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Yield Losses Associated with *Dectes* Stem Borers in Soybean and Efficacy of Fipronil Seed Treatments in Controlling *Dectes* Stem Borers, Scandia, 2008[1]

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Summary

Fipronil soybean seed treatments were evaluated in large plots (8 rows by 65 ft) near Scandia, KS. *Dectes* infestations were quite high; 75% of plants were infested in untreated plots. The fipronil seed treatment gave 100% control of the *Dectes* stem borer. Plots with treated seed had 5.6 and 7.6 bu/a more grain yield than plots with untreated seed at normal and late harvest for changes of 7.5 and 11.5%, respectively. The late harvest was also associated with significant yield losses, 10.1 bu/a for untreated seed and 8.1 bu/a for treated seed. These results revealed significant physiological yield loss of 8.2% and a plant lodging loss of 2.9% associated with *Dectes* stem borer infestations. Fipronil seed treatment could be a useful technology to protect soybean grain yield from *Dectes* stem borer, but it is not yet registered for use on soybean. Timely harvest is also successful in reducing grain yield loss caused by lodging and pod shattering.

Procedures

Soybean seed (Pioneer 93M92, maturity group III) was divided into two lots; one was treated with fipronil (Regent 500TS) at 100 mg a.i./100 kg seed, and the other was left untreated. Plots were machine planted May 16 at 16 seeds per row-foot at the North Central Kansas Experiment Field near Scandia with a small-plot row-crop planter. The treated and untreated main plots were eight rows wide and 65 ft long. Four-row subplots were harvested October 8 when the plants dried down enough to harvest (normal harvest) and on November 18 after the *Dectes*-infested plants had lodged (late harvest). This was almost 6 weeks later. *Dectes* stem borer observations were recorded on September 30 by dissecting five consecutive plants taken from each of the two center rows in each subplot for a total of 10 plants per subplot. We recorded entry nodes, upper stem tunneling, tunneling that reached the base of the plant, and the number of live larvae present. A small plot combine with a grain header was used to collect grain yield from the two center rows. Grain yield was converted to bushels per acre based on 13% moisture. The experimental plan was a split-plot randomized block design with two factors, seed treatment and harvest time, and five replications. The SAS-ANOVA procedure was used to analyze the data. Means were compared by LSD.

[1] This research is sponsored by the Kansas Soybean Commission

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[3] K-State Research and Extension Irrigation and North Central Kansas Experiment Fields, Scandia, KS

Results and Discussion

Dectes infestations were quite high; 75% of plants were infested in untreated plots (Table 1 and Figure 1). Fipronil seed treatment significantly suppressed the numbers of entry nodes, stem tunneling, tunneling to the base, and number of live larvae per 10 plants compared with untreated plants. The fipronil seed treatment gave 100% control for each of the *Dectes* observations. These data indicate that the residual activity of the fipronil seed treatments remained effective through August when the *Dectes* stem borer larvae were tunneling in the plant stems.

Effects of the treatments on grain yield were significant across seed treatment as well as harvest date, but the interaction was not significant (Table 1). At the normal harvest, treated seed had 5.6 bu/a more grain, and at the late harvest, there was 7.6 bu/a less grain for differences of 8.2 and 13.0% (Figure 2). Yield losses associated with untreated seed can be attributed to *Dectes* stem borers. The losses at the normal harvest would be mostly physiological yield losses because there was very little lodging. Consequently, very little soybean was left in the plots after harvest.

Late harvest was also associated with significant yield losses: 10.1 bu/a for untreated seed and 8.1 bu/a for treated seed for reductions of 14.7 and 11.8%, respectively (Table 2, Figure 2). Losses for untreated plots can be associated with lodging plus harvest delay (mostly pod shattering). The 10.1 bu/a losses for untreated seed can be attributed to both harvest delay and lodging. Therefore, we can calculate the difference between these to determine lodging losses of 2 bu/a, or 2.9%. These results reveal significant physiological yield loss of 8.2% and plant lodging losses of 2.9% associated with *Dectes* stem borer infestations (Figure 2).

Fipronil seed treatment could be a useful technology to protect soybean grain yield from *Dectes* stem borer, but it is not yet registered for use on soybean. Timely harvest is also successful in reducing grain yield loss caused by lodging and pod shattering.

Table 1. Treatment means, percentage of control, and F-test probability values for ANOVA tests for the two main effects, insecticide treatment and harvest time, Irrigation Experiment Field, Scandia, 2008

	Entry nodes	Stem tunneling	Base tunneling	Live larvae	% of plants infested	Grain yield
	---------- per 10 plants ----------					bu/a
ANOVA F-test probability						
Insecticide treatment	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Harvest timing	–	–	–	–	–	< 0.0001
Insecticide × harvest	–	–	–	–	–	0.3388
Insecticide treatment means						
Untreated	14.9	7.7	6.0	4.3	75.0	63.7
Treated	0.0	0.0	0.0	0.0	0.0	70.2
% Control/Yield increase	100%	100%	100%	100%	100%	+10.6%

Fipronil treatment was applied as a seed treatment.

Table 2. Dectes stem borer yield damage components at Scandia, 2008

Yield loss components	Scandia	
	bu/a	% NH UT
Physiological loss		
(TR NH) – (UT NH)	5.6	8.2
Delay (D)		
(TR NH) – (TR LH)	8.1	11.8
Delay and lodging (D&L)		
(UT NH – (UT LH)	10.1	14.7
Lodging		
(D&L) - D	2.0	2.9
Total losses		
(TR NH) – UT LH)	15.7	22.9

TR = treated; UT = untreated; NH = normal harvest; LH = late harvest, D = delay losses, D&L = delay and lodging losses.

