2018 Northeast Cover Crops Council Conference

State College, PA
November 15 – 16, 2018

Presented by:

PennState

PASA Sustainable Agriculture

NORTHEAST SARE Sustainable Agriculture Research & Education

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Many thanks to the 2018 NECCC Meeting Planning Committee:

Sjoerd Duiker, chair
Victoria Ackroyd
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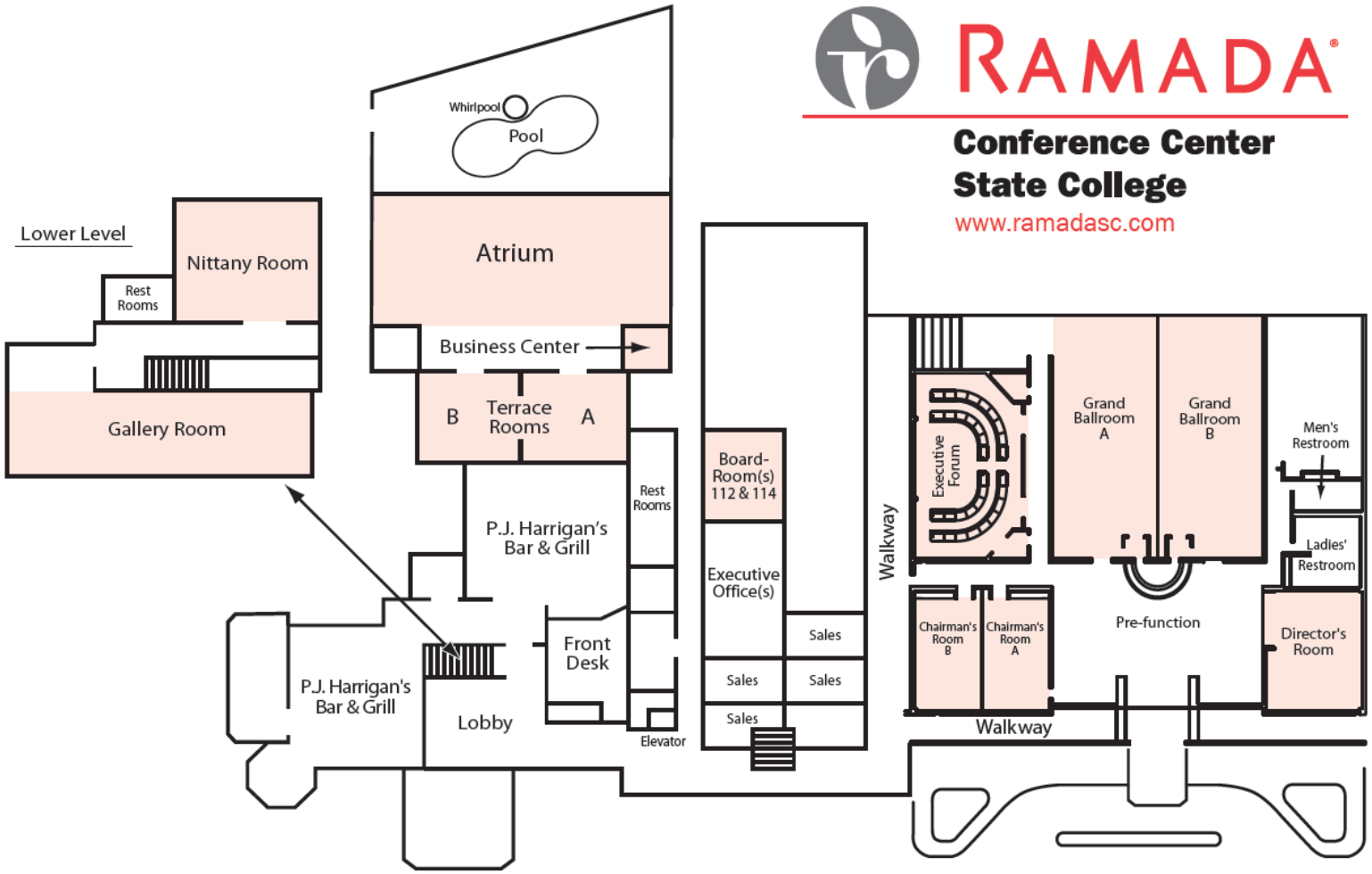
RAMADA
Conference Center
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Lower Level
Nittany Room
Rest Rooms
Gallery Room
Whirlpool
Pool
Atrium
Business Center
B
Terrace Rooms
A
P.J. Harrigan's Bar & Grill
Rest Rooms
Front Desk
P.J. Harrigan's Bar & Grill
Lobby
Elevator
Board-Room(s) 112 & 114
Executive Office(s)
Sales
Sales
Sales
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Walkway
Executive Forum
Grand Ballroom A
Grand Ballroom B
Men's Restroom
Ladies' Restroom
Chairman's Room B
Chairman's Room A
Pre-function
Director's Room
Walkway

