FLANAGAN State Bank

Organic Research Newsletter

NOV 2023

So, how'd that research go?

Update on multi-state organic cropping systems research:

Fall marks the end of field season for the "Eco-intensified organic crop rotations" project taking place at Purdue University, Western Illinois University, and University of Wisconsin. Soil samples are in cold storage, weed seeds are stratifying, insects are preserved, and yield data is in the books – except at Wisconsin, where some of the soybean plots are still drying down in the field. While analysis gets underway this fall and winter, there is time to reflect on the first year of the project and the growing pains that naturally come with managing a brand-new research on university research farms. *(cont. pg. 2)*

Insect trap in a soybean plot with antifreeze solution (pink liquid) designed to capture and preserve flying insects.

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FSB Locations

301 W. Falcon, Flanagan

403 State, Benson

2401 E. Washington, Bloomington

111 N. Fayette, El Paso

500 S. Persimmon, Le Roy

208 E. Gridley, Gridley

One challenge is that this study involves a LOT of bug traps. A major goal of the study is to quantify differences in the invertebrate community for two cropping system treatments: a "standard" organic system, with typical tillage practices found on an organic row crop farm, and an "eco-intensified" organic system, with increased use of cover crops, reduced tillage (i.e. planting green), and intercropping. Researchers installed dozens of funnel traps and pitfall traps over the 12 acres used in the study to collect and preserve insects, spiders, and other invertebrates. All these traps can make field operations challenging! Research teams came to Northeast Purdue Ag Center to empty the traps once a week, but organic fields demand attention every other day early in the season. So, our operations team had to pull some of these traps out of the field multiple times per week so that they could run tine harrows and row cultivators in the field. Imagine if you had to pull dozens of wooden stakes out of the ground just to cultivate 12 or so acres multiple times per week … and then replace them where they're all supposed to go afterward!

Another big challenge is that our field at Purdue suffers from a giant ragweed infestation. It's much harder to get good data out of a field where ragweed interferes with yield and harvest. We hired a custom zapper to come out and electrify our field twice during the growing season to keep the ragweed at bay.

Zapper passes killed whatever ragweed could touch the toolbar and reduced its interference with harvest this year. We are hopeful that zapping each season will not only reduce the amount of ragweed fodder in our grain every harvest, but also reduce the viability of any seed that might have been developing on each ragweed plant. Giant ragweed creates quite a bit of yield drag in this field, so hopefully our field will become easier to work with over the next few years. We'll be excited to share how the community of weed species changes over time with this effort.

This study, funded by the Organic Research and Extension Initiative, is a big research effort looking not just at invertebrates, but also soil, weed species, and plant disease. If you'd like to find out more about the project, and learn how to set up pitfall traps on your farm, plan to attend the Indiana Organic Grain Farmer Meeting on February 28, 2024 in West Lafayette. Registration opens December 1st, 2023! Visit the Purdue Organic Agriculture website for more information: https://extension.purdue.edu/anr/_teams/dffs/organic_ag/programs/org-grain-farmer-meeting.html

Soybeans are intermixed with foxtails and other weeds in this photo from September. A closer look reveals blackened ragweed plants from a successful pass with a Weed Zapper a few weeks before.

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Interseeding Cover Crops into Organic Corn

Cover crops have always been a foundational practice in organic management, including for the production of organic grains. A core goal of organic agriculture is stewarding our soils and building soil health, both of which can be facilitated by integration of cover crops into our crop rotations. Cover crops can provide many services, including reducing water and soil runoff and erosion, increasing nutrient and water retention, and aiding in successful weed management through reducing the need for tillage and cultivation. However, in the Upper Midwest, intensification of cover crops within the organic grain rotation can be challenging due to our shorter growing season. After organic corn harvest, limited hours of sunlight and temperatures conducive to crop establishment and growth, thus limiting both the cover crop species that can be planted, establish, and survive the winter, as well as the amount of biomass that cover crops can produce. Interseeding cover crops while corn is still in the field allows farmers to not only maximize the optimal growing conditions for cover crops, expanding the number of cover crops that can be used and the services they can provide, but also harness more agroecosystem benefits throughout the growing season.