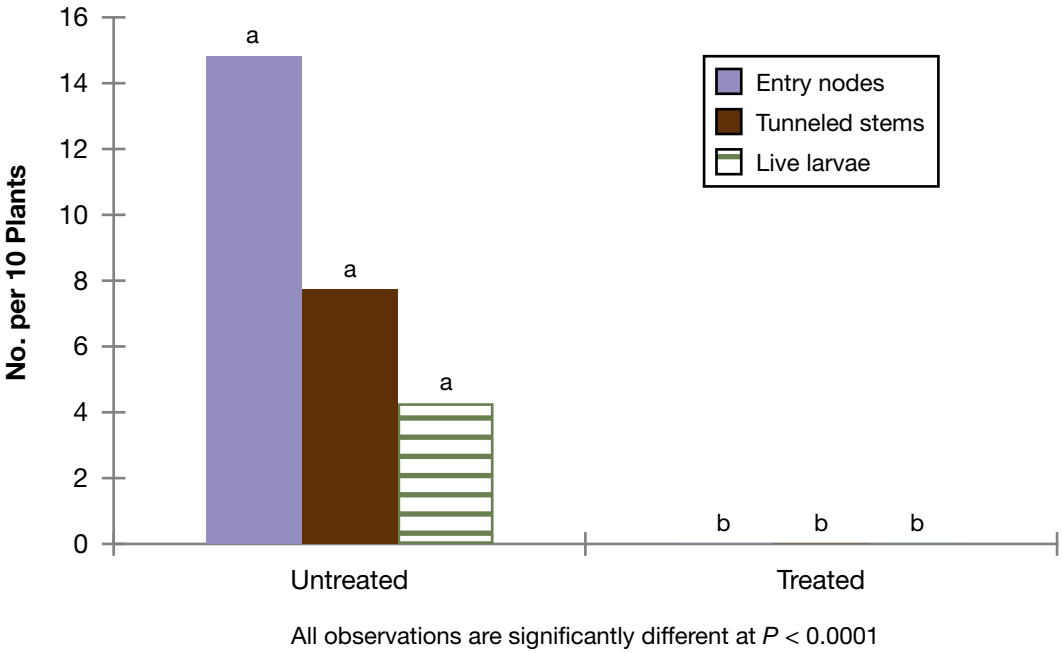
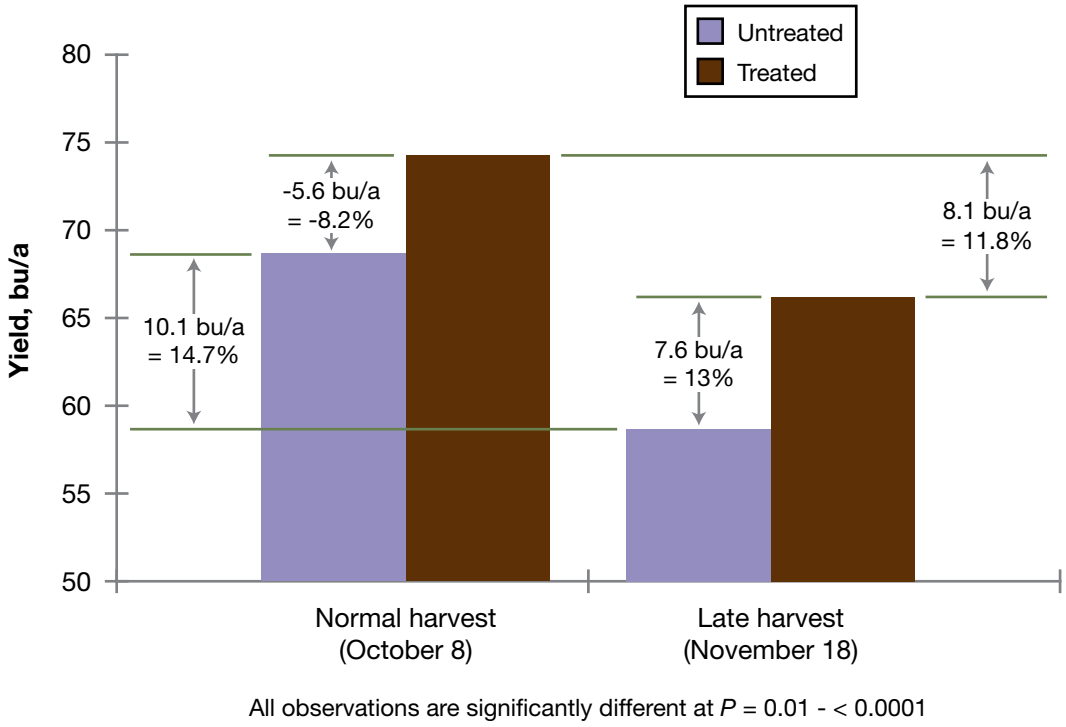


Figure 1. Mean numbers of several *Dectes* stem borer observations (entry nodes, tunneled stems, and live larvae) per 10 plants at Scandia, 2008.



All observations are significantly different at $P = 0.01 - < 0.0001$

Figure 2. Grain yield at two harvest dates for treated and untreated soybean together with calculated differences used to calculate the *Dectes* stem borer yield damage components at Scandia, 2008.

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