2018 Northeast Cover Crops Council Conference

Early Morning Plenary Sessions in Welcome Hall and Grand Ballroom	
Time	Session
8:00 - 8:30	Registration
8:30 - 8:40	Welcome by Sjoerd Duiker, Chair
8:40 – 9:40	Keynote 'Roots not Iron' by Blake Vince, Ontario Grain Farmer
9:40 – 10:40	Poster Session

Morning Breakout Sessions				
	CCs Adoption, Education, Outreach Grand Ballroom	**CCs and Livestock Production** Chairman's Room	**Vegetables and Row Crops** Executive Forum	**Nutrient Management** Director's Room
10:40 – 11:00	Cover Crops Mean Cleaner Water & Healthier Soils **Jim Hershey**, Pennsylvania No-Till Alliance	Integrating Grazing Livestock & Cropping Systems through Interseeded Forages **Jessica Williamson**, Penn State University	Expanding the Cover Crop Window: Living Mulch Management in Plasticulture **Alyssa Tarrant**, Michigan State University	Nitrogen Management in Cover Crop Based No-Till Corn **Nate Richards**, University of Maryland
11:10 – 11:30	Building Soil Health Through MD Ag Service Provider Education **Nevin Dawson**	Annual Spring Forages as an Alternative to Alfalfa in Dairy Rotations **Dave McLaughlin**, Little Germany Farms	Small Scale Cover Crop Management: Highlighting Innovative Practices & BMPs **Natalie Lounsbury**, University of New Hampshire	Managing Nitrogen through Cover Crop Species Selection in the Mid-Atlantic **Jason Kaye**, Penn State University
11:40 – 12:00	Roots, Not Iron, continued **Blake Vince,** Ontario Farmer	Grazing Cover Crops to Extend the Grazing Season **Sjoerd Duiker**, Penn State University	Extending Crop Rotations to Reduce Tillage & Build Organic Matter **Cameron Pedersen**, Bending Bridge Farm	Root Traits of Cover Crops & Soil Organic Carbon Stabilization **Joseph Amsili**, Cornell University

2018 Northeast Cover Crops Council Conference

Afternoon Plenary Sessions in Grand Ballroom	
Time	Session
1:00 – 1:10pm	Update on the state of the NECCC by Steven Mirsky
1:10-2:00	Keynote by Ray Weil, University of Maryland
2:00-3:00pm	World Café
3:00-3:30	Coffee Break

Afternoon Breakout Sessions				
	CCs Adoption, Education, Outreach Grand Ballroom	**CCs and Livestock Production** Chairman's Room	**Vegetables and Row Crops** Executive Forum	**Cover Crop Mixtures** Director's Room
3:30 – 3:50	Cover Crop Decision Support Tools **Steven Mirsky,** USDA ARS	Cereal Rye Cover Crop vs. Silage Removal and Losses **Jonathan Binder,** Penn State University	Rye Cover Crop Impacts the Squash Phyllosphere Community and Plant Expression: A Sustainable Tool to Fight against *P. syringae* **Remi Maglione,** University of Quebec	Planting Date & Nitrogen Availability Drive Cover Crop Mixture Expression **Barbara Baraibar**, Penn State University
4:00 – 4:20	Survey of Costs, Constraints, & Benefits of Cover Crops in NY State **Cedric Mason**, Cornell University	Management of Sunn Hemp in the Northeast for Feed and Fertilizer **Sam Corcoran,** University of Massachusetts	Planting Green: *Glycine max* Benefits, *Zea mays* lets you down **Heidi Myer**, Penn State University	NH's Network for On-Farm Evaluation of Cover Crop Mixtures **Chad Cochrane**, USDA NRCS
4:30 – 4:50	Farm-Based Research to Boost Cover Crops & Grow Healthy Soils **Franklin Egan,** PASA		Improving Cover Crop Performance when Interseeding into "Big Corn" **Ron Hoover**, Penn State University	Cover Crop Identity, not Diversity, & Agroecosystem Characteristics Affect the Occurrence of a Beneficial Soil Fungus **Mary Barbercheck**, Penn State University

