Bean Leaf Beetle and Bean Pod Mottle Virus in Wisconsin – Where Do We Stand?

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SUMMARY

Relatively mild winters, with fewer subfreezing temperature unit accumulations, have been correlated with increased survival of overwintered bean leaf beetle, *Ceratoma trifurcata*, populations in the Midwest in recent years (UW Soybean Plant Health, 2004; Lam and Pedigo, 2001). Bean leaf beetle adults emerging in the spring feed on wild and cultivated legumes, moving to early planted soybeans where they continue to feed and then deposit eggs of the first generation. While direct damage caused by early season defoliation (overwintered population) and pod feeding (second generation) can occur, beetle population density must be quite high to cause economic yield loss and treatment thresholds are available to suppress populations below damaging levels (Boerboom et al., 2005).

A more complex interaction occurs in the association between bean leaf beetle, bean pod mottle virus (BPMV) and the soybean plant. BPMV can reduce soybean yields between 3 and 52% (Gergerich, 1999) with infected plants producing fewer, smaller and lower weight seeds, along with potential for a mottled seed coat discoloration. Quantifying yield loss relationships that incorporate bean leaf beetle population density, feeding time, BPMV inoculum and overwintering potential (within the beetle; within the infected legume plant), and BPMV transmission efficiency, is complex. A dual bean leaf beetle and BPMV treatment threshold is not available. Therefore, it is important to assess BPMV incidence in Wisconsin on a regular basis to determine transmission potential to soybean as bean leaf beetles emerge each spring. In 2004, the Wisconsin Department of Agriculture Trade and Consumer Protection (DATCP) and the University of Wisconsin Entomology Department shared field survey information and research plot data on bean leaf beetle distribution and population density in relation to BPMV incidence in Wisconsin.

The Wisconsin DATCP pest survey team conducted a spring survey of overwintered bean leaf beetle and BPMV in alfalfa. Twenty-eight contiguous counties in the southern third of Wisconsin were surveyed, with 102 alfalfa field sites total. Bean leaf beetle sweep net samples were conducted between May 17 and June 10, 2004. Bean leaf beetle numbers were recorded at each site, and beetles were returned to the laboratory and tested for BPMV using Enzyme-Linked Immunosorbent Assay (ELISA). Bean leaf beetle BPMV results were negative at 92% (94/102) of the sites. These negative results consisted of zero beetles detected at 39 sites, and bean leaf beetles *without* BPMV collected from 55 sites. Bean leaf beetles *with* BPMV were recovered from 8% (8/102) of the sites. These eight positive results were restricted to first (six sites) and second (two sites) southern tier counties.

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Wisconsin DATCP conducted a summer survey of 293 soybean fields throughout Wisconsin between July 19 and August 24, 2004. Bean leaf beetle samples were taken in each field and beetles were returned to the laboratory and tested for BPMV by ELISA. In addition, trifoliate leaves were collected from 40 plants in each of the 293 soybean fields and returned to the laboratory to assess BPMV in soybean plants by ELISA. None of the bean leaf beetles collected in the July 19 – August 24 soybean survey tested positive for BPMV. Likewise, of the 293 soybean fields sampled none of the soybean plants tested positive for BPMV.

University of Wisconsin, Entomology Department established a bean leaf beetle and BPMV experimental plot in a southern tier county location at the Rock County Farm in 2004. One objective of the study was to investigate the interaction between bean leaf beetle population density in untreated plots and BPMV incidence in these plots following 1) overwintered bean leaf beetle population and 2) first generation bean leaf beetle population. Plots were planted in 30-inch rows on May 3, 2004 with the soybean variety NK S19-V2. Plot dimensions were 4 rows (10 ft.) wide by 25 ft. long. The untreated plots were part of a larger efficacy trial planted in a completely randomized block design replicated four times. Plots were sampled weekly from May 25 (V1-V2 soybean growth stages) through August 19. Each week, population density was enumerated as bean leaf beetles per row foot (BLB/ft) using whole plant counts early season, then switching to drop cloth samples as soybean foliage developed. UW Soybean leaf samples were collected from 20 plants in each plot (n=80 plants per treatment) on June 29 when weekly bean leaf beetle samples indicated the overwintered population had declined, and first generation had not yet begun to build in the plots. Leaves were returned to the laboratory to assess BPMV in soybean plants by ELISA. Soybean leaf samples were again collected from 20 plants in each plot (n=80 plants per treatment) on August 17 when weekly bean leaf beetle samples indicated that late season bean leaf beetle populations (first and second generation) had developed within the plots. Leaves were returned to the laboratory to assess BPMV in soybean plants by ELISA.

None of the June 29 untreated soybean plant samples (0/80 plants) tested positive for BPMV. Likewise, none of the August 17 untreated soybean plant samples (0/80 plants) tested positive for BPMV. These results indicate that BPMV incidence was very low during 2004, such that BPMV could not be detected in the UW Entomology soybean plant samples from overwintered population bean leaf beetle feeding or first and second generation bean leaf beetle feeding. Overwintered bean leaf beetle population density in the UW study peaked at 0.5 BLB/ft. in the untreated plots on May 25. First generation bean leaf beetle population density in this study peaked at 1.3 BLB/ft. in the untreated plots on July 27. Both population densities remained well below defoliation treatment thresholds (Boerboom et al., 2005). Mean yield for the untreated plots in this study was 60.2 bushels/acre.

Results from the WI DATCP bean leaf beetle and BPMV distribution survey documented that BPMV incidence in Wisconsin remained low (spring 2004 alfalfa survey) to non-detectable (summer 2004 soybean survey) during the 2004 season. Results from UW Entomology established that in a year with low springtime BPMV inoculum in a region, sub-threshold (defoliation thresholds) bean leaf beetle population densities have poor transmission efficiency of BPMV to soybean. Future collaboration will continue to investigate the relationship between bean leaf beetle population densities, the proportion/distribution of BPMV infected bean leaf beetles, and proportion/distribution of BPMV infected soybean plants in Wisconsin.

References

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