Effects of Stink Bug Feeding and Fungicide Application on Green Stem Disorder of Soybean

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Introduction

Green stem is a disorder of soybean, *Glycine max* (L.) Merrill, that causes a differential maturation of parts of the plant with the stems remaining green and moist even after pods and seeds have fully ripened and dried. The cause of the disorder is unknown, however variable sensitivity to the disorder among soybean cultivars has been identified (Hill, *et al*., 2006). Hobbs, *et al*., (2006) ruled out *Bean pod mottle virus* as a main cause of the disorder. Other possible causes that have been put forward include stink bug feeding (Boethel, *et al*., 2000; Lustosa, *et al*., 1999), fungicide treatments (Padgett, *et al*., 2003) and environmental factors (Malvick, 2001). The objectives of this study were to compare the effects of application of the foliar fungicide Pristine® (pyraclostrobin + boscalid) and stink bug feeding with controls on the incidence of green stem in a sensitive cultivar and an insensitive cultivar.

Materials and Methods

- Field experiments were conducted in 2004 and 2005 in Urbana, Illinois, USA. Experimental design was a split-plot with four whole-plot treatments and two sub-plot treatments replicated three times. Three whole-plot treatments were contained inside 3m x 3m x 2.1m insect-proof cages (Figure 1.; Redwing Empire Awning, Santa Rosa, CA, USA).

- Whole-plot treatments:
  1. Pristine® (BASF, Raleigh, NC, USA) applied at the rate of 5.1g (38% a.i.)/600 ml H20 at 10-14 d intervals from the V2 through the R6 soybean growth stages (Caged).
  2. Stink bugs, *Euschistus servus* (Say) and *Acrosternum hilare* (Say), about 20 individual late instar nymphs collected during August. Populations multiplied to >100 individuals inside each replicate by the end of each season (Caged).
  3. Untreated control (Caged).
  4. Untreated control (Uncaged).

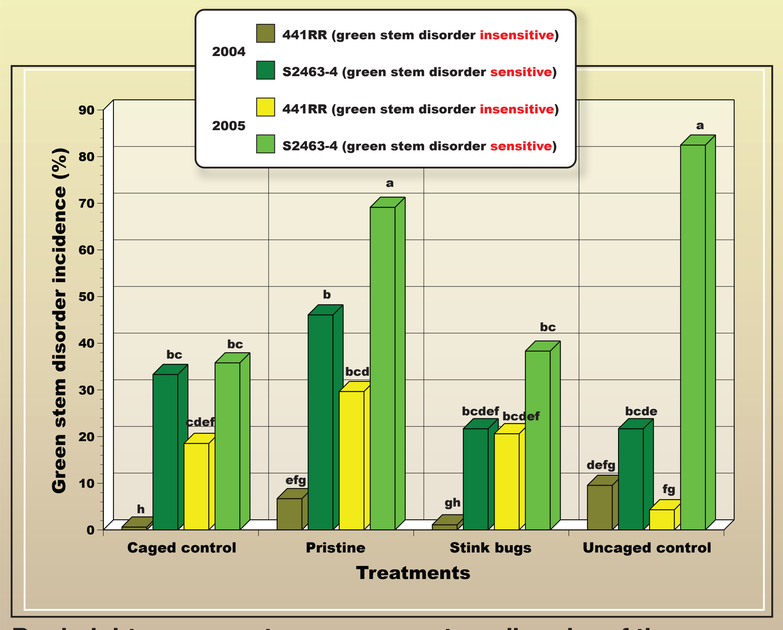
- Sub-plot treatments were two Maturity Group II soybean cultivars planted in 1.8m long two-row plots:
  1. Hughes 441RR (green stem disorder insensitive).
  2. Stine S2463-4 (green stem disorder sensitive).

- Evaluation: percentage of plants that had green stem disorder (Figure 2) in each sub-plot treatment after pods on both cultivars had fully ripened and dried. Statistical analysis was done with the aid of JMP 5.1 (SAS Institute, Cary, NC, USA).

Figure 1. Field cages used to contain the fungicide application, stink bug feeding, and caged control treatments.

Figure 2. Normal mature soybean stems (left side plants above) and stems showing green stem disorder (right side plants).

Figure 3. Interaction between years, treatments and cultivars on incidence of green stem disorder in Urbana, Illinois, during 2004 and 2005.



Bar heights represent mean green stem disorder of three replications. Bars without common letters above were significantly different ($P<0.05$).

Results

- There was a highly significant ($P<0.01$) Year x Treatment x Cultivar interaction (Figure 3).
- Green stem disorder incidence ranged from 0.6% for 441RR in the caged control in 2004 to 83% for S2463-4 in the uncaged control in 2005.
- 441RR consistently had lower incidence than S2463-4.
- Pristine® application significantly increased incidence in S2463-4 both years (14 and 33% in 2004 and 2005, respectively) and in 441RR in 2004 (6%) compared to the caged control.
- The fungicide did not appear to delay the maturation of pods or seeds.
- Stink bug feeding did not increase green stem incidence compared to the controls.
- Green stem disorder incidence was significantly higher in the uncaged control than the caged control for 441RR in 2004 and for S2463-4 in 2005.

Conclusions

- Application of the fungicide Pristine® can increase the incidence of green stem disorder, especially in a sensitive cultivar.
- Fungicide application may increase incidence of green stem disorder by delaying maturation of stems but not pods and seeds or it may control fungi that normally colonize and kill the stems by the end of the season, such as *Macrophomina phaseolina* (Tass.) Gold. Further investigation of the second possibility is in progress.
- A third field test is required and is currently in progress to help confirm the results of the experiments in 2004 and 2005.

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