Assessment of the role of neonicotinoid seed treatments to manage early season corn and soybean pests in Ontario

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A four year study is underway in Ontario, Canada to evaluate the utility of neonicotinoid insecticide seed treatments in corn and soybean production systems. The objectives of this study are to:

- Determine the key early season insect pests in corn and soybeans and their distribution in Ontario.
- Develop early season insect pest risk assessments tools.
- Measure the economic impact of neonicotinoid seed treatments for early season pest control in these crops.

The extensive dataset generated by this study will provide context to the overall discussion of the value of neonicotinoid seed treatments in corn and soybeans in Ontario.

From 2014 to 2016, approximately 200 strip trials have been conducted on OSCIA cooperator's farms comparing corn or soybean seeds treated with:

- Fungicide-only
- Fungicide + neonicotinoid insecticide (Fig. 1).

In 2016, a number of corn trials also included a third treatment, fungicide + diamide insecticide. Each trial consisted of at least three replications of each treatment (Fig. 2). Cooperators sourced and planted their own seed. Once notified of planting, UGRC researchers installed wireworm bait traps in fungicide-only plots. For all plots, plant populations and vigour were measured on one or two field visits for soybeans and corn, respectively. Destructive sampling was completed within each plot one to two times to assess below-ground and foliar damage by insect pests. All insects found in bait traps or destructive sampling areas were collected and identified to species. Soil samples were collected from fungicide-only plots to measure soil texture composition, organic matter content, and neonicotinoid residue levels. Trials were harvested by the cooperators and yield data were reported to the researchers.

Preliminary results are presented below. The percentage of sites where early season pests were found in baits or destructive sampling is shown in Table 1. Of the sites where wireworms were detected, 3, 2, and 5 sites had an average of >1 wireworm per bait trap in 2014, 2015, and 2016, respectively. In 2014, plant stands of corn treated with fungicide + neonicotinoid seed treatments were significantly higher than corn treated with fungicide alone. Plant stands did not significantly differ among treatments for either corn or soybeans in 2015 and 2016 (Fig. 2). The proportion of wireworm and white grub species found at all sites in 2014 and 2015 are described in Figure 3. Identification of insects collected in 2016 is currently underway. The mean difference in yield of corn and soybeans treated with fungicide-only or fungicide + neonicotinoid seed treatments in 2014 and 2015 is presented in Figures 4 and 5. Across all corn trial locations, the average yield advantage to the neonicotinoid seed treatment was 2.0 ± 3.9 and 3.4 ± 6.9 bu/ac in 2014 and 2015, respectively. For soybeans, the average yield advantage across all locations was 3.0 ± 1.6 bu/ac. In each year, approximately 50 per cent of corn or soybean trial locations achieved the average yield gain, or better.

Further analyses of these data sets will be conducted which will take into account the presence/absence of early season insect pests. Cooperators have also provided information for each trial location including crop rotation history, tillage practices, cover crop history, hybrid/variety information, planting dates, etc. which will be considered in the final analysis to evaluate risk factors for early season insect pests.

We are extremely grateful for the participation and cooperation of OSCIA members throughout this project and for funding provided by the Grain Farmers of Ontario through AAC as part of the *Growing Forward 2* program. We are currently awaiting the 2016 harvest data and planning for the final year of the study in 2017. If you are interested in participating in the study in 2017, please contact onneonicstudy@gmail.com.

This project was funded in part through *Growing Forward 2 (GF2)*, a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of *GF2* in Ontario.

