European Corn Borer Management in Snap Bean: Advancements in Insecticide use and Influence of Landscape

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European corn borer (ECB), *Ostrinia nubilalis*, is a perennial pest of snap bean in the Great Lakes region of North America. ECB infestations in snap bean fields are typically low, but this insect is considered a significant problem because larvae (**Fig. 1**) may be processed and packaged in cans or frozen bags with the beans, thereby contaminating the product.

Fig. 1. European corn borer larva exiting a bean pod.

ECB only threatens the snap bean crop during a 14-day window, from bud stage (~26 days before harvest) to the pod formation stage (~12 days before harvest). Thus, insecticide applications target ECB during this period. Insecticide sprays before bud stage or within 12 days of harvest are not needed because ECB larvae that hatch from eggs laid during these periods will not bore into market-sized pods. Therefore, fields are recommended to be treated during the pod formation stage to control ECB (**Fig. 2**). However, it would be preferable to manage ECB using a single insecticide application timed during the early bloom stage (bloom) because this would coincide with the fungicide application used for control of white and gray mold (**Fig. 2**). Another possibility might be to co-apply an insecticide with a post-emergence herbicide, which is applied around 30 days after planting (bud stage) (**Fig. 2**). Both scenarios would be possible if the insecticide had a long residual activity. Based on previous research in New York and Wisconsin, anthranilic diamides like cyantraniliprole (Exirel®) have the type of residual activity that could meet one or both of these scenarios.

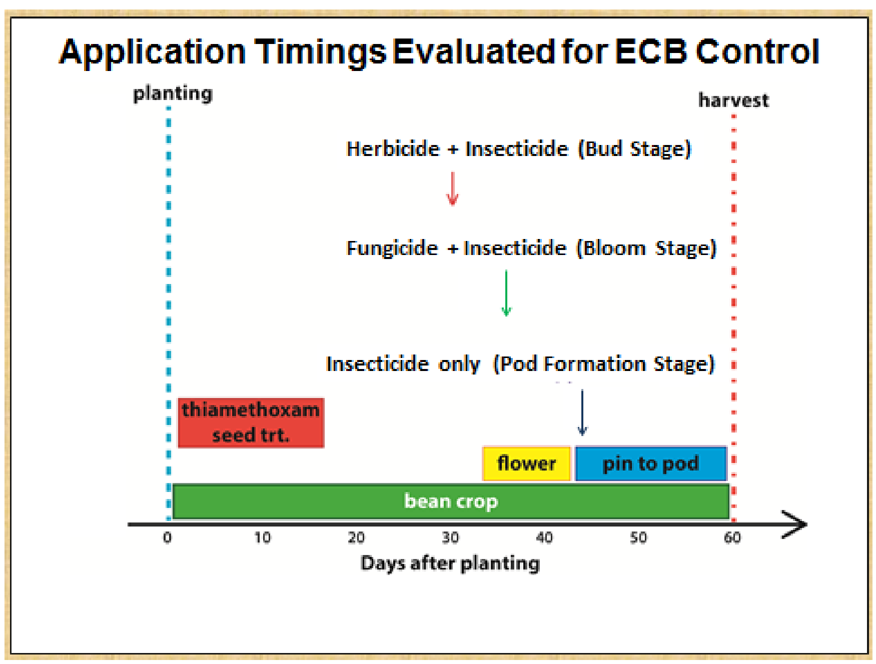

Fig. 2. The insecticide-only application timing is currently recommended for ECB control. The earlier timings were evaluated using an insecticide with a long residual activity as possible alternatives for the standard timing.

Research was conducted in New York from 2012-2014 to examine various application timings and insecticides for ECB control. Insecticide application timings evaluated were the following: bud stage, early bloom stage, and pod formation stage (= standard timing treatment) (**Fig. 2**). Insecticides evaluated were cyantraniliprole (Exirel®) @ 13.5 fl oz/acre (100 g AI/ha) and @ 20.5 fl oz/acre (150 g AI/ha), and bifenthrin (Brigade® 2EC) @ 3 fl oz/acre (= standard). All insecticides were evaluated at each of the three timings.