5:00-7:00pm Evening social with appetizers and drinks in Welcome Hall

2018 Northeast Cover Crops Council Field Day Agenda
Meet at Penn. State Dept. of Ag. Livestock Evaluation Center
Friday, November 16, 2018

Time	Activity
8:00 – 8:30	Arrival at the Livestock Evaluation Center, Coffee
8:30 – 8:45	Welcome and Overview of the Agenda
8:45	Take the busses to one of the three stations
8:55 – 9:40	Station
9:40 – 9:50	Transition to next station
9:50 – 10:35	Station
10:35 – 10:45	Transition to next station
10:45 – 11:30	Station
11:30 – 11:40	Transition
11:40 – 12:25	Station
12:25 – 12:30	Back to the Livestock Evaluation Center
12:30 – 1:00	Lunch and Evaluation
1:00	Adjourn

Stations

- **Cover crop mixtures.** You will visit the "Cover Crop Cocktails project" and hear about how and when cover crop mixtures can provide multiple ecosystem services, and how cover crop mixtures respond to soil and environmental factors such as soil N or growing degree days. Speakers: Jason Kaye, Mary Barberchek and Barbara Baraibar.
- **Planting green**. This station showcase the benefits and challenges of planting cash crops into standing cover crops. You will learn about ways you can manage cover crop residues to ensure a good cash crop stand, and you will see different types of equipment that can be used to "plant green". Speakers: Heidi Myer and Heather Karsten
- **Interseeding cover crops for grazing**. In this station you will learn about how and when to interseed cover crops into standing corn and how these cover crops can be grazed late in the fall. Speakers: Jessica Williamson and Miguel Schevenin.
- **Cover crops for weed management**. This project intends to follow-up on earlier studies devoted to developing a true herbicide-free no-till corn production system that utilizes a rolled heavy cover crop for weed control. In this stationyou will see two mixtures of hairy vetch and cereal rye drilled into rows either 5.5 or 7.5 inches apart, and we will discuss how narrow corn spacing can further improve both weed control and corn grain yield. Speakers: Ron Hoover

Social Events and Meals

Thursday, November 15, 2018
9:40 – Coffee and posters
12:10 – Buffet lunch
3:00 – Coffee and posters
5:00 – Evening social, drinks and appetizers

Friday, November 16, 2018
8:00 – Coffee
12:30 – Boxed lunch

Grand Ballroom: Morning Keynote

8:40 – Roots, not Iron
Author: Blake Vince
Affiliation: Ontario farmer
Speaker Bio
Blake is a fifth generation farmer and Canadian Nuffield Scholar from Merlin, Ontario, Canada. Working with his father, Elwin Vince, they currently produce commercial corn, soybeans, and winter wheat on 1200 acres (485 ha). Their management practices are centered on soil health and they are considered to be no-till pioneers in their corner of Canada where they adapted to no-till farming techniques in the early 1980s. Blake considers himself very fortunate to have been taught, from a young age, the merits of no-till farming. His claim to fame, as a 46 year old farmer, is that he has never used a moldboard plow. Knowing that soil is not an infinite resource and working with the objective to leave his farms in better condition for future generations, Blake has been using a multi-species cover crop blend to protect and enrich them. His practices are in stark contrast with others in his area of Southwestern Ontario where more and more farmers are reverting back to conventional tillage.

