%) applied sidedress injected four to six weeks after planting. There were four replications per location. Leaf disease ratings were taken 3-4 weeks after fungicide applications and again at 6-7 weeks. Stalk quality and disease ratings were taken at physiological maturity.

Table 1. Site information for each location, 2008.

	DSAC	BRC
Soil Type	Grantsburg sil.	Caseyville sil.
Previous crop	Corn	Wheat
Planting date (rate)	May 1 (32,000 plts/acre)	June 12 (32,000)
Fungicide (rate)	Headline (9 oz/acre)	Headline (9 oz/acre)
Fungicide application date	July 17 (VT)	August 11 (VT)

RESULTS AND DISCUSSION

Primary diseases were gray leaf spot, northern corn leaf blight and common rust at both locations. Common and southern rusts were most prevalent at BRC, especially at the second rating date. There was a significant reduction in leaf diseases at DSAC with the application of fungicide, even though disease levels were low (<12%) (Table 2). At BRC, there was also a significant reduction in leaf diseases with the application of fungicide, but here the diseases exploded with greater than 50% leaf coverage on Sept. 29, primarily common and southern rusts. Increasing N rates significantly increased leaf diseases, especially without fungicide application (Figures 1 and 2). Stalk rot was not affected by fungicide treatment at DSAC but was significantly lower at BRC with the application of fungicide. Increasing N rates to 120 lb N/acre had the highest stalk rot rating at DSAC, whereas, at BRC the maximum rating occurred at approximately the 60 lb N rate (Figures 3 and 4). IST had no effect on ear-leaf or stalk rot diseases.

Increasing N rates significantly increased ear-leaf N concentrations and corn grain yields at both locations (T able 3). The IST had no effect on ear-leaf N concentration at DSAC, but significantly increased ear-leaf N (by 5%) at BRC. The IST had no effect on yield at either location, but increased final plant stand at DSAC by about 1000 plants/acre (data not available for BRC due to extreme lodging at harvest). The fungicide treatment had no effect on ear-leaf N concentrations at either location, but application of a foliar fungicide at BRC significantly increased grain yield (by over 7%).

There was a significant quadratic response to increasing N rates at both locations which allowed us to calculate the economic optimum N rate (EONR) assuming a N price of $0.50 and a corn price of $5.00. The EONR for DSAC was 240 lb N/acre, whereas the EONR for BRC was only 139 lb N/acre, probably an indication of previous crop differences and a higher OM level at BRC (Figure 5). The IST had no effect on EONR at DSAC, but at BRC, the EONR was 37 lb N/acre less with the 1250 IST compared to the 250 IST (Figure 6).

CONCLUSIONS

This is only the first year's results and should be viewed cautiously. Increasing N rates tended to increase leaf diseases, but this effect was significantly reduced as were plant diseases in general with the application of fungicide at tasseling. There was a 15 bu/acre increase in corn grain yields at BRC, but no effect at DSAC. IST had no effect on yields at either location, but the higher IST at BRC significantly reduced the EONR.

REFERENCES

Nafziger, E. D., R. G. Hoeft, E. A. Adee, R. E. Dunker, S. A. Ebelhar and L. E. Paul. 2005. Assessing variability in corn response to N rate. In R. G. Hoeft (Ed.) 2005 Proc. IL Fert. Conf.

Table 2. Effects of N rate, IST and foliar fungicide application on corn diseases, 2008.