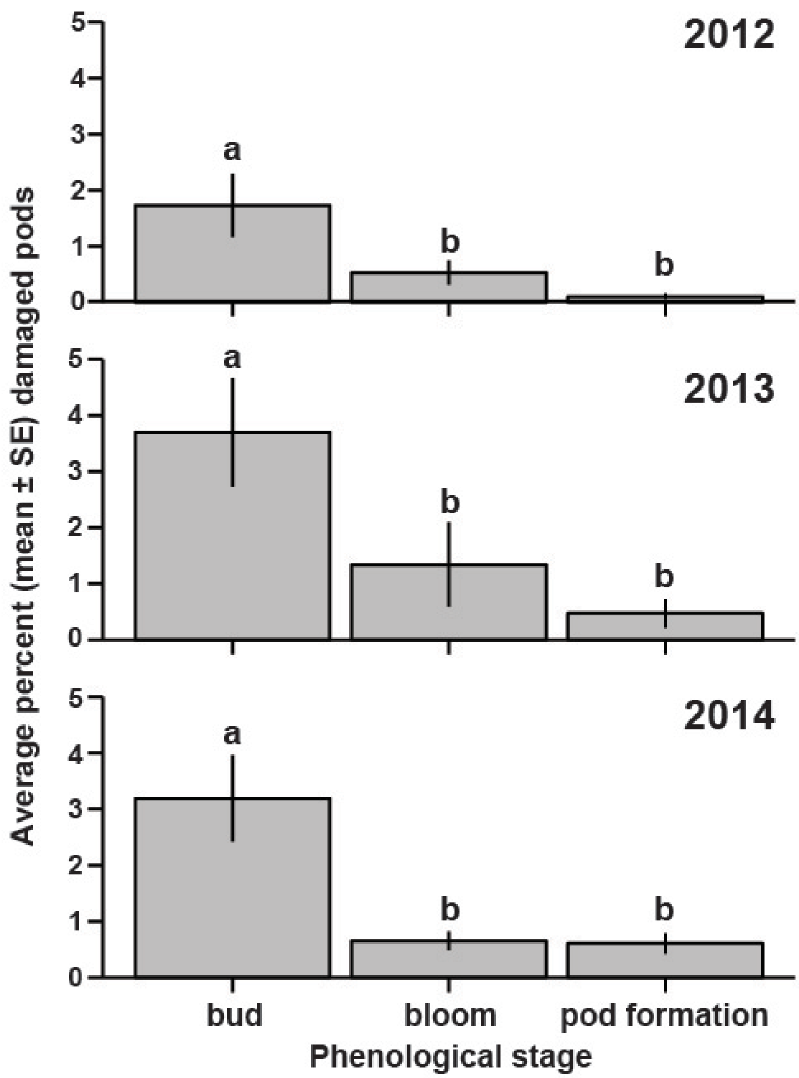

Fig. 3. Average (mean percentage ± SE) ECB snap bean pod damage within each phenological application timing in 2012, 2013 and 2014. Means followed by the same letter do not differ significantly (Tukey HSD test at *P*=0.05).

In all three years, insecticides applied during the pod formation and bloom stages significantly reduced the percentage of ECB-infested and damaged market-sized bean pods at harvest compared with the bud-stage application (**Fig. 3**). These results indicate that an insecticide application to coincide with an herbicide application 30 days after planting during the bud stage is too early to control ECB.

In 2014, bifenthrin and cyantraniliprole insecticides reduced levels of ECB damage to plants and market-sized pods equivalently within each of the three application timing windows. However in 2013, when ECB pressure was much higher, cyantraniliprole tended to perform better than bifenthrin within each of the three timing application windows, although differences were not always significant (**Fig. 4**). No differences in performance existed between rates of cyantraniliprole. These results indicate that cyantraniliprole could be applied during the early bloom stage to provide excellent control of ECB, rather than waiting until the pod formation stage to make the application. The advantage of this earlier timing is that cyantraniliprole could be co-applied with fungicides for white and gray mold control. Additional research in New York has shown no negative effects on ECB control when co-applying cyantraniliprole with fungicides typically used for white and gray mold control (data not shown).