When and how do I interseed cover crops into organic corn?

Previous research based in the northeastern US investigated the interseeding of cover crops into conventional corn production. This work supported a recommendation that cover crops be interseeded at the V5 stage, after the critical weed free period of corn. However, when these recommendations were brought to the Midwest, it was found that interseeding cover crops at that stage of corn maturity was too late to support adequate cover crop growth for the cover crops to persist until harvest. Preliminary research in conventional systems in WI showed that interseeding at V3 leads to more vigorous and persistent cover crop growth. A concern with interseeding at the earlier V3 corn growth stage in organic systems is balancing the need for mechanical weed management with the need to plant cover crops when sunlight is still able to penetrate into the crop canopy (which unfortunately also promotes weed growth).

Planting cover crops in interseeding systems can be accomplished using several strategies. Achieving good seed to soil contact allows for quicker and more consistent germination of the cover crop seed and better cover crop establishment. Specialized interseeding equipment has been designed to allow for rows of cover crops to be planted between an established corn crop at the 3-5 collar stage. However, modifications of other equipment - such as taking planter units off of existing drill seeders - can also achieve similar set-ups. Cover crops can also be interseeded using broadcast seeding methods, although this strategy is riskier with respect to achieving adequate and uniform seed to soil contact. If broadcast seeding, the cover crops should ideally be broadcast just prior to a rain.

What species should I use?

Cover crops can be placed into various broad classes, including grasses, legumes, and broadleaves. The choice of which cover crop to plant depends on one's management goals. If the primary goal is weed suppression, brassicas (such as oilseed radish) will rapidly establish, with their leaves spreading out under the corn canopy and outcompeting weeds. Grasses, including annual ryegrass and winter cereal rye, have dense fibrous root systems which benefit soil health and will sequester excess nitrogen after corn harvest when the grasses continue to grow. Legumes, including red clover, hairy vetch, and peas, form relationships with rhizobium bacteria, allowing for the capture of nitrogen from the atmosphere. Legume species have the potential to add a nitrogen credit to the system and reduce the need for fertilizer inputs.

When grown in mixes - particularly mixes which include different cover crop classes - cover crops can provide multiple benefits simultaneously. Increasing biodiversity can bring added benefits to ecosystem function such as pest, pathogen, and weed management, and increased resilience to extreme weather events.

Do interseeded cover crops impact fertility management?

Preliminary research at the University of Wisconsin Arlington Agricultural Research Station has shown that cover crops interseeded at the V3 stage of organic corn do not lead to negative effects on plant available nitrogen levels throughout the growing season nor corn yield. The nitrogen credit of legumes will depend on how well the cover crops establish and if they survive the winter. A fall planting of winter cereal rye may tie up nitrogen in the spring and can reduce the amount of nitrogen available to subsequent crops depending on the amount of growth, C:N ratio, and timing of winter cereal rye termination.

Organic interseeding research at the University of Wisconsin

Dr. Erin Silva's research team at the University of Wisconsin-Madison has been researching several strategies to interseed cover crops into organic corn production.

In the first study, led by graduate student Claire Benning and in collaboration with Dr. Matt Ruark, several classes of cover crops (brassicas, grasses, and legumes), either alone or in combinations (Table 1), were planted using an interseeder at the V3 stage. Corn was planted on 5/31/22 and cover crops were planted on 6/22/2022 at the V3 maturity stage.
Soil nitrate measured at 30 days after interseeding, and cover crop and weed biomass measured at corn harvest. Tine weeding and rotary hoeing were performed per standard practices in the cover crop treatments, but the final in-row cultivation passes were only performed in the control plots.