Grand Ballroom Morning Session: CC Adoption, Education, Outreach

10:40 - Cover Crops Mean Cleaner Water and Healthier Soils
Speaker: Jim Hershey
Affiliation: Pennsylvania No-Till Alliance; Crop and Livestock Producer
Abstract
I have been no-tilling 30+ yrs. Been using Cover Crops 15yrs. I have been using multi-species covers for 5 yrs. So in my presentation I will use a Power Point to share my experience with using different cover crops and explain how they have reduced the amount of herbicide used on our corn and soybeans. I have had 5 yrs of experience in planting green technology that has helped reduce crop stress due to capturing moisture and retaining more moisture and has reduced insect pressure. I will also present how I manage covers in the spring with the method rolling. I will also include in my presentation how Cover crops and No-Till have improved our Soil Health and productivity of our crops. And then as time permits I will share with the audience my experience with manure incorporation into green living cover as well as interseeding covers.

11:10 - Building Soil Health Through MD Ag Service Provider Education

Speaker: Nevin Dawson
Affiliation: University of Maryland Extension

Abstract

The Maryland Northeast Sustainable Agriculture and Education (NE SARE) Professional Development Program (PDP) designs and coordinates educational programs for agricultural service providers (ASPs). The presenter conducted a needs assessment to determine a focal topic for a three-year project (FY 2015-2017) and designed a program to address that topic: Soil Health. Project design included a focus on a core group of ASPs who continued their participation throughout the project, with a mix of events targeted at this smaller group and other events open to a larger more casual audience including farmers. The highest rated methods for learning new information indicated by the needs assessment served as the base for this project's outreach efforts. Project activities included 8 field days and meetings, 1 on-farm demonstration, and 9 webinars and presentations. Tabletop slake demonstrations and rainfall simulations were presented at 7 conference exhibits. These events reached 283 ASPs and 331 farmers. A soil health segment for the popular Maryland Public Television program, "Maryland Farm & Harvest," was also coordinated and aired. The following performance target outlines the three-year project goals, to be achieved through the above activities. Total outcomes measured after Year 2 are in parentheses. 30 (49) ASPs will incorporate soil health concepts into their current programming and advising, reaching 500 (2,060) producers farming 37,500 (31,060) acres. Of those, 10 ASPs will develop and offer in-depth programming in soil health concepts to their clientele for 150 producers farming 11,250 acres. Verification of third year outcomes is currently underway at time of press.

11:40 - Roots, not Iron, *cont.*

Author: Blake Vince
Affiliation: Ontario farmer

Speaker Bio

Blake is a fifth generation farmer and Canadian Nuffield Scholar from Merlin, Ontario, Canada. Working with his father, Elwin Vince, they currently produce commercial corn, soybeans, and winter wheat on 1200 acres (485 ha). Their management practices are centered on soil health and they are considered to be no-till pioneers in their corner of Canada where they adapted to no-till farming techniques in the early 1980s. Blake considers himself very fortunate to have been taught, from a young age, the merits of no-till farming. His claim to fame, as a 46 year old farmer, is that he has never used a moldboard plow. Knowing that soil is not an infinite resource and working with the objective to leave his farms in better condition for future generations, Blake has been using a multi-species cover crop blend to protect and enrich them. His practices are in stark contrast with others in his area of Southwestern Ontario where more and more farmers are reverting back to conventional tillage.

Chairman's Room Morning Session: CCs and Livestock Production

10:40 – Integrating Grazing Livestock and Cropping Systems through Interseeded Forages

Speaker: Jessica Williamson[1]*, Gregory Roth[1], Tara L. Felix[2], Kathy J. Soder[3]

Affiliations: [1]Dept. of Plant Science, Penn State University; [2]Dept. of Animal Science, Penn State University; [3]USDA-ARS Pasture Systems and Watershed Management Research Unit, University Park, PA