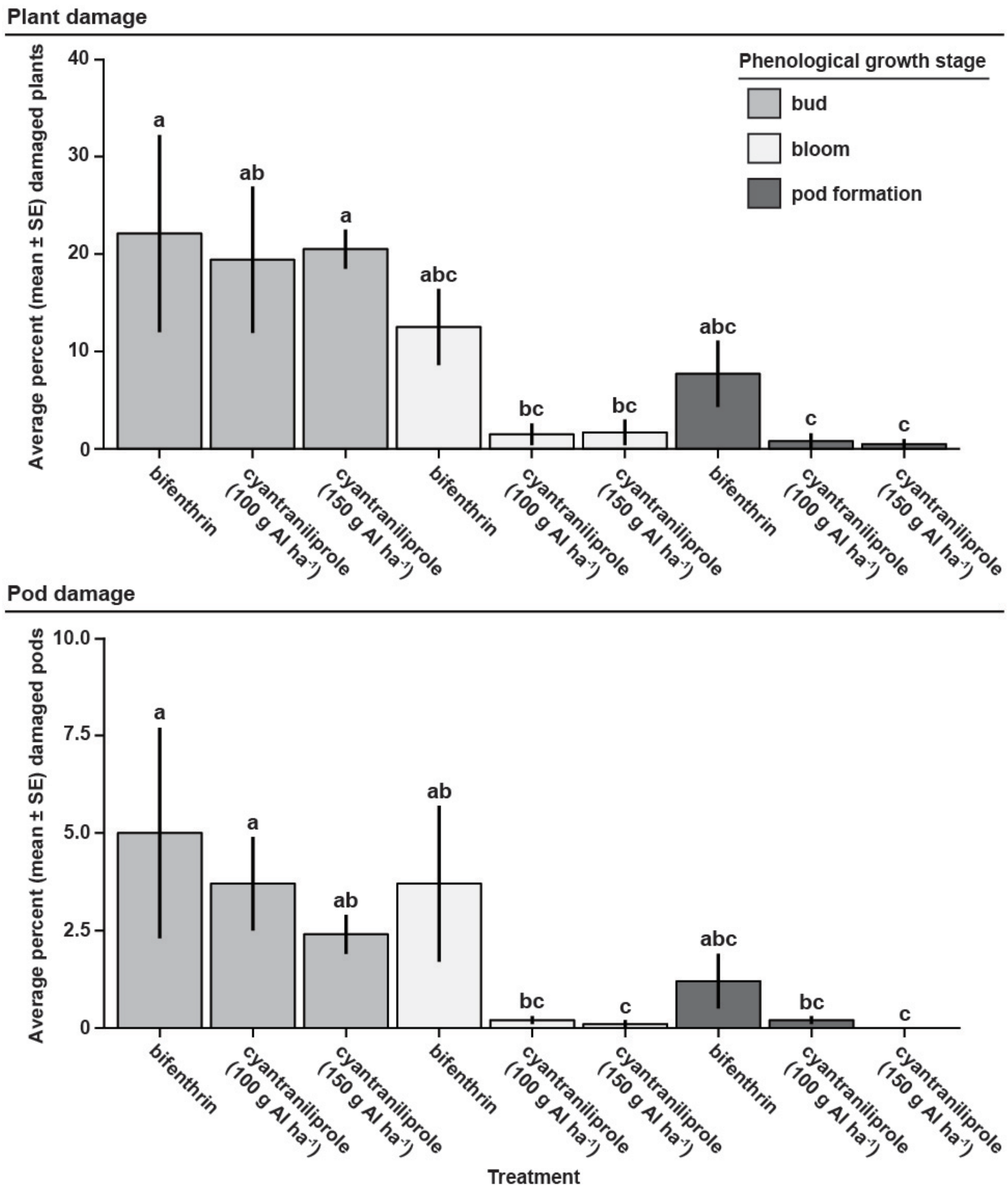

Fig. 4. Average (mean percentage ± SE) ECB snap bean plant and pod damage within each phenological application timing in 2013. Means followed by the same letter do not differ significantly within individual snap bean damage group (Tukey HSD test at *P*=0.05).

Over the past five years or so, detection of ECB-contaminated beans in processing facilities from beans grown in central and western New York have been low to absent. The reason for this is unknown, but some hypothesize that local ECB populations have declined as a result of the adoption of *Bt* field corn. Corn is ECB's favorite host, but *Bt* corn is lethal to ECB. Field grown is grown throughout central and western New York, but there are areas where it is grown more intensively and other areas where it is not (**Fig. 5**). If *Bt* field corn is grown intensively year after year in a certain area, one might expect that this practice could reduce or eliminate the local ECB population in that area. In contrast, in areas where *Bt* field corn is grown less frequently, ECB populations may flourish on non-corn hosts. To examine this question, 40 processing snap bean fields that were planted during the second half of the 2014 season were monitored for ECB moths using pheromone-baited traps (**Fig. 5**). Half of the snap bean fields were located in areas where field corn had been intensively grown and half in areas where field corn had not been intensively grown (we assumed that most of the field corn was *Bt*). One pheromone trap was placed along the edge of each snap bean field in a "grassy action site" where ECB were predicted to be active. Each trap included a lure for the E-race. Traps were monitored weekly and always encompassed the bloom period of the snap bean crop, which is the crop stage most attractive to egg-laying moths.