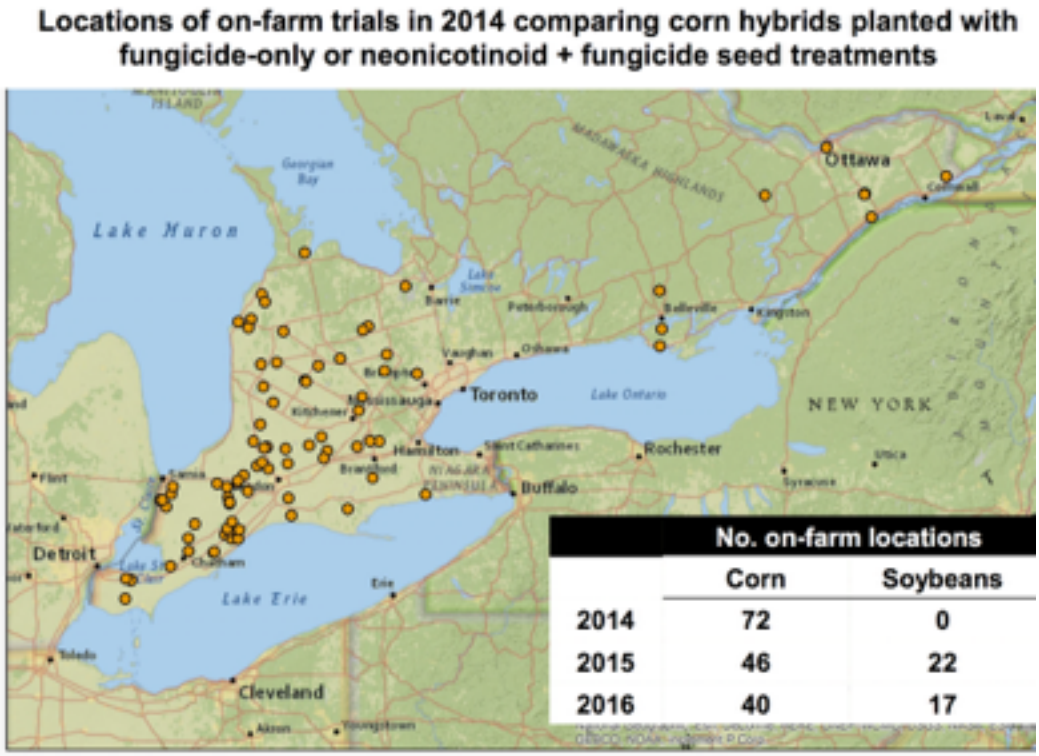


Figure 1. Distribution of on-farm strip trial locations in 2014 and summary of the number of sites in Ontario, 2014-2016.

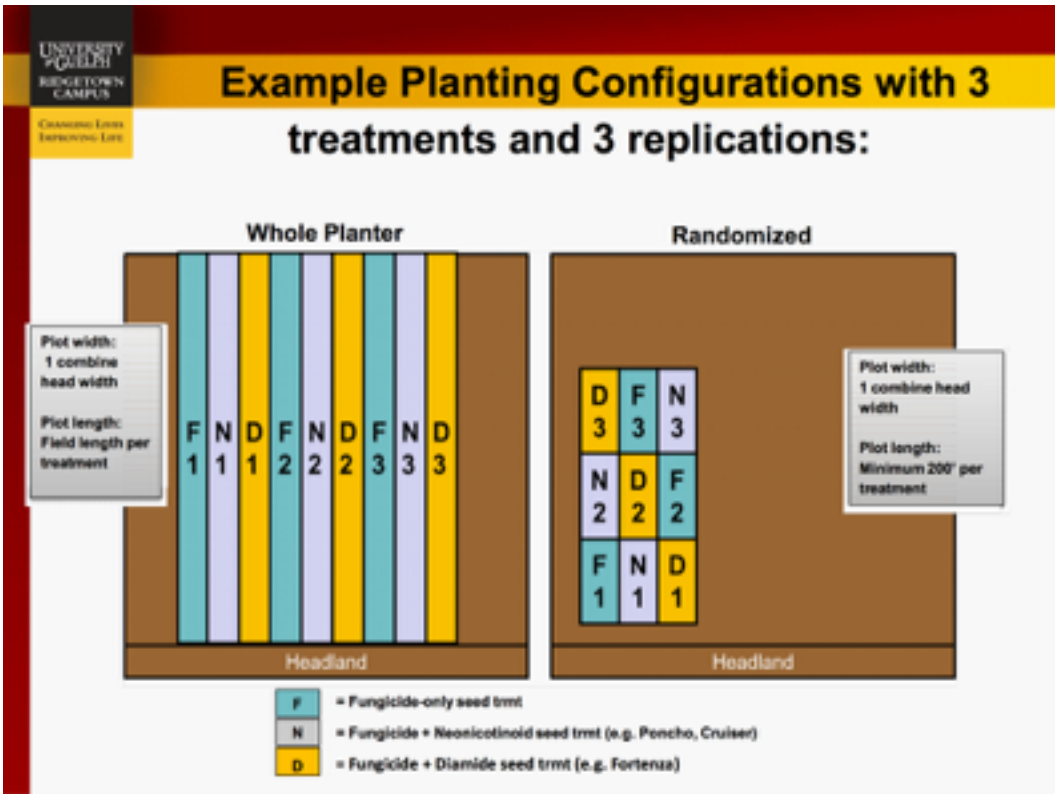


Figure 2. Example planting configuration of on-farm strip trials comparing seed treatment combinations for corn and soybeans in Ontario.

