VIRGINIA CORN BOARD
PROJECT REPORT – 2022 - 2023

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Title: Role of cover crops in increasing harmful insect-pests in corn
Expected Duration: Two years (one year completed)
Date: Project initiation March, 2022

Objectives:
Objective 1. *Evaluating the influence of various cover crop species on insect-pest infestation in row-crop (corn) in summer and fall 2022.*
Objective 2. *Evaluating the influence of cover crop biomass on insect-pest infestation in corn.*

1. Summary Results

Cover crops offer a promising strategy for Integrated Pest Management, as they diversify pest management selection pressure and can synergistically improve soil health. In eastern Virginia, there are several programs that provide incentives to farmers to plant cover crops for the protection from soil erosion and the reduction of nutrient losses to ground or surface water. The specific benefits of a cover crop depend on the species and growing environment. Four cover crops (rapeseed mustard, hairy vetch, wheat, and cereal rye) were planted in Fall 2021. These cover crops were terminated in last week of April, and corn was planted in first week of May, 2022. This was a collaborative study involving researchers from three discipline areas – weed science (Vijay Singh), entomology (Tom Kuhar), and soil science (Mark Reiter). The study provided many new insights and information which was not available earlier.

There were significant variations in insect populations as a result of cover crop treatments. Cucurbit beetle infestation was greatest in corn plots where we had rapeseed mustard as cover crop in winters. There were no differences in cucurbit beetle infestation in other plots where we had other three cover crops. This study results indicate that if infestation of cucurbit beetle is greater in grower field, rapeseed mustard should not be planted in winter as cover crop. Alternately, growers need to plan application of insecticides specifically for controlling cucurbit beetles if rapeseed mustard was planted as cover crop in winter. Similarly, sap beetle population was significantly greater in corn preceeded by rapeseed mustard. This beetle infestation was lowest in corn when wheat or hairy vetch was planted in winter as cover crop. Least number of stinkbugs were found in corn plots where we had wheat as cover crop in winters. Stinkbug population was variable in case of other cover crops and all plots had similar infestation. Billbug population was greatest in corn plots where we had wheat as cover crop in previous winters. We also observed yield differences in corn as a result of these treatments. However, yield differences corresponds to combination of different insects and herbicide treatments as well.

This study is not complete. Based on results from 2022, researchers have decided to conduct these studies on bigger scale with larger plots and maybe on two different locations. For doing so, we have to plan and plant cover crops ahead of experiment (generally in September and October). However, we could not plant these cover crops in October 2022, and we can only do it now in October 2023. Therefore, we have not requested second year funding for this project now. We will request second year funding for this experiment in next year cycle (2024). The expected results from these studies will help in generating new recommendations for cover crop selection based on potential harmful insects, more information on efficacy of additional combination of herbicides on termination and weed management in general.