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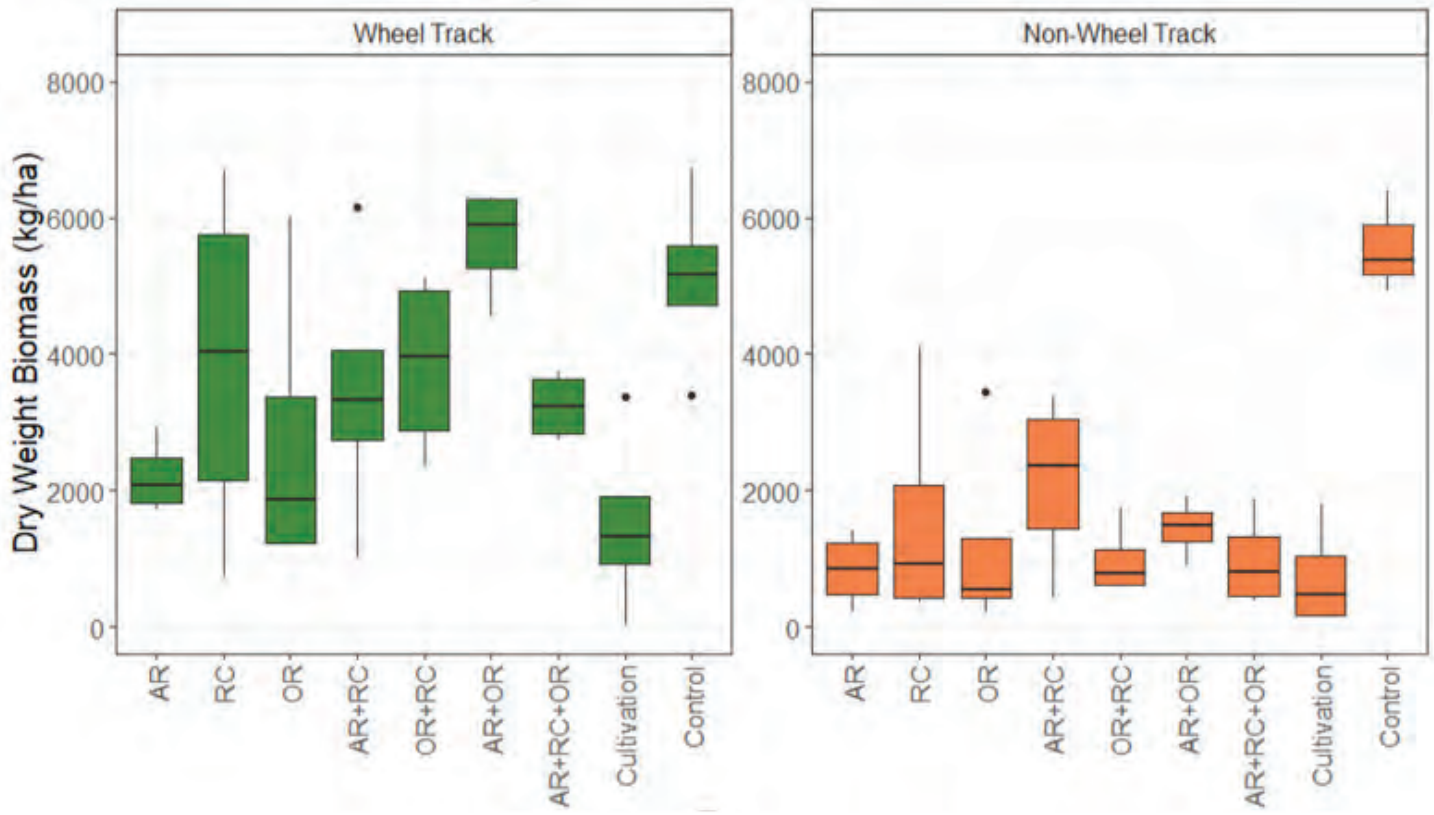
Table 1. Cover crop species and seeding rates interseeded into organic corn.

