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Evaluation of Management Tactics for Bean Leaf Beetles and Bean Pod Mottle Virus in Soybean

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Abstract

An increase in bean leaf beetles has caused an increase in bean pod mottle virus - a yield robbing plant pathogen in Iowa soybeans. The incidence of bean pod mottle virus is often positively correlated with bean leaf beetle populations. For example, the greatest increase in bean pod mottle virus infection occurs after the first generation of bean leaf beetles reaches peak population density (late July). However, soybeans are most affected when soybeans are infected as seedlings.

Keywords

Entomology, Plant Pathology

Disciplines

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Introduction

An increase in bean leaf beetles has caused an increase in bean pod mottle virus—a yield robbing plant pathogen in Iowa soybeans. The incidence of bean pod mottle virus is often positively correlated with bean leaf beetle populations. For example, the greatest increase in bean pod mottle virus infection occurs after the first generation of bean leaf beetles reaches peak population density (late July). However, soybeans are most affected when soybeans are infected as seedlings.

Management of bean leaf beetles typically requires the use of an insecticide and several insecticides are currently labeled for use in soybeans. One of these, lambda-cyhalothrin (Warrior®), results in significantly fewer bean leaf beetles in soybeans and apparently has a long residual activity period. Lambda-cyhalothrin is effective against bean leaf beetles at 1.9–3.2 oz a.i./acre. Additionally, recent field studies indicate that systemic seed treatments such as thiamethoxam (Cruiser®) or imidacloprid (Gaucho®) also may be effective for managing bean leaf beetles at low application rates.

In theory, the use of a seed-treated insecticide instead of an early-season foliar-applied insecticide would be highly desirable to growers. Use of a seed treatment would reduce environmental impact, reduce soil compaction, increase grower convenience, and protect soybeans at emergence. Furthermore, this short-term management strategy affords researchers time to develop long-term solutions for this disease complex (e.g., gene resistance or transgenic plants).

The objective of this experiment is to measure the efficacy of systemic seed-treated and foliar-applied insecticides for bean leaf beetle and bean pod mottle virus management in Iowa soybeans.

Materials and Methods

Field studies were conducted at three ISU research farms in Iowa from 2002 to 2004: Ames, Nashua, and Sutherland. Only one location is presented here. Within each field, seven and eight treatments (12 rows × 100 ft) were replicated four and eight times, for 2002 and 2003, respectively, in a completely randomized block design.

In 2002, treatments included: 1) Cruiser seed application, 2) early-season Warrior spray (1.92 oz/acre), 3) mid-season Warrior spray (3.2 oz/acre), 4) early- and mid-season Warrior spray (1.92 and 3.2 oz/acre, respectively), 5) Cruiser seed application + mid-season Warrior spray (3.2 oz/acre), 6) untreated control. In 2003–2004, treatments included: 1) Cruiser seed application, 2) Cruiser seed application + Warrior spray approximately 10 days postemergence (3.2 oz/acre), 3) early-season Warrior spray (2.5 oz/acre), 4) mid-season Warrior spray (3.2 oz/acre), 5) early- and mid-season Warrior spray (2.5 and 3.2 oz/acre, respectively), 6) Cruiser seed application + mid-season Warrior spray (3.2 oz/acre), and 7) untreated control.

The planting date at each location was late April to early May. These dates span the normal planting times for soybeans in Iowa and correspond with overwintering bean leaf beetle emergence. Roundup Ready™ soybeans Kruger 277 (in 2002) or Mark 0124 (in 2003 and 2004) were planted. Treatment response is only reported here based on yield and mottling.

Results and Discussion

In 2002, bean leaf beetle abundance was significantly suppressed by insecticide treatments, during three periods of increasing abundance (Figure 2) relative to an untreated control. This suppression in beetle abundance increased yield for some treatments, although not significantly (Table 1). In 2003 and 2004, the early-season Warrior treatment alone significantly reduced beetle abundance in sample weeks 1–4 (Figure 2). However, Cruiser provided better mid- and late-season suppression of bean leaf beetle abundance. The addition of a Warrior application to an early-season Cruiser or Warrior application gave season-long suppression of bean leaf beetle abundance. In 2004, beetle abundance was equal to or lower than that in 2003. Additionally, a hailstorm, around sample week 7, removed all leaf tissue from our plots at Sutherland; therefore, only early-season treatments could be incorporated into the analysis from that location.

Seed mottling, in 2002, was highest in control plots (Table 1). In general, seed-treated soybeans had a higher percentage mottling than the foliar treatments. However, seed mottling and virus incidence are not always correlated. Therefore, data will be released at a later time to fully explain the relationship between mottling, virus incidence, and the effect of these management tactics for bean pod mottle virus. Furthermore, data is forthcoming that will explain the effect on these treatments on the virus epidemiology throughout the growing season.

Table 1. Yield and mottling of soybean seed harvested from Sutherland, Iowa, in 2002, 2003, and 2004. Values are averages ± SE. Treatment means with differing letters are statistically different, alpha = 0.05.

