Project Title: Adapting Trap Cropping of Colorado Potato Beetle To Minnesota and North Dakota

Principal Investigators:

Dr. Ian MacRae,
Dept. of Entomology,
U. Minnesota Northwest
Research & Outreach Center
2900 University Ave.
Crookston, MN 56716
imacrae@umn.edu
218 281-8611 Office
218 281-8603 Fax

Dr. David Ragsdale
Dept. of Entomology
University of Minnesota
1920 Folwell Ave
St Paul, MN 55108
ragsd001@umn.edu
612 624-6771 Office

Cooperating Institution: UMN Northwest Research & Outreach Center, Crookston, MN

Executive Summary – This project was designed to evaluate the adaption of trap cropping as a mechanism to control Colorado Potato Beetle (CPB) in Minnesota and North Dakota. This proposal was in response to the expected continued development and spread of neonicitinoid resistant CPB. Trap cropping requires early germinating varieties, yet most of the varieties grown in ND and MN can be described as such. We will establish trap crop plots surrounding a production potato field block. We will assess several techniques designed to encourage emergence in the trap crops prior to the emergence of potatoes grown in the field block inside the perimeter of trap crop plots. Trap crop plots will then be treated with non-neonicitinoid insecticides and destroyed by discing prior to the maturation of any surviving CPB larvae. Colorado potato beetle populations will be monitored in both the trap crop plots and the production field. Defoliation and yields will be compared from the production field adjacent to the trap crop fields.

Methods & Materials

Location & Plot Description - Plots were established at the UMN Northwest Research & Outreach Center in Crookston, MN. Trap plots were 6 rows wide and 33' long. Standard weed and disease treatments were applied pre and post planting.

Experimental Design & Data Collection - All plots and the field block were planted with an early variety (i.e. Red Norlands) planted on all sides bounding a ~3 ac field (~360' x 360'). Seed potatoes in the outer trap plots were either untreated, environmentally conditioned prior to plant by exposing them to ambient temperatures for 1 week, or treated with Giberellic Acid (GA) to encourage sprouting and early emergences by using a 5ppm GA mist and allowing treated potatoes to dry prior to planting. Trap plots were 30' long and were separated with plot-sized breaks in the trap crop perimeter to serve as an untreated check allowing beetles to enter the main field behind the trap plot rows. Four unplanted rows were left between the outer trap plots and the main field. All trap plot rows were planted as shallowly as possible (~2"-3"), while still allowing emergence and growth. The field block established inside the perimeter of the trap crop plots was planted and managed using standard production techniques, including hilling (~6"-8" deep). Previous work (Grafius 2005) indicates little movement from trap crop potatoes to adjacent potatoes occurs, consequently trap crop plants needed emerge only early enough to attract CPB immigrating into the field. Beetle emergence, oviposition and larval development were recorded in both trap crops and production field adjacent to plots. Trap crop rows were to be treated with Rimon, and/or Agri-mek and/or Spintor. After treatment, trap rows were destroyed by discing before any remaining larvae mature. Beetle colonization and numbers in production field were be monitored through the rest of the season. Yields and crop damage in

areas adjacent to trap crop plots were collected and compared. Yields were assed from 10' of sampled row

Results & Discussion – Plots and fields were planted on May 21. Emergence was considerably delayed by unseasonable spring temperatures and precipitation, with all trap plots and the 3 ac field block emerging June 12-17. Emergence was not uniform, resulting in patchy stands for 1-2 weeks in all plots and the field block. There was no significant difference in the timing of emergence in any of the plots or the field block, the entire field emerged at roughly the same time. CPB populations per plant were not significantly different in field blocks adjacent to any trap plot treatment, nor was there any significant difference in the mean number of CPB in any plot trap and the adjacent field block at any sample date. This uniform distribution of beetles resulted in a rescue application of Spintor applied to the entire experimental area. The chemical treatments incorporating mixed and solo applications of Agri-Mek, Rimon and Spintor were consequently not attempted. There was considerable variation in yields from the field block adjacent to the trap plots and there was no significant difference associated with any trap plot treatment.

While the field block inside the perimeter of the trap plots was planted deeper and hilled, plant emergence was no later than observed in the trap plots. Seed potatoes in the trap plots were planted as shallowly as possible to encourage accumulation of heat and result in an earlier emergence than potatoes in the field block. However, we suspect the irregular temperatures experience in the spring of 2009 may have resulted in exactly the opposite situation. Any early heat may have raised temperatures in the soil and the deeper soil over the seed in the field block may have held it more efficiently than the shallow soil over the seed in the trap plots. This would result in the deeper planted seed accumulating heat in a more consistent pattern, and possibly over longer period of time than the trap plots, the seeds of which would have cooled rapidly after any temperature drop. Because all plantings in the experiment emerged at roughly the same time, it is not surprising there was no difference in the timing or rate of establishment and subsequent distribution of CPB in the experiment field. The uniform distribution of CPB would, in turn, explain the lack of yield differences between any trap plot treatment and the 3 ac field block.

Conclusions – While the results of the experiment were heavily influenced by the weather conditions in 2009, it should be noted that irregular spring temperatures and precipitation are not unusual in the Red River Valley. Consequently, these results are probably indicative of what can be expected in years with varying spring temperature and precipitation. It is therefore concluded that this technique does not have application as a management tool in the Red River Valley. The lack of tactics to manage the loss of neonicitinoid insecticides underscores the necessity of developing techniques to delay or prevent its onset in the Red River Valley.

Table 1. Mean Colorado potato beetle larvae populations in the field block adjacent to trap plots. Means followed by the same letter are not significantly different at the P = 0..05 level. It is important to note that there also was no difference in the population of Colorado potato beetle in any of the trap plots or the adjacent field blocks. Spintor was applied July 15.

Treatent	**June 19**	**June 25**	**July 6**	**July 14**	**July 21**	**July 28**
Untreated	0a	0.2a	3.2a	3.3a	0.2a	0a
GA treated	0a	0.5a	2.8a	3.3a	0.1a	0a
Conditioned	0a	0.1a	1.9a	4.9a	0.3a	0a
No Trap Plot	0a	0a	2.9a	3.9a	0.2a	0a

Table 2. Mean treatment yields from the field block adjacent to the trap treatment. Values represent lbs/10 foot row sample. Means followed by the same letter are not significantly different at the P = 0..05 level

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Teatment	**Yield**
Untreated	12.25a
GA treated	13.19a
Conditioned	13.22a
No Trap Plot	10.27a