Table 1. Early season pest presence within corn and soybean strip trials detected in wireworm bait traps and destructive sampling, Ontario 2014-16.

	Percentage of sites (# of sites)			
	No pests	Wireworms	White grubs	Wireworms & grubs
		CORN		
2014	16.7% (12)	45.8% (33)	22.2% (16)	15.3% (11)
2015	30.4% (14)	58.7% (27)	37.0% (17)	26.1% (12)
2016	25.0% (10)	67.5% (27)	35.0% (14)	30.0% (12)
		SOYBEANS		
2015	72.7% (16)	27.3% (6)	0.0% (0)	0.0% (0)
2016	70.6% (12)	17.6% (3)	11.8% (2)	0.0% (0)

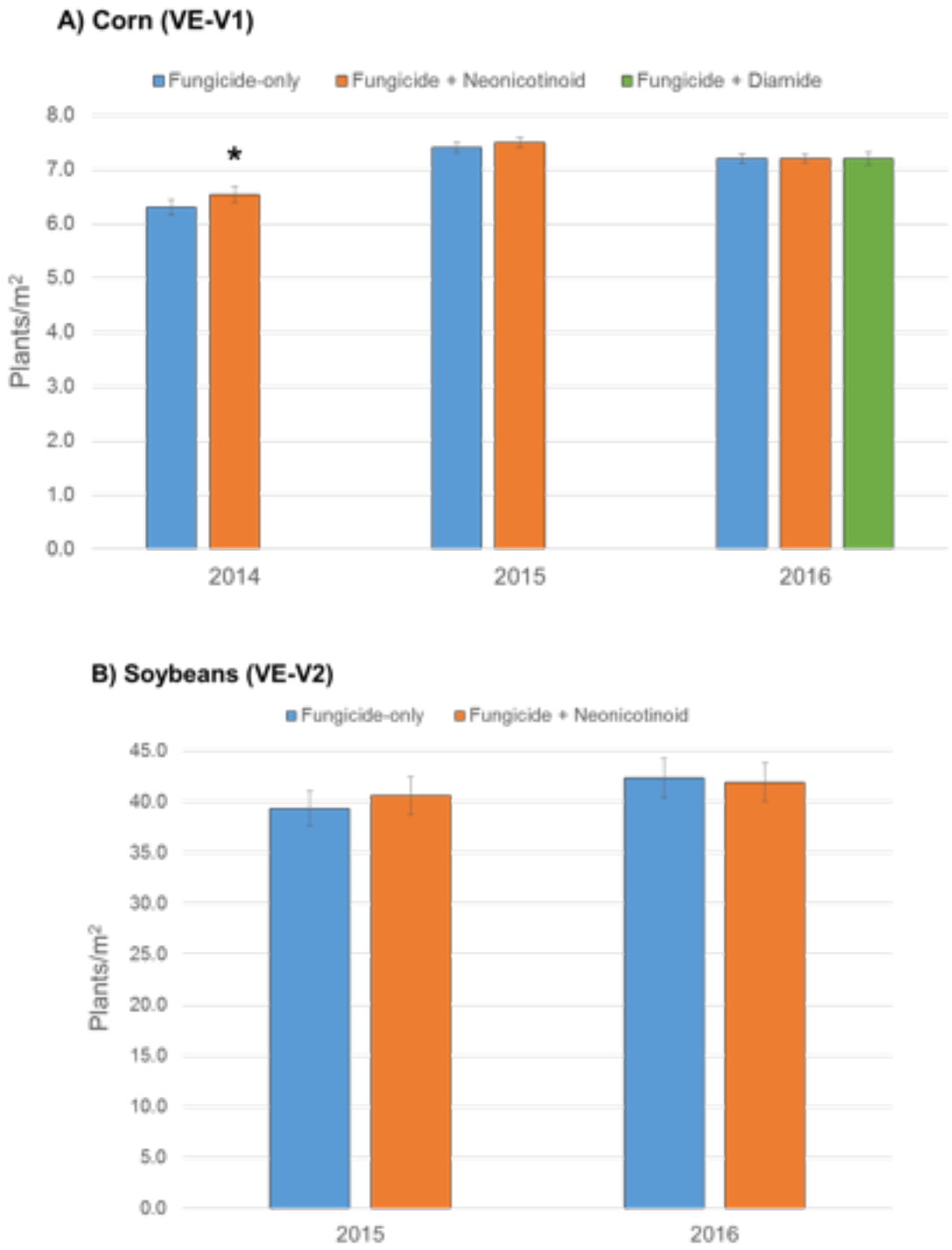


Figure 2. Average plant stand of A) corn and B) soybeans at the VE-V2 stages treated with fungicide-only, fungicide + neonicotinoid, or fungicide + diamide seed treatments in on-farm strip trials in Ontario, 2014-16.

