Evaluation of Biocontrol Agents for Colorado Potato Beetles
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Defoliation of potatoes and other Solanaceous crops by Colorado Potato Beetles (CPB) may cause yield losses, with the extent of damage depending on insect populations and the vigor of the crop. Consistent chemical control of CPB is complicated by their rapid development of resistance to a range of pesticide chemistries. Application of biocontrol agents may represent an alternative to standard chemical control. This trial evaluated the biocontrol agents *Bacillus thuringiensis* and *Beaveria bassiana* for their ability to control CPB populations in an irrigated potato crop in Saskatchewan.

The trials were conducted on the Plant Sciences Department Potato Research plots in 1999 and 2000. Russet Burbank (1999) or Norland (2000) potatoes were grown using standard irrigated production practices. The long history of potato production in the plot area has provided ample opportunity for establishment of a CPB population. In previous years, CPB numbers were sufficient to cause some yield loss. To increase the CPB populations in the test area, adult beetles captured in other areas were released into the plot in the first week of July. The final population of adults (ca 1/plant) approximates the economic damage threshold.

The treatments were:

- Control - no CPB control methods applied.
- Chemical - Decis (deltamethrin) @ 150 ml/ha
- *Beaveria bassiana* - Mycotrol® (Mycotech Corp.) @ 2.3 l/ha
- *Bacillus thuringiensis* - Safers® BTK™ @ 3.3 l/ha in 1999 and B.t. tenebriones in 2000

The sprays were applied to the foliage of the crop beginning in late June 20 with the emergence of the first larva and repeated every two weeks until early August. Counts of CPB larvae and adults were done weekly. The crop was harvested in late September.

**Results**

From mid June through early July only overwintering adults were present in the test plots. Significant populations of larva became apparent in mid-July. Larvae numbers reached a peak within two weeks and then gradually declined over the remainder of the sampling period (Figures 1 and 2). The non-treated control treatment supported the highest numbers of larva, with the Mycotrol and Bt treatments providing about 50% control. Foliar applied Decis provided almost complete control of the CPB larvae. By early August adult beetles of the year were beginning to appear in the test plots (Figures 3 and 4). Although these beetles cause little damage to the crop, their numbers are important as an indicator of infestation levels in the next cropping season. The numbers of adult CPB in the various treatments reflected the effectiveness of the treatments at controlling the larval stage. The control treatments supported the most adult beetles followed by the two biocontrol treatments.
Yields in both years were fairly typical of irrigated potatoes in Saskatchewan. None of the CPB control measures significantly improved yields over the non-treated controls. Typically, yield losses in potatoes due to insect damage or mechanical defoliation are not apparent until there is about 25% defoliation. In this trial, insect populations in the control treatment were insufficient to produce this level of defoliation.

Conclusion

Application of the Bb (mycotrol) and BT provided some degree of CPB control, although the the degree of control was greatly inferior to chemical control. The limited control provided by the biocontrol agents may reflect:

a) unfavorable conditions for development of the Bb infection or survival of the BT
b) insufficient dosage and/or insufficient time period for development of Bb populations

High humidity levels are critical to the establishment of the Bb infection - the dry conditions typical of Saskatchewan summers may not be favorable for this biocontrol agent. CPB mortality from Bb is not rapid, but it adds up in later life stages. Bb therefore has a greater impact in areas where CPB has several generations each season.

The CryIII protein of Bt has been shown to provide effective control of CPB under controlled conditions. However, its efficacy is highly dependant on the beetles consuming a fatal dosage of the bacteria before the bacteria are killed by exposure to UV light. This necessitates multiple applications (every 2-4 days) of this product.

Potatoes are relatively tolerant of defoliation, with significant yields losses only occurring once 25% of the leaf area has been lost. Although efforts were made to increase Colorado Potato Beetle populations in this trial, the numbers were still insufficient to cause significant yield losses. The cv Russet Burbank used in 1999 is a very vigorous variety which produces abundant foliage, particularly when grown under intensively managed conditions. The cv. Norland used in the 2000 trial produces a much smaller plant canopy, but it is highly tolerant of stress. This again may make this cultivar fairly tolerant of CPB damage. Higher populations coupled with reduced crop vigor due to poor genetics or inappropriate crop management would increase the potential for significant yield losses due to CPB damage.