Treatment	Yield	Mottling
2002		
Poncho seed treatment	45.9 ± 1.5	10.8 ± 2.8**c**
Cruiser seed treatment	48.0 ± 2.0	9.5 ± 1.9**c**
Early-season Warrior	47.4 ± 2.7	8.5 ± 1.0**bc**
Mid-season Warrior	46.6 ± 1.2	4.0 ± 0.9**ab**
Early- and mid-season Warrior	47.0 ± 1.0	3.3 ± 0.6**a**
Cruiser and mid-season Warrior	51.8 ± 2.3	4.3 ± 1.7**ab**
Untreated control	44.6 ± 4.2	12.3 ± 1.0**c**
2003		
Cruiser seed treatment	63.3 ± 3.2**abc**	1.7 ± 0.7
Cruiser and Warrior 10d	60.4 ± 2.8**cd**	1.9 ± 0.2
Early-season Warrior	57.7 ± 3.6**d**	2.1 ± 0.6
Mid-season Warrior	62.5 ± 2.9**bc**	1.8 ± 0.5
Early- and mid-season Warrior	61.9 ± 3.4**bcd**	2.1 ± 0.5
Early- and mid-season Asana	65.7 ± 2.8**ab**	3.4 ± 0.5
Cruiser and mid-season Warrior	67.2 ± 3.0**a**	1.9 ± 0.4
Untreated control	59.6 ± 2.4**cd**	3.4 ± 0.9
2004		
Cruiser seed treatment	27.3 ± 0.8	3.8 ± 0.7
Cruiser and Warrior 10d	28.1 ± 1.5	2.5 ± 0.8
Early-season Warrior	28.3 ± 1.3	3.0 ± 0.7
Mid-season Warrior	NA	NA
Early- and mid-season Warrior	NA	NA
Early Asana	27.8 ± 0.9	3.6 ± 0.6
Cruiser and mid-season Warrior	NA	NA
Untreated control	30.2 ± 1.0	3.4 ± 0.6

NA = not available.

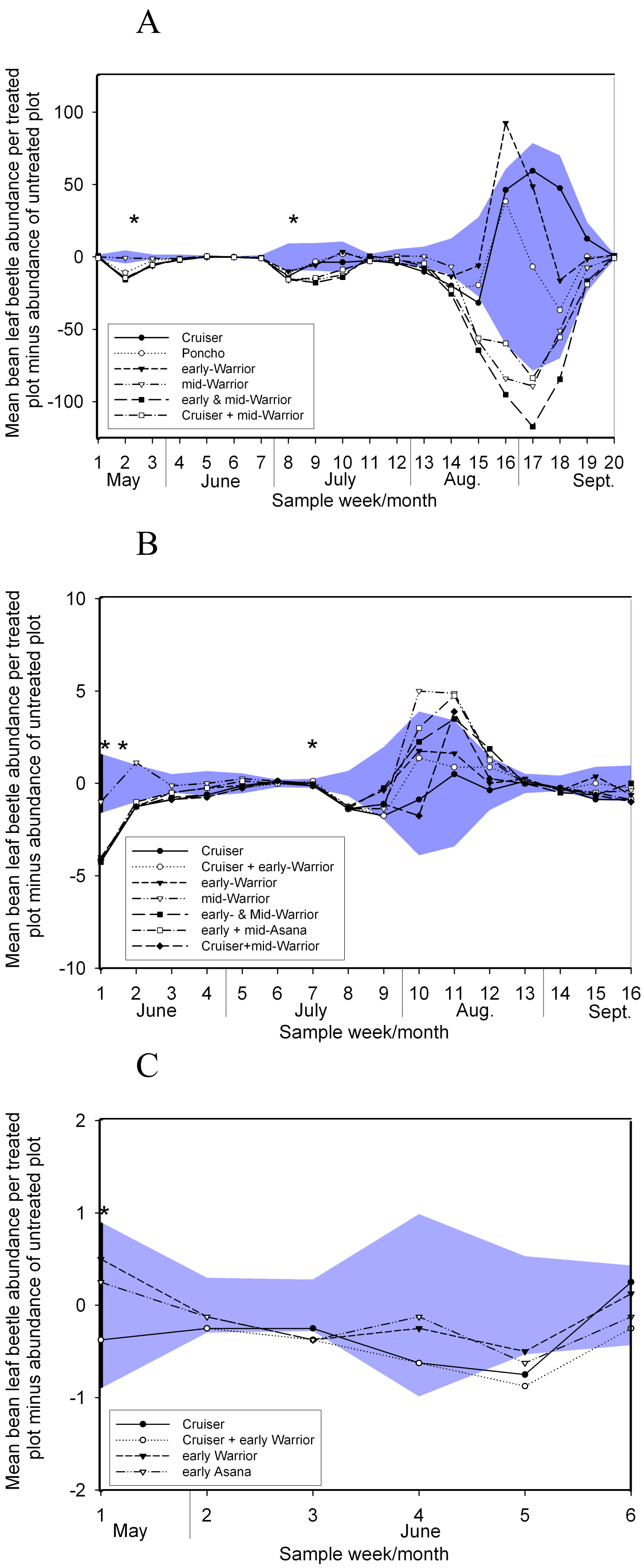

Figure 2. Mean difference of bean leaf beetle abundance in insecticide-treated from untreated soybean plots, origin=untreated control, from Sutherland, Iowa, in 2002 (**A**), 2003 (**B**), and 2004 (**C**). Boundary of shaded area equals LSD, alpha=0.05. Asterisks indicate times of foliar applications.