Treatment	Seeding Rate kg/ha
Annual Ryegrass (AR)	22
Red Clover (RC)	11
Oilseed Radish (OR)	11
AR + RC	11 + 11
RC+ OR	11 + 2
AR + OR	15 + 2
AR + RC + OR	11 + 9
Cultivation	No Cover
Control	Weedy Check

This research demonstrated that cover crops interseeded into corn at the V3 growth stage can suppress weed growth to an equivalent degree to systems that include in-row cultivation passes (with typical blind cultivation passes with tine weeders and rotary hoes performed prior to the V3 stage) (Figure 2). Across cover crop classes (brassicas, legumes, and grasses), brassicas provided the most effective in-season weed suppression, and the addition of a brassica to a grass or legume cover crop increased the weed suppression of the system in comparison to grasses or legumes grown alone. The presence of an interseeded cover crop did not negatively impact corn yields (Figure 3).

Figure 2. Weed biomass collected from different interseeded cover crop treatments planted into organic corn (AR=Annual ryegrass; RC=red clover; OR=oilseed radish), UW-Madison Arlington Agricultural Research Station. Weeds within wheel track and non-wheel track rows measured separately due to improved cover crop establishment in non-wheel track rows.



cont. pg. 5

Figure 3. Corn silage yields harvested from different interseeded cover crop treatments planted into organic corn (AR=Annual ryegrass; RC=red clover; OR=oilseed radish), UW-Madison Arlington Agricultural Research Station.