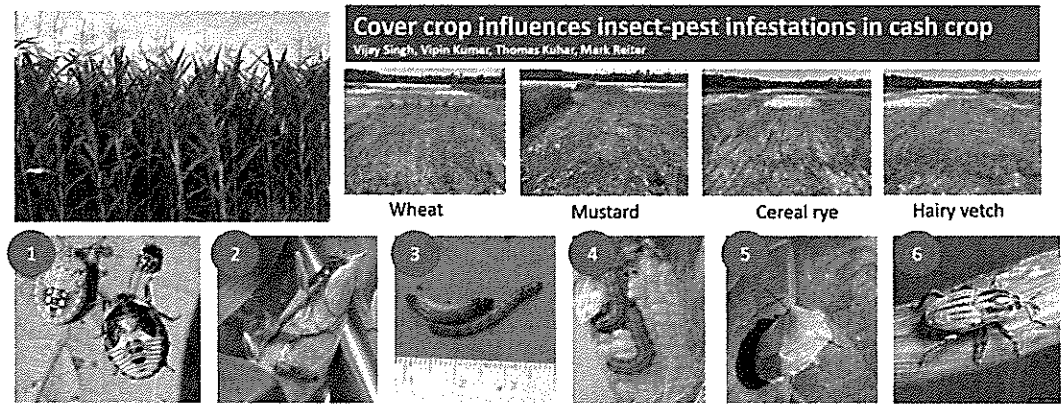
PROBLEM

Studies have reported that cover crops can serve as an alternate host for insect pests (especially lepidopteran species like cutworms and armyworms. It has been generally hypothesized that late termination of cover crops or non-effective termination may act as a "green bridge effect" where insects can move from the cover crop to the row-crop (Huseth 2020). A lot of these pests are coming out of the previous crop, and they're persisting on that green bridge. Secondary insects take root in that green cover crop bridge which can translate into problems for your row-crop in the subsequent season. It is important to understand the probability of risk and to manage secondary pest infestations. This problem becomes severe in case of mixture of cover crop species. Multiple cover crop mixes offer benefits in terms of soil nutrition and preventing compaction, but they also serve as a good host for secondary insect pests. For example, three cornered alfalfa hopper and stem borers can be a real issue in high residue cover crop systems (Huseth 2020). Alfalfa hoppers reside below the residue level and are difficult to scout and manage because of the residue cover. This indicates that these pests survive when the cover crop is terminated before the planting season and move on to next crop.

Therefore, this project was planned to determine how cover crops influence insect populations in corn, and to determine the best termination timing or biomass of cover crop to avoid "green-bridge effect".

DETAILED RESULTS

Results of preliminary studies (Figure 1)



1. Southern green stink nymphs
2. Brown marmorated stink bug on corn (brown and green were the predominant species in the study)
3. Wireworm and grub
4. Corn earworm — Wheat
5. Green stink bug — Mustard
6. Billbug — All, except check
7. Sap beetles — Wheat

Figure 1. *Figure indicates results of preliminary study conducted at Eastern Shore AREC, Virginia Tech, Painter, VA; where cover crops influenced insect-pest infestations in corn. Red dots denote insect populations in corn that were significantly higher when corresponding cover crops were planted in winter. For example, corn earworm infestation was greater in corn when wheat was used as cover crop in winter. Similarly, green stink bug infestation was higher when mustard (cover crop) was followed by corn.*