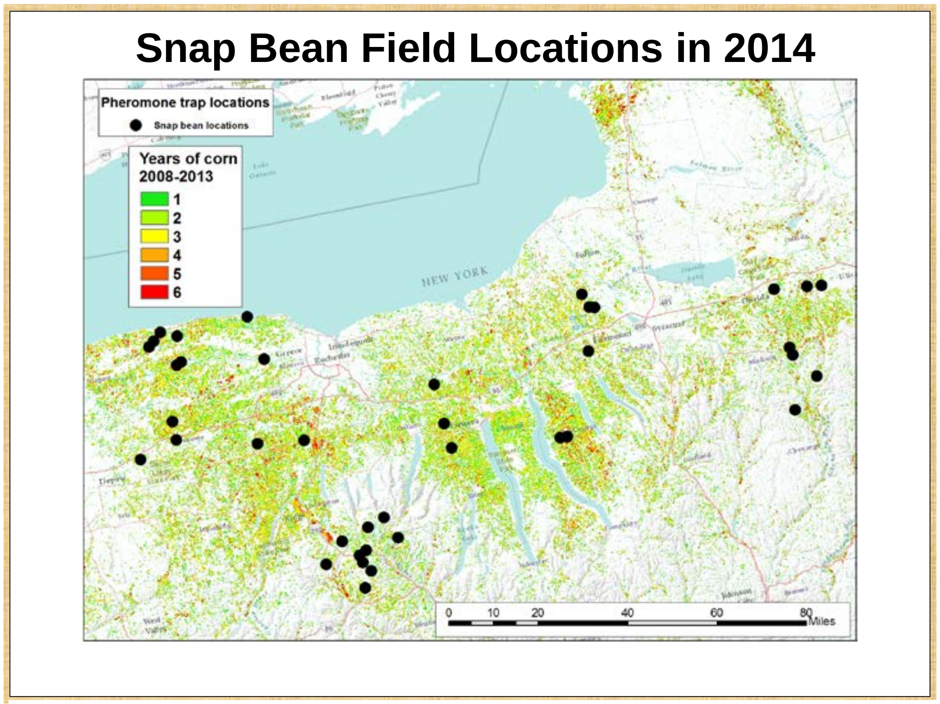

Fig. 5. Map illustrates various intensities of field corn production in space and time. The "warm" colors signify fields that have been planted repeatedly with corn, whereas the "cool" colors signify fields grown less intensively with field corn. The black circles represent snap bean fields in which ECB E-race moths were monitored in 2014.

Overall, very few moths were trapped and numbers of moths captured in traps located in snap bean fields where field corn had been intensively grown was similar to those captured in traps in bean fields where field corn had not been grown intensively (**Fig. 6**). Results suggest that ECB moths may rarely infest snap bean fields. Additionally, these results do not suggest that ECB populations are lower in areas where *Bt* field corn has been intensively grown. Research is needed to identify landscape features and/or production practices associated with ECB populations for making advancements in predicting their infestations in snap bean fields.

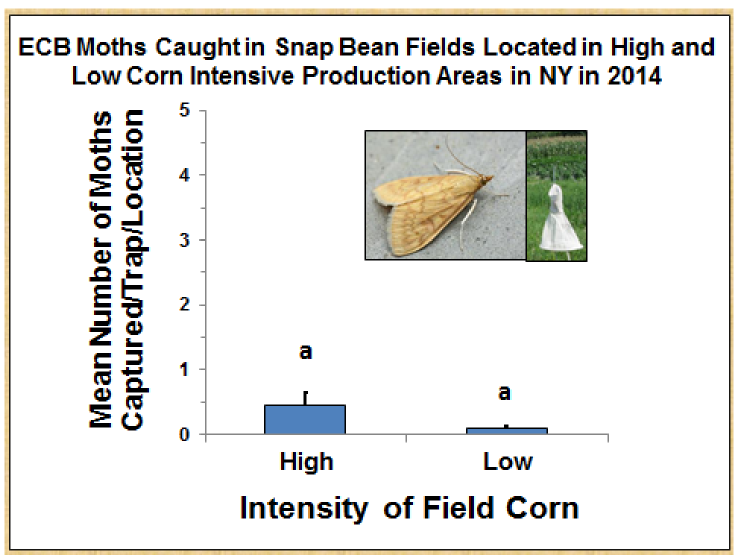

Fig. 6. Mean numbers of ECB moths captured in pheromone traps placed in snap bean fields where field corn production intensity was considered either high or low in New York in 2014.