Abstract

Integrating grazing livestock and cropping systems on an operation can increase diversity, sustainability, and overall profitability of both enterprises. Integration of these systems can optimize land use, reduce stored and harvested feed needs, reduce environmental impact, and provide an outlet for manure application. The InterSeeder™ was developed to sow cover crops directly into the interrows of standing corn while simultaneously applying herbicides and fertilizer. Planting cover crops earlier in the season rather than after corn harvest allows for germination while not affecting corn growth and yield. After corn harvest, the cover crop can then be managed as an alternative forage and utilized in the fall and spring for ruminant livestock grazing. The objective of this study is to enhance ruminant livestock-cropping systems that promote sustainable intensification through balancing agricultural productivity and environmental quality by improving soil and nutrient conservation, extending the grazing season, and reducing imported nutrients. An annual forage crop will be planted using the InterSeeder™ at the corn V4 to V5 stage. Soil fertility will be managed to favor the corn as a cash crop prior to grain harvest. Following the harvest of corn for grain, nutrients will be applied to the interseeded forage to maximize forage mass for grazing. Growing cattle will graze corn stover and interseeded alternative forages in the fall, and if growth allows, again in the spring before subsequent crop planting. In this project, carrying capacity, forage quality, stocking rate, subsequent crop yield, insect pressure, and soil health characteristics will be evaluated.

11:10 – Annual Spring Forages as an Alternative to Alfalfa in Dairy Rotations

Speaker: Dave McLaughlin

Affiliation: Little Germany Farms

Abstract

Up through 2015, Little Germany Farms and Eleven Holsteins had used a traditional rotation of full season corn silage acres and alfalfa/grass acres, to provide for the forage needs of the dairy. Starting in 2016, these two operations moved to an annual spring harvested forage (triticale and annual ryegrass) followed by double crop corn, for corn silage., to provide the majority of the dairy's forage needs. Some of the benefits, that these two operation have observed include, increased consistency of forage quality going to the dairy cows, more efficient use of acres available, more efficient use of on farm produced nutrients and increased soil health. Our farm contributes to PASA's Soil Health Benchmark Study, so we plan to monitor changes in soil health through the new rotations.

Chairman's Room Morning Session: CCs and Livestock Production, *cont.*

11:40 – Grazing Cover Crops to Extend the Grazing Season
Speaker: Sjoerd W. Duiker
Affiliation: Dept. of Plant Science, Penn State University
Abstract
Well-managed perennial pasture is one of the best land management systems to protect land from erosion, build soil organic matter content, and improve soil structure. Similarly, no-tillage systems have been shown to provide erosion protection and improve soil health. Integration of no-till systems with grazing has many potential benefits. In this paper we will report the results of a 3-yr project where we studied three farms in Pennsylvania where grazing and no-tillage was integrated. We observed that by using no-tillage farmers were able to maintain soil health benefits of perennial sod when establishing annuals, which helped increase soil resilience against soil erosion and soil compaction. Annuals provided a great opportunity to control a worn-out sod and unwanted vegetation before establishing a new perennial pasture. Winter annuals provided forage for grazing before perennial cool season grass in the spring. Summer annuals provided forage to alleviate the summer slump in production of cool season perennials. Warm and cool season annuals could be stockpiled for winter grazing. Warm season perennials and annuals could meet summer forage needs so cool season perennials could be rested for winter stockpiling. By combining cool and warm season annuals and cool season and warm season perennials, both grasses and forbs, farmers were able to greatly extend the grazing season, reduce costs, and improve profits.

Executive Forum Morning Session: Vegetables and Row Crops

10:40 – Expanding the Cover Crop Window: Living Mulch Management in Organic Plasticulture Vegetable Production

Speaker: Alyssa Tarrant[1]*, Zachary D. Hayden[1], Daniel C. Brainard[1], Lisa K. Tiemann[2]
Affiliations: [1]Dept. of Horticulture, Michigan State University; [2]Dept. of Plant, Soil, and Microbial Sciences, Michigan State University