Results of study conducted in 2022 at Eastern Shore AREC, Painter, VA

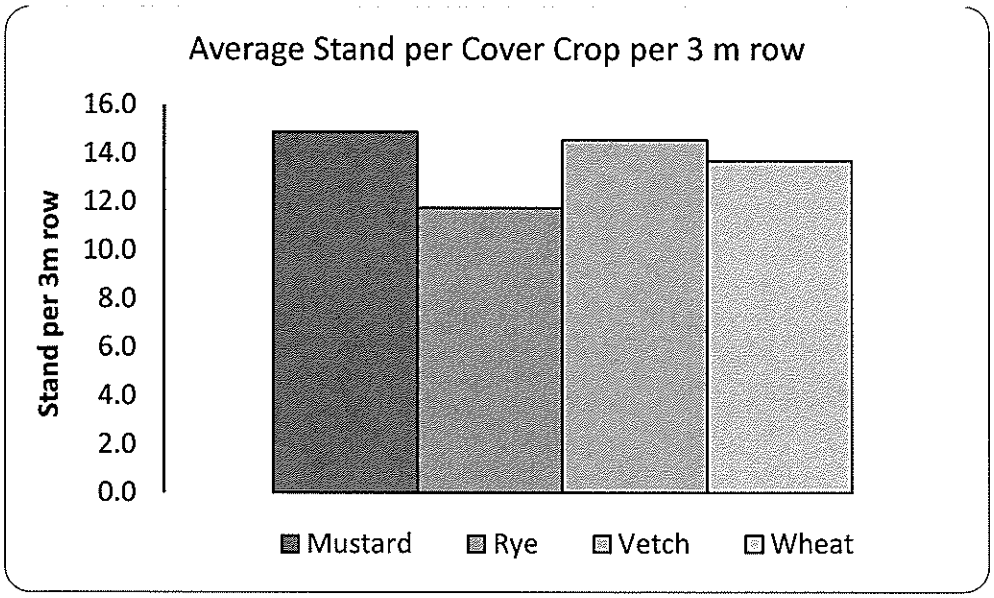
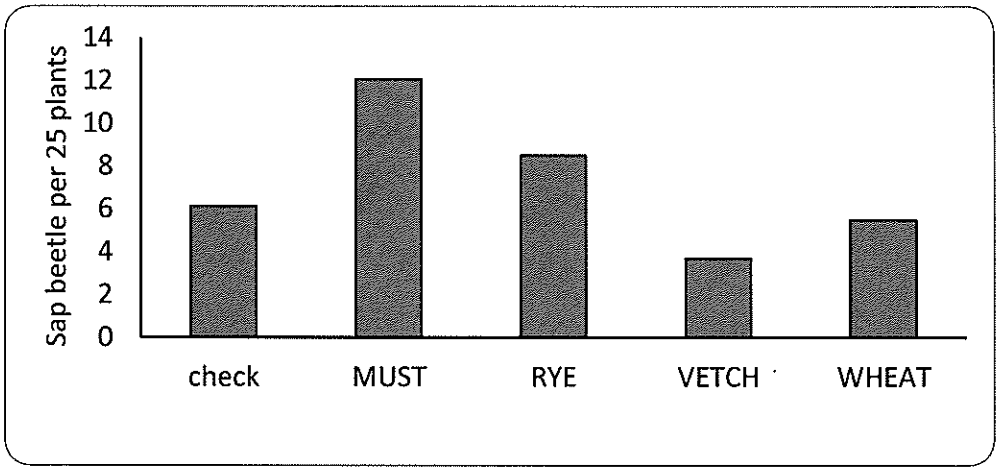
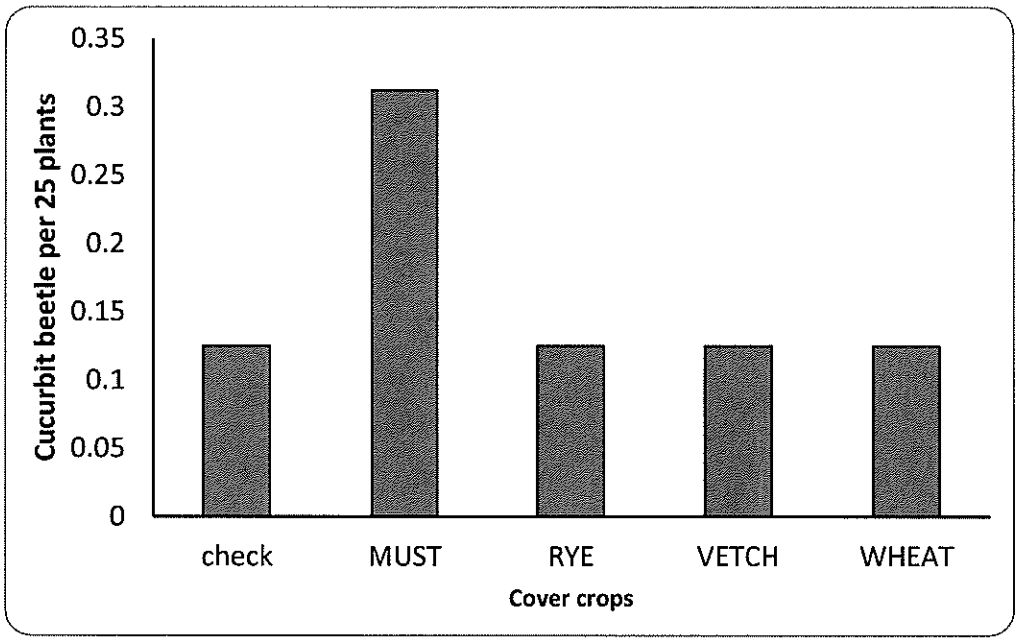


Fig 2. Average stand of cover crop per 3m row was similar across cover crop species and plots. This helped us in conducting comparative study and scoring of insect pests in different cover crops.



