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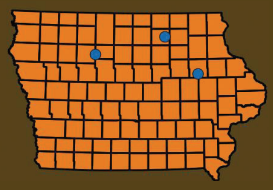
Field Crops Research



Are neonicotinoid seed treatments in soybean production worth it?

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- **Dick Sloan – Rowley**
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In a Nutshell

- Neonicotinoid seed treatments in soybean production are ubiquitous but recent evidence has called their benefit to yields and their ecological impact into question.
- Farmer-cooperators compared soybean yields from soybeans of the same variety grown from neonicotinoid-treated seeds and seeds not treated with a neonicotinoid.

Key findings

- At each location, there was no measured effect of seed treatment on soybean yield.
- Furthermore, the economic practicality of neonicotinoid seed treatments can be questioned given the lack of measured yield benefit.

Project Timline:
2014

Soybeans at Dick Sloan's farm in late June 2014.

Background

Neonicotinoids, or "neonics" as they are often called, are a family of insecticides commonly found in corn and soybean seed treatments across the US Corn Belt. Seed treatments such as Poncho®, Votivo®, Gaucho®, and Cruiser® all contain one form or another of a neonicotinoid insecticide. These insecticides are systemic, meaning that as the crop grows from the treated seed the insecticide is translocated through the plant into root and leaf tissues. In turn, this provides protection from chewing and sucking insect pests of corn and soybeans, such as cutworms and aphids.

Recent findings, however, have implicated neonicotinoids among several factors negatively affecting the health of non-target beneficial insects, such as honey bees, parasitoids, and aquatic insect larvae. Pollinator species like honey bees can be at a high risk of exposure as the insecticide can be expressed in pollen due to the systemic nature of the insecticide (Sanchez-Bayo, 2014). Moreover, talc, a common lubricant used to move seed through the planter box while planting treated seed, can function as a carrier of the neonicotinoid insecticide seed treatment. Foraging bees can then come into contact with the contaminated talc as it is expelled during planting (Hodgson and Krupke, 2013). Concern has also surfaced about the persistence of neonicotinoid insecticides in the soil from plant residues and the potential effects on soil microorganisms (Hodgson and Krupke, 2013; Sanchez-Bayo, 2014). Furthermore, the US Environmental Protection Agency recently released a report that concluded that neonicotinoid seed treatments provide "little to no" agronomic or financial benefit to soybean production (Myers et al., 2014).

The objective of this research project was to assess the agronomic and economic performance of soybeans grown from neonicotinoid-treated seeds. Comparisons are made on three cooperator farms between soybeans grown from seed treated and not treated with neonicotinoids.

Method

This study was implemented by three farmer-cooperators: Dick Sloan near Rowley in Buchanan County; Bob Lynch near Gilmore City in Humboldt County; Wendy Johnson and Doug Johnson near Charles City in Floyd County.

Treatments were soybean seeds treated with a neonicotinoid (treated) and soybean seeds without neonicotinoid seed treatment (untreated). Each farmer selected a soybean variety suitable for his/her own operation and location. Thus, varieties differed among locations but were the same within each location. Dick Sloan grew two different soybean varieties in pairs of treated and untreated seed in separate fields--treated soybeans included a neonicotinoid, a fungicide and an inoculant while untreated soybeans included an inoculant. Bob Lynch and Wendy and Doug Johnson each grew one pair of treated and untreated soybeans in a single field.

Dick and Bob planted their treated and untreated soybeans in replicated paired strips that ran the length of their fields in Spring 2014. Wendy and Doug Johnson seeded one half of a field with treated soybean seeds and the other half with untreated soybean seeds, thus, no statistical analysis could be made. Specific information pertaining to each farm is presented in **Table 1**. Apart from the seed treatment, cooperators managed the soybeans in all strips similarly at each location (i.e., weeds were managed the same across all strips in a field).

In Fall 2014, farmers harvested and weighed soybeans from strips of treated and untreated soybeans individually (except at Johnson) using a weigh wagon or yield monitor. Soybean yields were corrected for 13% moisture.