Variable		DSAC			BRC		
		Ear-leaf 8/7/08	**Ear-leaf 8/29/08**	**Stalk Rot 9/15/08**	**Ear-leaf 9/8/08**	**Ear-leaf 9/29/08**	**Stalk Rot 10/31/08**
Fungicide	N Rate	---------- Disease Severity (% or 1-5 scale) ----------					
No	0	9.4 %	5.8 %	1.7	5.5 %	42.7 %	2.8
	60	10.0	9.8	2.7	6.5	49.0	3.8
	120	9.6	9.2	3.1	6.3	61.9	3.7
	180	10.2	10.2	2.5	4.5	62.7	3.5
	240	11.9	11.3	1.8	6.4	71.7	4.0
	Average	10.2 a	9.2 a	2.4 a	5.8 a	57.6 a	3.6 a
Yes	0	3.1 %	1.5 %	1.6	1.5 %	7.5 %	2.0
	60	5.4	3.7	2.6	2.8	8.8	2.7
	120	5.8	3.3	2.6	1.5	6.7	2.8
	180	5.6	3.8	2.3	1.2	6.7	2.0
	240	5.6	3.8	1.8	2.2	7.9	2.1
	Average	5.1 b	3.2 b	2.2 a	1.8 b	7.5 b	2.3 b
Insecticide							
250		7.3 a	6.6 a	2.3 a	4.0 a	32.6 a	3.0 a
1250		8.0 a	5.9 a	2.3 a	3.7 a	32.5 a	2.8 a
Statistics							
+/- Fungicide (F)		***	***	*NS*	***	***	**
+/- Insecticide (I)		*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
N lin (N)		***	***	*NS*	*NS*	***	*NS*
N quad		*NS*	*	***	*NS*	*NS*	*
F x I		*	*NS*	*NS*	**	*NS*	*NS*
F x N		*NS*	*NS*	*NS*	*NS*	***	*NS*
I x N		*NS*	*NS*	*NS*	**	*	*NS*
F x I x N		*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

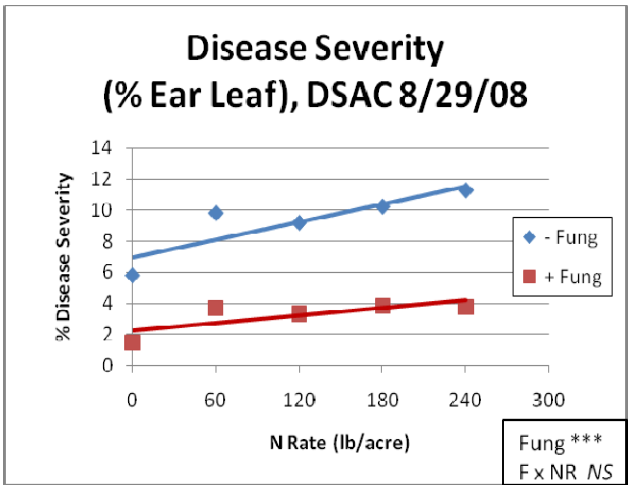
*, **, and *** refer to significance at the 10%, 5% and 1% levels, respectively.
NS = non-significant. Means within a column followed by the same letter are not significantly different at the 5% level.

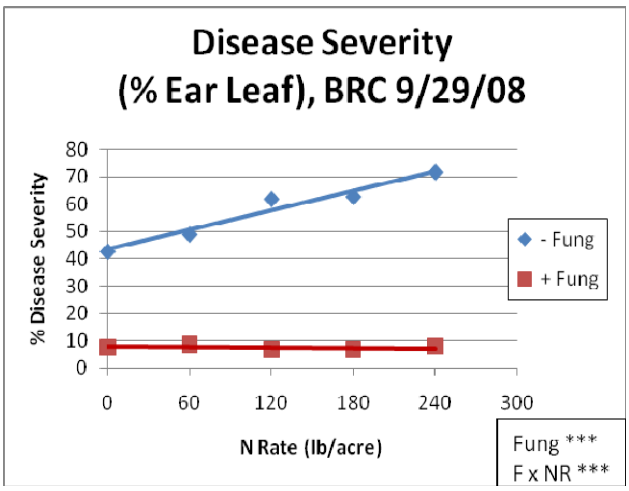
Table 3. Effects of N rate, IST and foliar fungicide application on corn yield and ear-leaf N composition, 2008.