Where MUST = rapeseed mustard, RYE = Cereal rye, VETCH = hairy vetch, WHEAT = wheat cover crop

Fig 3. Sap beetle population was significantly greater in corn preceeded by rapeseed mustard. This beetle infestation was lowest in corn when wheat or hairy vetch was planted in winter as cover crop



Where MUST = rapeseed mustard, RYE = Cereal rye, VETCH = hairy vetch, WHEAT = wheat cover crop

Fig 4 a. Cucurbit beetle infestation was greatest in corn plots where we had rapeseed mustard as cover crop in winters. There were no difference in cucurbit beetle infestation in other plots where we had other cover crops. This study results indicate that if infestation of cucurbit beetle is higher in grower field, rapeseed mustard should not be planted in winter as cover crop. Alternately, growers need to plan application of insecticides specifically for controlling cucurbit beetles if rapeseed mustard was planted as cover crop in winter.

Both larvae and adults may damage corn plants. Newly hatched larvae feed primarily on root hairs and outer root tissue. These can also feed on silk hairs and cause severe physiological stress on corn. The lodged and misshapen plants often pollinate poorly and are difficult to harvest, contributing to yield losses (Example image Fig. 4b)

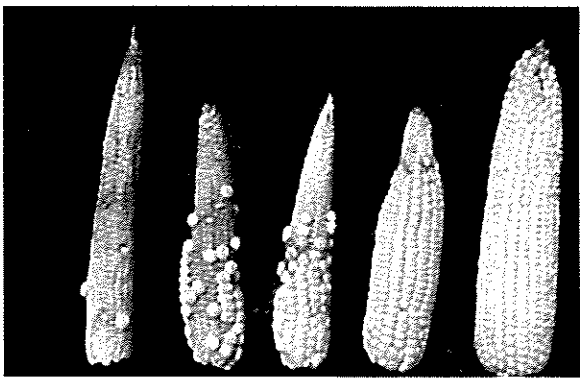


Fig 4b. Example of Varying degrees of poor pollination from silk feeding damage by cucurbit beetle
Photo by J. Obermeyer

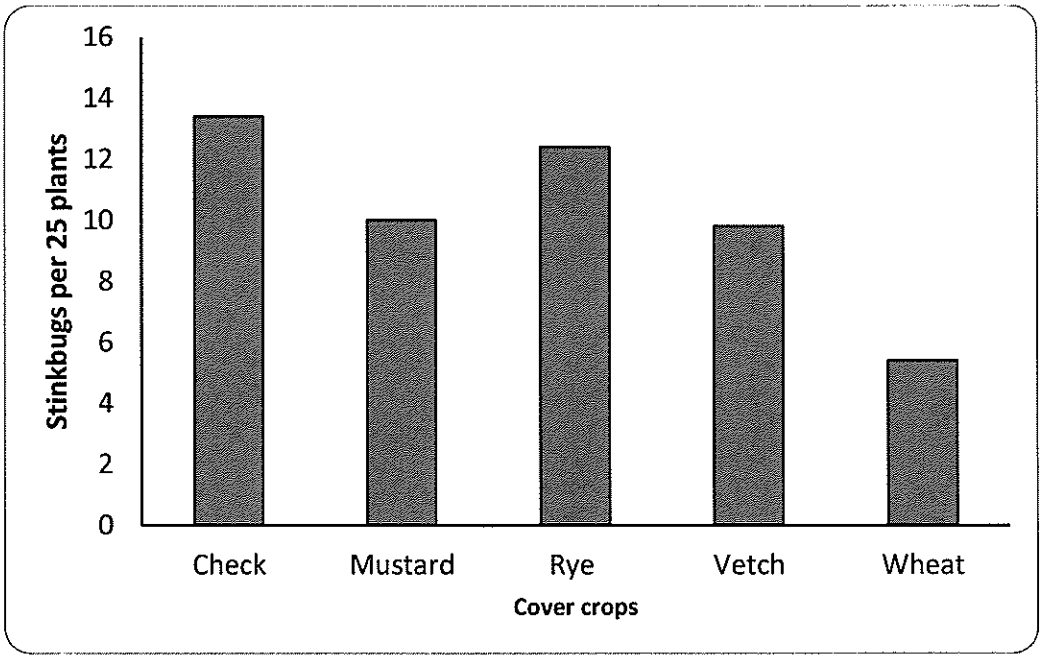


Fig. 5. Least number of stinkbugs were found in corn plots where we had wheat as cover crop in winters. Stinkbug population was variable in case of other cover crops and all plots had similar infestation.