Data from both Dick and Bob's farms were analyzed using JMP Pro 10 (SAS Institute, Inc., Cary, NC) and comparisons among measured variables employ least squares means for accuracy. Means separations between treatments are reported using the least significant difference (LSD) generated from a t-test. Statistical significance is reported at the $P \leq 0.05$ level with tendencies noted at the $0.05 < P \leq 0.10$ level.

Results and Discussion

Total rainfall during the period of April 1-September 30 for 2014, as well as the historical average, for each location is presented in **Table 2**. Rainfall at each location in 2014 was 4.4-6.9 in. greater than the corresponding historical average.

Soybean yields

Figure 1 shows the soybean yields observed at each location. There was no difference in soybean yields grown from treated or untreated seed at Dick Sloan's (both fields) and Bob Lynch's farms. Mean soybean yields were 55, 54, and 31 bu/ac at the Sloan-1, Sloan-2, and Lynch locations. Yields from the Sloan fields were greater than the 10-year soybean yield average for Buchanan County of 47 bu/ac while yields from the Lynch farm were less than the 10-year average for Humboldt County of 48 bu/ac (USDA-NASS, 2014). Bob attributed his wide variations in yield (evidenced by the large LSD) and low yields for soybeans from both treatments to the trial being conducted in a field with a history of low yields on his farm. Yields at the Johnson farm were 49 and 50 bu/ac for the soybeans grown from treated and untreated seeds, respectively, which was just greater than the 10-year average for Floyd County of 47 bu/ac (USDA-NASS, 2014).

Economic considerations

Each farmer provided the cost associated with the seed treatments (**Table 3**). Across the farms, the average cost associated with the seed treatments featuring a neonicotinoid was $13.15/ac. The cost of the seed treatment was provided by each cooperator and the price of soybeans was accessed from the Chicago Board of Trade (CME Group, 2014). The cost of the seed treatment at each farm each year is presented in terms of $/ac and bushels of soybeans per acre. Essentially, the cost in bu/ac is the additional amount of bushels the farmer purchased by applying the seed treatment. As there was no difference in soybean yields between soybeans grown from the treated and untreated seeds at both Sloan locations and the Lynch location (**Figure 1**), it appears that the cost of the seed treatment was not warranted.

Table 1

Number of replications, soybean varieties, seed treatments, and dates of field operations at each farm

Location	No. reps	Soybean variety	Seed treatment	Soybean planting date	Planting pop. seeds/ac	Row spacing	Weed control	Harvest date
Sloan-1 (Rowley; northeast Iowa)	3	Pioneer 92Y51	PPST 2030 (Neonicotinoid + fungicide + inoculant)	May 7, 2014	148,000	7.5 in.	Pre-plant: Prowl + 2,4-D; At-plant: glyphosate; Post-plant: glyphosate + Flexstar-GT	Sept. 28, 2014
Sloan-2 (Rowley; northeast Iowa)	3	Pioneer 92Y75	PPST 2030 (Neonicotinoid + fungicide + inoculant)	May 8, 2014	148,000	15 in.	Pre-plant: Prowl + 2,4-D; At-plant: glyphosate; Post-plant: Flexstar-GT + Assure II + Warrant	Oct. 10, 2014
Lynch (Gilmore City; north-central Iowa)	2	NK S22-S1	CruiserMaxx® (Neonicotinoid + fungicide)	May 18, 2014	145,000	15 in.	Pre-plant: Optill Pro; Post-plant: Flexstar-GT	Oct. 8, 2014
Johnson (Charles City; north-central Iowa)	1	Asgrow 2031	Acceleron® (Neonicitinoid + fungicide)	May 27, 2014	160,000	15 in.	Pre-plant: Optill and Touchdown; Post-plant: Touchdown, Fusillade and Warrior	Oct. 16, 2014

Table 2

Total rainfall (in.) during the period April 1-Sept. 30at each location in 2014 comparedto the historical average

Location[a]	2014	Historical avg.
Sloan (Rowley)	29.2	24.8
Lynch (Gilmore City)	30.4	23.5
Johnson (Charles City)	29.7	24.8

[a] Rainfall data were accessed from the Independence (11 mi. from Sloan), Humboldt (12 mi. from Lynch), and Charles City (Johnson) weather stations (Iowa Environmental Mesonet, 2014).