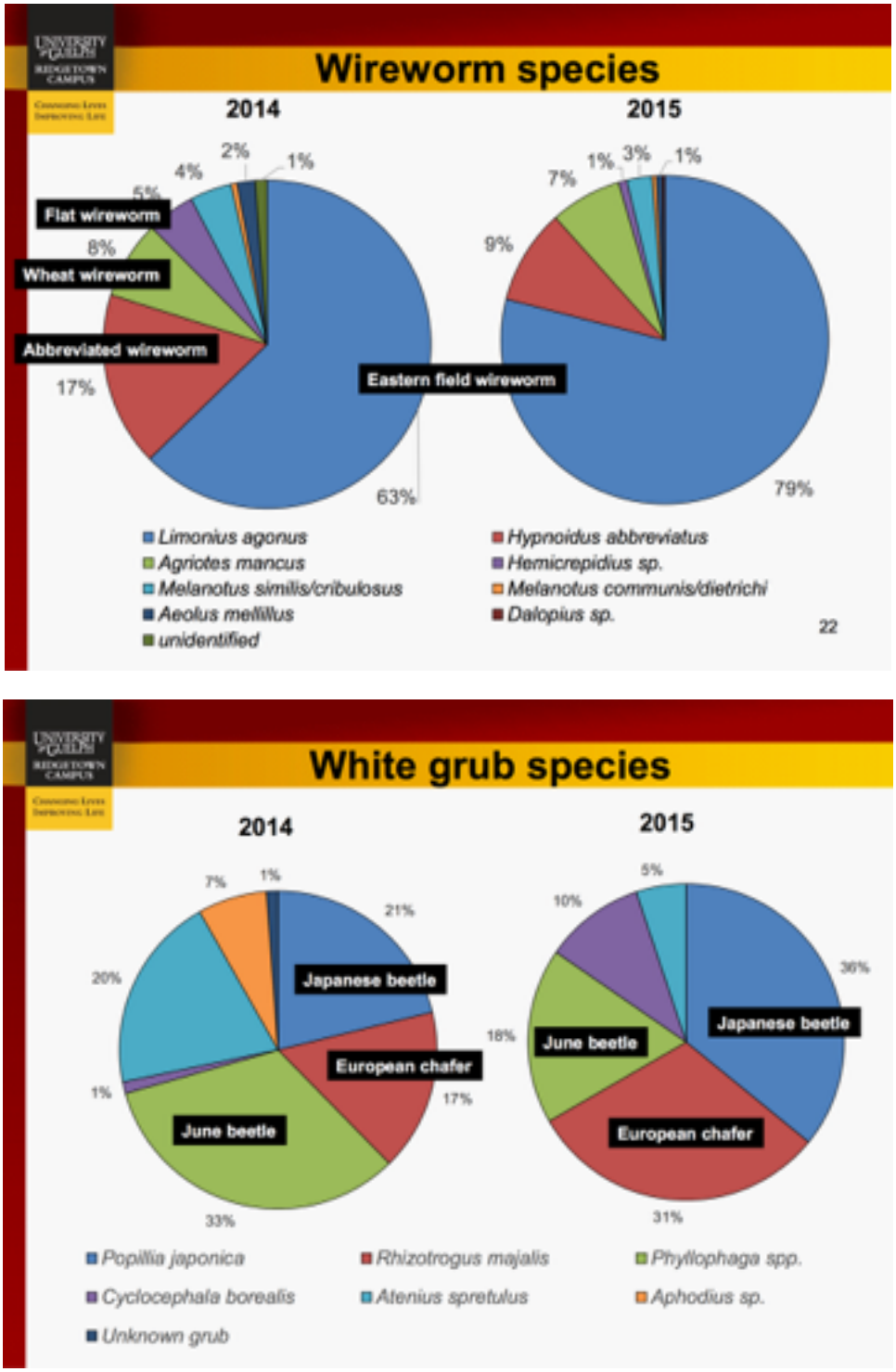
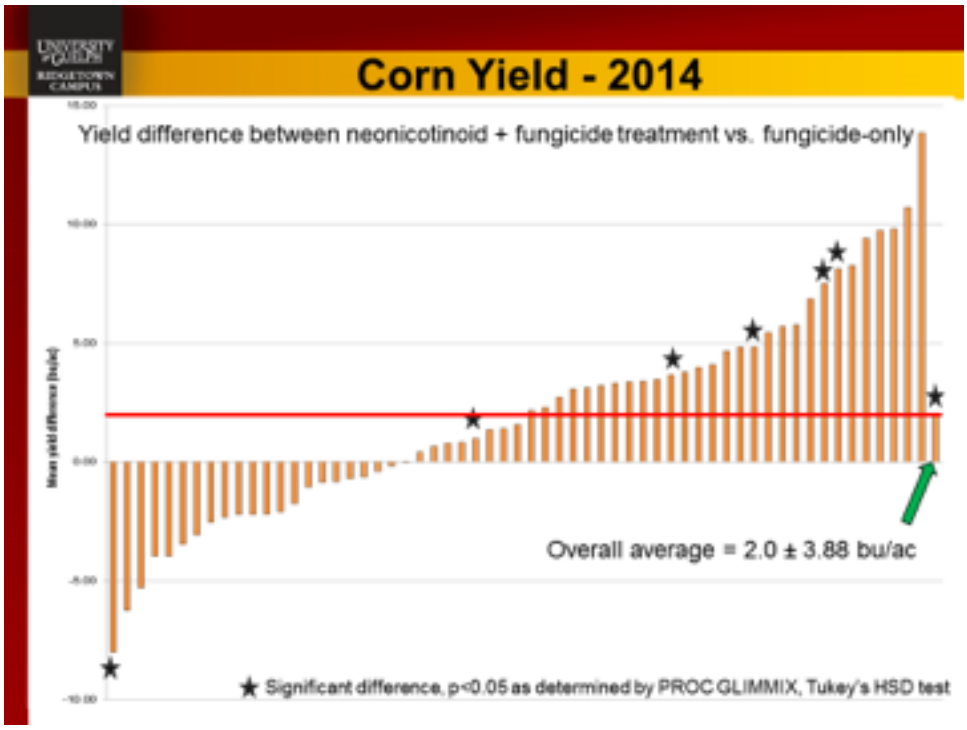


Figure 3. Wireworm and white grub species found in corn and soybean on-farm strip trials in Ontario, 2014-15.