Variable		DSAC			BRC		
		Ear-leaf % N	**Yield (bu/acre)**	**Stand (plts/a)**	**Ear-leaf % N**	**Yield (bu/acre)**	**Lodging (0-9)**
Fungicide	N Rate						
No	0	1.26	72.0	30,077	1.96	161.6	4.8
	60	1.84	141.5	30,233	2.14	194.5	4.4
	120	2.25	195.5	30,751	2.57	204.8	5.5
	180	2.44	228.3	30,388	2.53	212.6	5.3
	240	2.59	249.4	29,922	2.51	201.8	6.5
	Average	2.08 a	177.3 a	30,274 a	2.34 a	196.0 b	5.4 a
Yes	0	1.27	75.4	29,351	1.97	170.1	4.9
	60	1.92	140.7	29,818	2.28	208.7	4.6
	120	2.32	193.8	31,633	2.46	226.1	5.0
	180	2.56	227.0	30,181	2.66	229.0	5.8
	240	2.52	255.7	30,285	2.73	221.0	6.4
	Average	2.12 a	178.5 a	30,253 a	2.42 a	211.0 a	5.3 a
Insecticide							
250		2.13 a	177.5 a	29,642 b	2.32 b	202.0 a	5.3 a
1250		2.07 a	178.4 a	30,886 a	2.44 a	204.0 a	5.3 a
Statistics							
+/- Fungicide (F)		*NS*	*NS*	*NS*	*NS*	**	*NS*
+/- Insecticide (I)		*NS*	*NS*	**	*	*NS*	*NS*
N lin (N)		***	***	*NS*	***	***	***
N quad		***	***	*NS*	***	***	*NS*
F x I		*NS*	*NS*	**	*NS*	**	*NS*
F x N		*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
I x N		*	*NS*	*NS*	*NS*	**	*NS*
F x I x N		*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

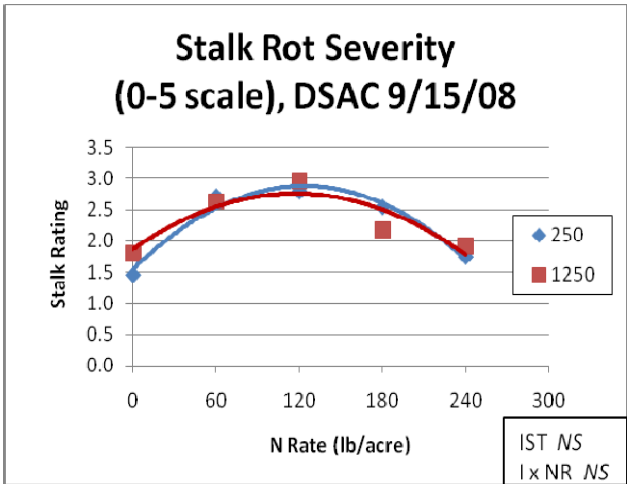
*, **, and *** refer to significance at the 10%, 5% and 1% levels, respectively.
NS = non-significant. Means within a column followed by the same letter are not significantly different at the 5% level.

Figures 1 and 2. Effects of N rate and fungicide on ear-leaf diseases, 2008.





Figures 3 and 4. Effects of N rate and fungicide on stalk rot, 2008.



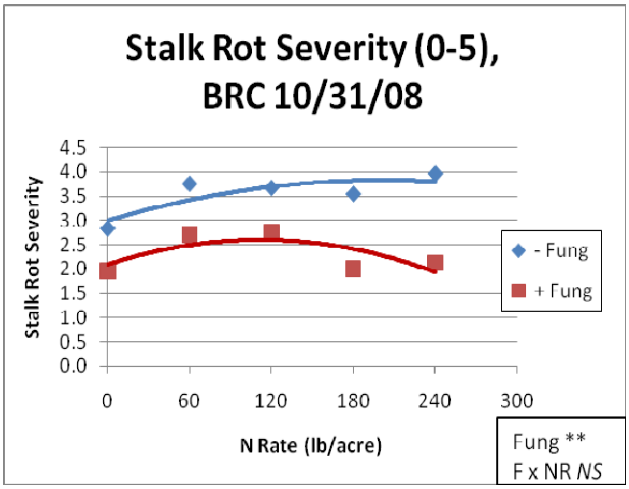


Figure 5. Effect of N rate on corn yields, 2008.

Figure 6. Effect of N rate and IST on corn grain yields at BRC, 2008.