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Seed treatments in soybean: Managing bean pod mottle virus

Jeffrey D. Bradshaw
Iowa State University

Marlin E. Rice
Iowa State University, merice@iastate.edu

John H. Hill
Iowa State University, johnhill@iastate.edu

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Seed treatments in soybean: Managing bean pod mottle virus

Abstract

Bean leaf beetles are the principal vectors of bean pod mottle virus (BPMV). Last week we discussed the affects of seed-applied insecticides on bean leaf beetles and whether such insecticides can substitute for an early-season foliar application within a BPMV disease management program. Although there is a positive relationship between bean leaf beetles and BPMV, the effect of chemical control on the disease is different than that for the insect vector. As we discussed last week, a management program that included seed-applied insecticides resulted in improved yield but lower seed quality. Why does this happen and how is BPMV affected?

Keywords

Entomology, Plant Pathology

Disciplines

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Seed treatments in soybean: Managing bean pod mottle virus

by Jeffrey D. Bradshaw and Marlin E. Rice, Department of Entomology, and John H. Hill, Department of Plant Pathology

Bean leaf beetles are the principal vectors of bean pod mottle virus (BPMV). Last week we discussed the affects of seed-applied insecticides on bean leaf beetles and whether such insecticides can substitute for an early-season foliar application within a BPMV disease management program. Although there is a positive relationship between bean leaf beetles and BPMV, the effect of chemical control on the disease is different than that for the insect vector. As we discussed last week, a management program that included seed-applied insecticides resulted in improved yield but lower seed quality. Why does this happen and how is BPMV affected?

Yield protection is important but what about seed quality? Early planting is recommended to maximize yield; however, early planting may put soybean crops in jeopardy of higher bean leaf beetle infestation, earlier BPMV-inoculation of the crop and reduced grain quality. The maximum percentage limits for the current USDA grade requirements for yellow soybean, according to Rules and Regulations of the Federal Register (Sept. 6, 2006. Vol. 71[172], p. 52403-52406), are strict (Table 1). The U.S. No. 2 grade is the most common trade standard for yellow soybeans (Federal Register. Sept. 6, 2006. Vol. 71[172], p. 52404). Note that these are the maximum limits, and buyers' contracts and cooperatives may require more stringent percentage limits. Financial penalties for poor seed quality are variable; however, seed contracted for export that can't make the appropriate grade will result in reduced market value.

"Soybeans of other colors" (Table 1) would include the symptomatic effects of viral diseases (e.g., BPMV) on soybean seed. Table 2 summarizes the effects of the bean leaf beetle/BPMV management program (and their individual treatment components) on BPMV incidence, seed mottling, and yield based upon our research. Generally, the seasonal incidence of BPMV was reduced (~15% relative to an untreated control) with the application of a seed-applied insecticide when it is applied as the only insecticide treatment. Additionally, there were substantial improvements in seed quality for some treatments (see last week's newsletter); however, none of the treatments improved quality enough to make U.S. No. 2 grade in 2002 or 2003.

The answer to grain quality may lie with the beetles. It is not surprising that mid-season foliar applications improve seed quality as pyrethroids are thought to have long-lasting repellency against insects (thus the pods may be protected from injury). However, it was surprising to

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find an increase in BPMV incidence with the addition of a mid-season foliar application within a previously seed-treated plot (Table 2). The same trend was measured in other foliar-applied combinations as well. Therefore, the mid-season bean leaf beetles must be altering their foraging behavior by feeding on more plants (e.g., increasing transmission activity) in response to low residues of insecticides but not so much so as to reduce pod injury. Similar increases in transmission rates in response to insecticide treatments have been documented with other viral diseases as well.

Based on published research, the economic injury level for BPMV is between 20 and 40 percent incidence. In our study, the total seasonal incidence of BPMV was never below 20 percent. Therefore, improvements in yield or seed quality that are associated with reduced virus incidence may not be realized with chemical control. However, the good news is that there are commercial soybean varieties that are tolerant to both BPMV and its seed-discoloring symptoms (e.g., Spansoy 201 [Hill et al. 2007. Crop Science, 47:212-218]).

The only reliable solution for protecting yield and seed quality from BPMV may be the use of tolerant soybean lines and the exploitation of their genetic potential.

Table 1. Maximum percent limits of USDA Grain Standards for soybean with damaged kernels (Federal Register, Sept. 6, 2006. Part 810, Official United States Standards for Grain. Vol. 71[172], p. 52406).

Damage Type	U.S. Standard Number Grades (%)			
	1	2	3	4
Heat (total)	2.0	3.0	5.0	8.0
Foreign material	1.0	2.0	3.0	5.0
Splits	10.0	20.0	30.0	40.0
Soybeans of other colors	1.0	2.0	5.0	10.0

Table 2. From experiments between 2002-2004 of seed- and foliar-applied insecticides to manage bean leaf beetles for the reduction of bean pod mottle virus. Incidence of bean pod mottle virus, percentage of mottled seed, and yield were measured in response to insecticides applied as a seed treatment (ST) or to foliage to target early-season (EF), mid-season (MF) bean leaf beetle populations or both (ST + MF or EF + MF). Arrows indicate direction and lines equal no change in responses relative to an untreated control.

	ST	EF	MF	ST+MF	EF+MF
BPMV incidence	↓	—	—	↑	↓
% mottled seed	↑	—	↓	—	↓
Yield	—	—	—	↑	↑

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