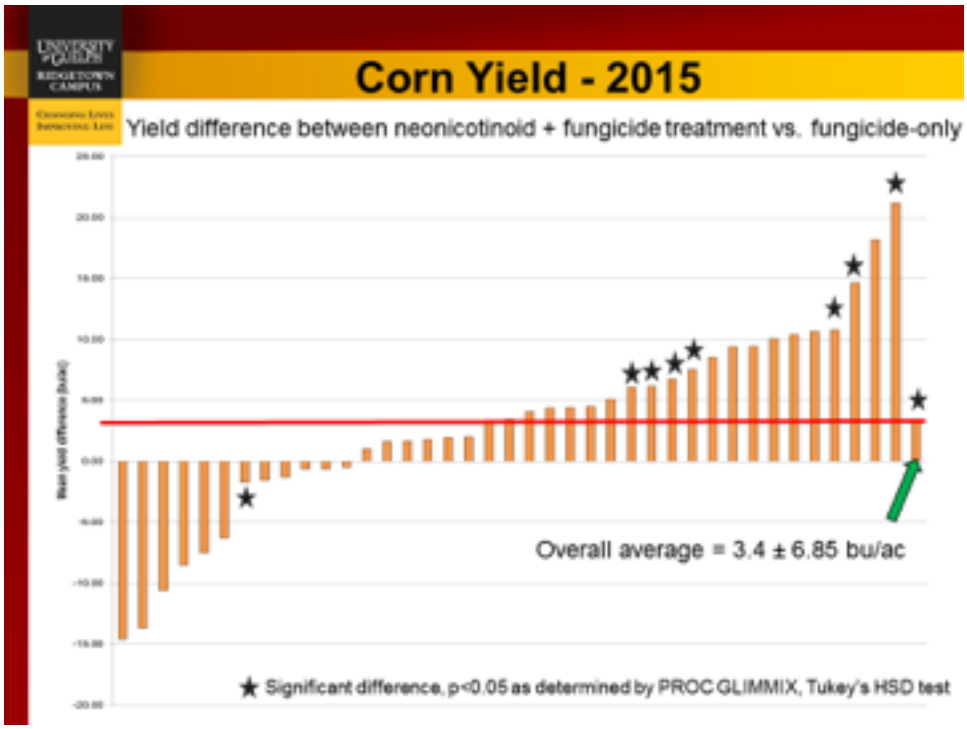


Figure 4. Mean yield difference (bu/ac) between corn treated with fungicide-only and fungicide + neonicotinoid seed treatments in on-farm strip trials in Ontario, 2014-15.

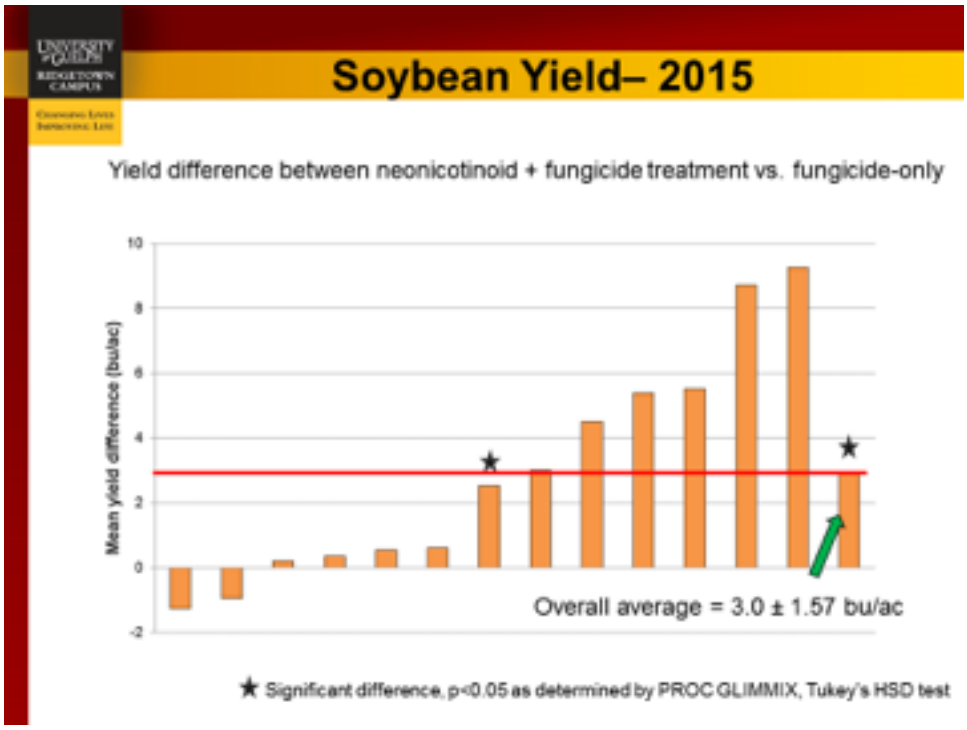


Figure 5. Mean yield difference (bu/ac) between soybeans treated with fungicide-only and fungicide + neonicotinoid seed treatments in on-farm strip trials in Ontario in 2015.