

Impact of neonicotinoid seed treatments on Maryland grain production

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Introduction

- Neonicotinoid seed treatments (NSTs) are widely used in US grain production; 79-100% of corn and 34-44% of soybean were treated as of 2011.
- NSTs are only effective against early season soil and seedling pests; not always economically beneficially
- NSTs can have various non-target impacts; soil is an important route of exposure as the majority of active ingredients from NSTs remain in the soil.

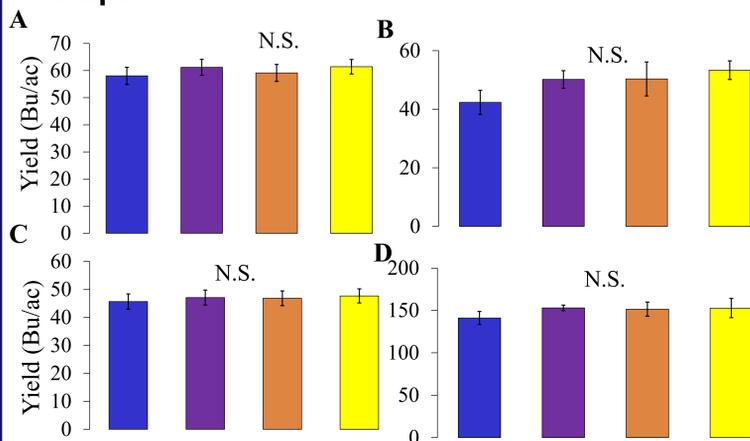


Treatments

- untreated seeds
- fungicide only
- fungicide + Gaucho 600 Flowable (imidacloprid)
- fungicide + Cruiser® 5FS (thiamethoxam)

1) Impact on Yield

- Pest pressure was consistently low throughout the study
- **There was no significant difference in yield between any of the treatments for any of the crops.**



Yield of A) full season soybean B) winter planted wheat C) double cropped soybean and D) corn, corrected to appropriate moisture contents. There was no significant difference between treatments in any case. N.S. = no significance and error bars indicate standard error.

Soybean (Summer 2015) Winter Wheat (Fall 2015) DC Soybean (Summer 2016) Corn (Summer 2017)



Variety P93Y84, Pioneer
Seeding rate:
BV:155,000 seeds/ac
QT:150,000 seeds/ac



Variety MBX14K297, Mercer
Seeding rate:
BV:1.75 million seeds/ac
QT:1.75 million seeds/ac



Variety P39T67R, Pioneer
Seeding rate:
BV:123,000 seeds/ac
QT:200,000 seeds/ac



Variety TA506-22DPR1b
Seeding rate:
BV:30,000 seeds/ac
QT:33,000 seeds/ac

Study Sites

- Central Maryland Research & Education Center, Beltsville
- Wye Research & Education Center, Queenstown

2) Impact of NST use over multiple years on soil health and quality

Soil quality: We collected soil to measure various soil quality indicators - **wet aggregate stability, texture, percent soluble salts, soil pH and carbon, hydrogen, and nitrogen content** at the beginning and end of the study to look for cumulative impacts.



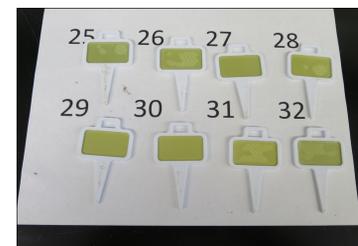
Results: None of the soil quality indicators were impacted by NST use over 3 years.



Soil Respiration: To measure soil respiration, we collected soil 3-4 times during each crop cycle and carried out a Solvita soil respiration test, which is a tool designed for farmers to measure soil respiration as a proxy for soil health.

Results: The NSTs did not have any significant impact on soil respiration as measured using the Solvita test.

Follow up: We are using quantitative PCR and Illumina sequencing to conduct molecular analysis of how NSTs impact the abundance and diversity of the soil microbial community.



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3) Presence of Neonicotinoids in Winter Annual Flowers

- We tested whether non-target plants can take up the active ingredients from NSTs from the soil, as a potential source of exposure for pollinators.
- Collected buds from weedy winter annual plants (**common henbit and common chickweed**) within our plots in spring 2016 and 2017 and had them analyzed for neonicotinoid residues



Results:
2016 – no neonicotinoid residues in any of the samples.
2017 - trace imidacloprid residues in some of the chickweed from Beltsville, but its presence not correlated to the experiment.

In this case, these species of weedy flowers did not pose a threat to pollinators.

Conclusions

- Use of NSTs did not impact yield in corn, soybean or winter wheat.
- The active ingredient from NSTs were not detected in chickweed and henbit flower buds.
- Use of NSTs did not impact soil respiration rate or soil quality parameters.

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