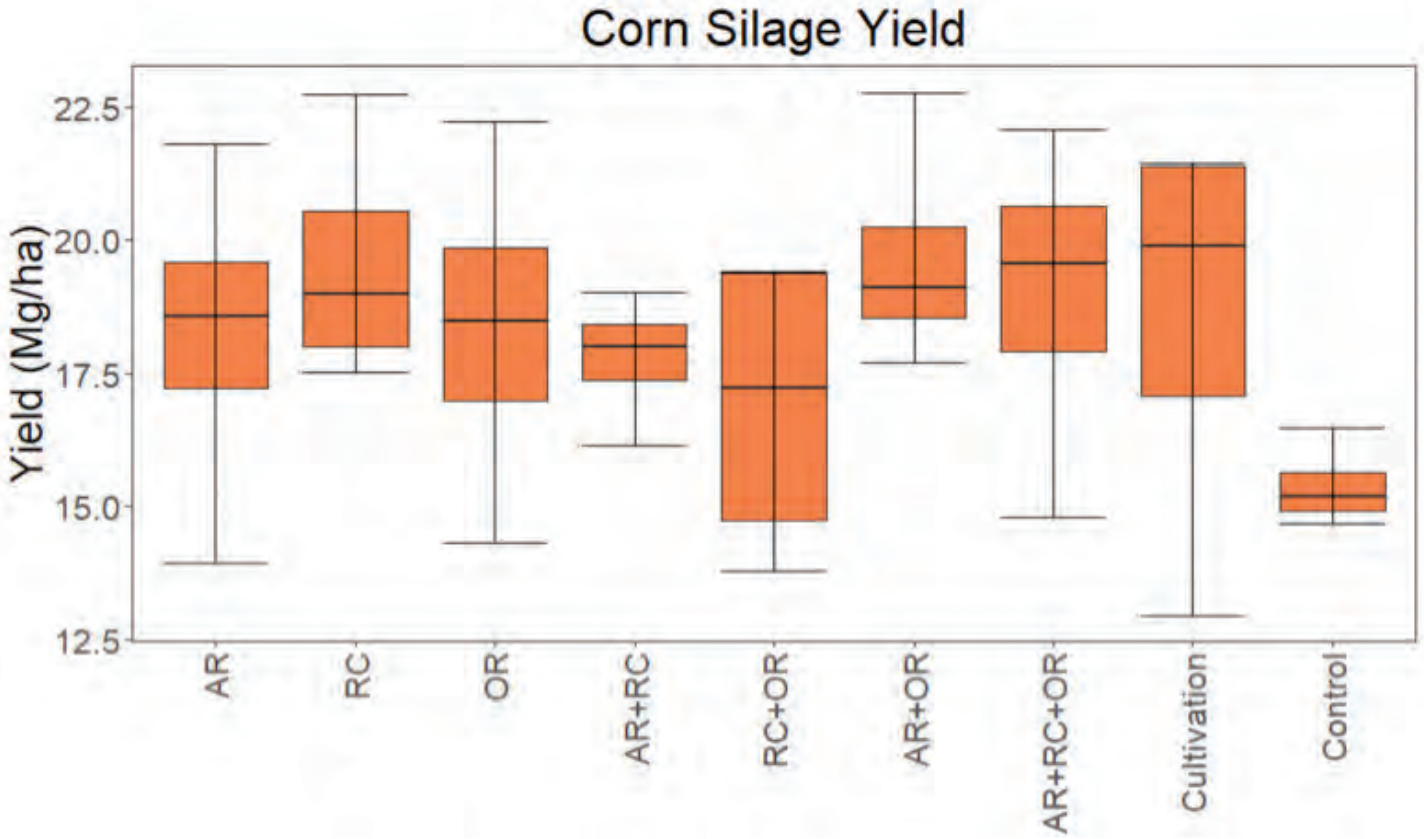


Figure 4. Interseeded annual ryegrass into organic corn on 30" rows.

Additional research at the UW Arlington Agricultural Research Station investigated the potential for wide row corn (corn grown at high in-row plant populations on 60" rows) to support successful interseeding systems. Planting corn in 60" rows could increase light interception and allow for cover crops to be integrated into the cropping system, which could also support forage production and the opportunity to integrate livestock and potentially improve soil health. Field trials were conducted in 2020 and 2021, with treatment including two corn seeding rates in the 60" systems, and a control treatment with corn grown on 30" rows with standard organic production practices (Table 2). Soybeans were interseeded between the 60" corn rows without the intention of harvesting the soybeans, but instead grown with the goal of serving as a nitrogen fixing cover crop. Manure was applied at a rate of 14,400 lb/ac on 12/3/19 and 13,200 lb acre on 12/14/2020. Prior to corn planting, 3-4 passes with a field cultivator were performed to manage weeds and prepare the seedbed. Corn and soybeans were planted together on June 1 2020 and 2021 using a John Deere 1750 planter. Post-planting, tine weeding, rotary hoeing, and row cultivation were performed as typical in organic corn production.

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Table 2. Corn and soybean varieties and seeding rates in 60" corn experiment, 2020 and 2021.

	60" rows + high corn population	60" rows + low corn population	30" row control
2020			
Corn seeding rate (seeds/ac)	28,000	20,000	32,000
Corn variety	Viking O.45-88P	Viking O.45-88P	Viking O.45-88P
Soybean seeding rate (seeds/ac)	205,000	205,000	
Soybean variety	BR e4765	BR e4765	
2021			
Corn seeding rate (seeds/ac)	28,000	24,000	32,000
Corn variety	BR 33A16	BR 33A16	BR 33A16
Soybean seeding rate (seeds/ac)	180,000	180,000	
Soybean variety	BR V4520S	BR V4520S	

In both 2020 and 2021, 60" row spacings reduced corn yields by an average of 13% compared to standard 30" row spacings (Table 3). While corn grain yield was reduced, the system does provide the potential for fall grazing, which can provide additional economic benefit to the system in the form of forage

Table 3. Corn yields in 60" corn experiment, 2020 and 2021.

Treatment	Corn Yield bu/ac, 2020	Corn Yield bu/ac, 2020
30" rows 32,000 seeds/ac	199 a	203 a
60" rows 20,000-24000 seeds/ac	177 b	177 b
60" rows 28,000 seeds/ac	181 b	170 b

Different letters indicate treatments are significantly different at p > 0.10

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Figure 5. Soybeans interseeded into organic corn on 60" rows.

Main take-aways:

● Cover crops interseeded with a drill interseeder were able to suppress weeds while eliminating the need for row cultivation passes in organic corn grown on 30" rows, with no negative impacts on corn yields. Blind cultivation practices should be used prior to cover crop planting.

● Organic corn planted with high in-row planting density on 60" rows with soybeans interseeded as a cover crop showed decreased yields but did provide the opportunity to support vigorous growth of cover crops that could be used for fall grazing.

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