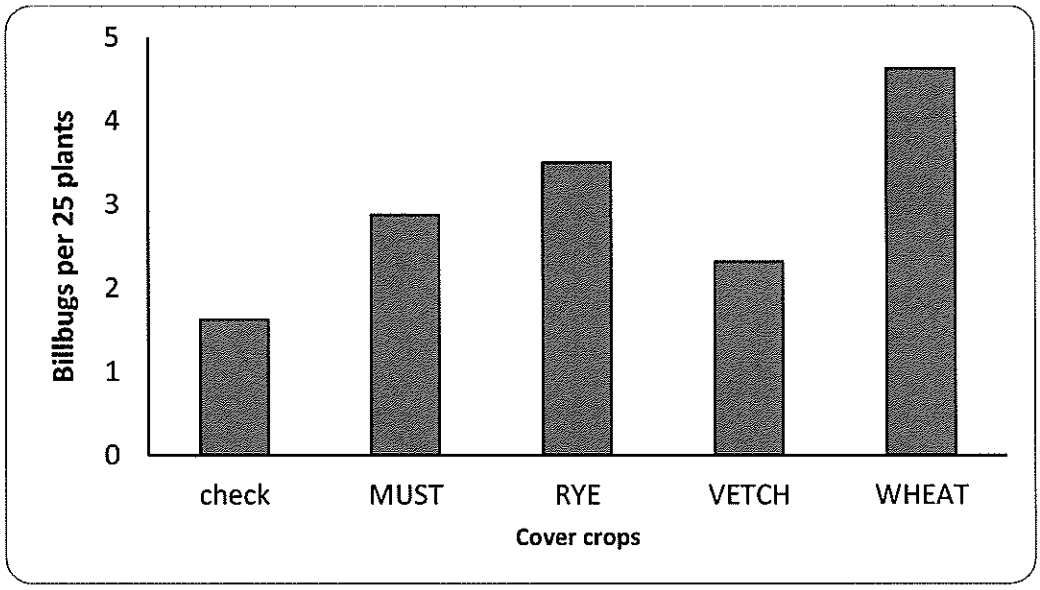


Fig. 6. Billbug population was greatest in corn plots where we had wheat as cover crop in previous winters.

CONCLUSION

Insect pests can result in millions of dollars in crop losses (Oerke 2006, Donatelli et al. 2017). In Virginia, especially in eastern shore region, the weather conditions are conducive for insect-pests due to high humidity, relatively higher winter temperatures but lower fluctuations over the season. The region presents the perfect case of insects harboring in winters in cover crops and pass on to row-crops in spring. The use of cover crops is encouraged by the university and other federal agencies for reclaiming the soils near Chesapeake Bay, however, cover crops can result in incidences of insect-pests in corn crop and higher biomass can lead to greater insect-pest infestations and consequently reducing the grain yield.

This was the first study in Virginia to generate information on the influence of four major cover crops on harmful insect pests in row-crop (corn). The study is not yet complete. We are planning to conduct these studies on larger scale next year (2024) and will try to establish it at two locations. We have not decided location and area for this study yet and that's why did not plant cover crops in fall 2022. Therefore, we are not requesting second year funds in 2023 but we will request second year funds in 2024 when we will conduct this study again.

The information generated would be used for management guides for recommending cover crops based on severity of insects. The findings of the study would also expand the information on available herbicides and timing for effective termination of cover crops to avoid yield losses due to insects. The data/information will be disseminated as extension publications, online blogs and refereed journal articles. Along with insects, we also intend to study the role of cover crops on plant pathogens/disease infestations in next funding cycle and would repeat the study next year (2024).

NOTE

I would like to inform and appreciate VA Corn Board for the funding provided in previous two years for studies on management of rapeseed volunteers and testing different herbicide programs in corn. As a result, one student graduated with MS degree, and two journal articles have been accepted (will be published in February 2023), third article will be submitted soon, several posters and oral presentations have been presented at national and state conferences, and farmer meetings. We have acknowledged VA corn board support for all these research activities. We will provide you copy of research articles in PLOS One and Agronomy Journal, once these will be published in February-March 2023. Thank you once again for your continued support.