Figure 1

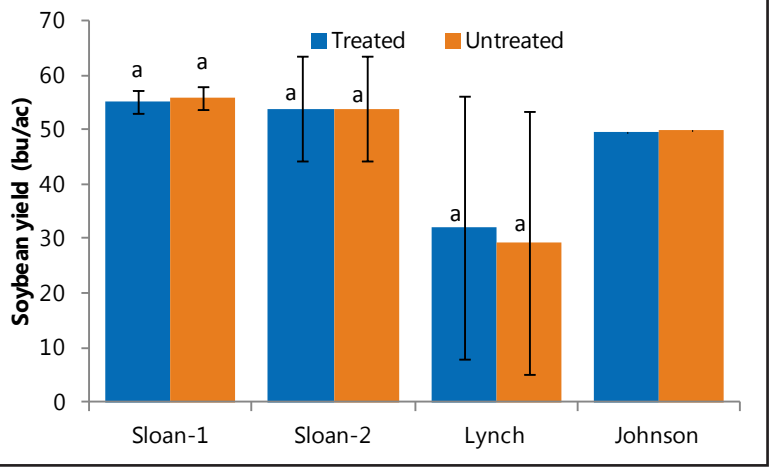

Figure 1. Mean soybean yields of the soybean grown from treated and untreated seed observed at the farms in Fall 2014. By farm, columns with different letters above them are significantly different. Black bars about the means represent the least significant difference between treatments at each farm (Sloan-1 LSD = 4 bu/ac; Sloan-2 LSD = 19 bu/ac; Lynch LSD = 48 bu/ac). No statistical analysis could be made at the Johnson farm due to lack of replication.

Table 3

Costs associated with seed treatments at each location

Location	Seed treatment	Cost/unit[a]	Units/ac	Cost/ac	Cost of treatment in soybean bu/ac[b]	Significant yield difference between treated and untreated?[c]
Sloan	PPST 2030	$13.25	1.1	$14.58	1.1	No
Lynch	Cruiser-Maxx®	$10.00	1.0	$10.00	1.0	No
Johnson	Acceleron®	$13.00	1.1	$14.86	1.4	--

[a] Quoted from each farmer.

[b] Price of soybeans was set at $10.47/bu, accessed from the Chicago Board of Trade (CME Group, 2014).

[c] Figure 1.

PFI Cooperators' Program

PFI's Cooperators' Program gives farmers practical answers to questions they have about on-farm challenges through research, record-keeping, and demonstration projects. The Cooperators' Program began in 1987 with farmers looking to save money through more judicious use of inputs. If you are interested in conducting an on-farm trial contact Stefan Gailans @ 515-232-5661 or stefan@practicalfarmers.org.

Conclusion and Next Steps

Farmer-cooperators compared soybean yields from soybeans of the same variety grown from neonicotinoid-treated seeds and seeds not treated with a neonicotinoid. At each location, the effect of the treated seed compared to the untreated seed was neutral. There were no differences in soybean yields between soybeans grown from treated and untreated seed. On average, the farmer-cooperators spent the equivalent of 1.3 bu/ac on the seed treatment. With this in mind, the cost of the seed treatment cannot be justified given that no significant increase in yield to cover that cost was provided. To be sure, Dick Sloan plans to run this trial again on his farm in 2015.

Given the findings in the EPA report and the findings of the farmer-cooperators in the present study, as well as the potential harmful effects of neonicotinoids on non-target species such as honey bees, it seems the use of neonicotinoid seed treatments in soybean production should be questioned.

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