Abstract
While plastic mulch offers excellent weed control in-row, weeds between plastic mulch beds (between-row) remain a challenge. In organic production, cultivation is commonly used to manage weeds between-row. However, bare between-row areas combined with aggressive runoff caused by the impervious surface of plastic mulch leads to erosion and nutrient leaching. Thus, integrating cover crops as living mulch between plastic mulch beds for weed, soil, and nutrient management is of great interest to organic vegetable growers. The aim of the current research is to address the following broad research questions: 1. How do between-row weed management strategies influence crop production and soil microbial communities? 2. Which cover crops best function as living mulches between plastic mulch beds? First year results (2017) indicate that warm-season grasses (Italian ryegrass, teff, and sudangrass) more effectively suppressed weeds than both cool-season grasses (rye, barley, wheat) and clovers (Dutch white, New Zealand white, and yellow sweet blossom). Inhibition of cash crops by living mulch was cash crop dependent; bell pepper yields were reduced by living mulches, while summer squash yields were maintained. Changes in soil microbial communities were not observed in bare ground or living mulch plots at any of the four sampling during the first year. Compared to bare ground plots, living mulch reduced between-row potentially leachable nitrogen in the fall. Continued research in 2018 is focused on addressing the production challenges associated with living mulches in plasticulture vegetable production.

11:10 – Small Scale Cover Crop Management: Highlighting Innovative Practices and BMPs

Speaker: Natalie Lounsbury[1]*, Jason Lilley[2]
Affiliations: [1]University of New Hampshire; [2]University of Maine Cooperative Extension

Abstract
Many farmers on small-scale diversified farms put a strong emphasis on soil health, but lack the tools and equipment to manage cover crops optimally. These farmers balance planting and harvesting schedules for dozens of crops, often planted in small blocks. Fitting cover crops into these small planting blocks and tight planting windows with suboptimal equipment can be difficult, and equipment that is specific to cover crop or grain management is generally too large or too expensive for these farms. However, inexpensive tools that are not designed for cover crop management can make seeding and terminating cover crops, as well as planting into cover crop residue, viable on a small-scale. From lawn rollers and snow shoes to tarps and dibblers, this talk will highlight the methods and tools being used to overcome the hurdles of fitting cover crops into small-scale diversified farms.

Executive Forum Morning Session: Vegetables and Row Crops*, cont.*

11:40 – Extending Crop Rotations to Reduce Tillage & Build Organic Matter

Speaker: Cameron Pedersen
Affiliation: Bending Bridge Farm

Abstract

At Bending Bridge Farm, we are experimenting with new crop rotations that extend cover cropping windows to reduce tillage. Cover crops are an essential part of any organic vegetable rotation, but we have found it challenging to terminate winter annual cover crops using organic methods. We have typically worked with winter rye and hairy vetch for overwintering cover crops, but we've found that the multiple spring disc and rototiller passes required to terminate a thick stand of rye and vetch is impeding our ability to build organic matter and soil health. Over the past few seasons, we are finding that we have the land base to produce enough for our markets while stretching out our rotations in space and time. Starting in 2018, we will be shifting our fields to a new rotation involving a full year of crimson clover followed by different vegetable groups. On fields where we do use rye/vetch mixes, we plan to follow with fall brassica transplants so that we do not need to rush the cover crop termination into a narrow spring window. Our farm contributes to PASA's Soil Health Benchmark Study, so we plan to carefully track changes in soil health and reductions in tillage through the new rotation.

Director's Room Morning Session: Nutrient Management

10:40 – Nitrogen Management in Cover Crop Based No-Till Corn

Speaker: Nate Richards[1]*, Steven Mirsky[2]
Affiliations: [1]University of Maryland Extension; [2]USDA ARS Sustainable Agricultural Systems Lab, Beltsville, MD

Abstract

This presentation will summarize the ongoing research on cover crop management in high residue no-till corn. It will examine both early-season N management in field corn production as well as the overall fertilizer rate needed across a gradient of cereal rye biomass. Nitrogen immobilization due to abundant cereal rye biomass can be mitigated by adjusting the N fertility program for the following crop. Increasing the proportion of total N applied as starter, with the rest applied at sidedress, could be used to address early-season N immobilization without increasing the application rate of N. I will cover the results of two years of starter N dose-response experiments across a gradient of cereal rye cover crop biomass (i.e. cereal rye terminated at varying growth stages) to help determine the proper "prescription" for managing corn fertility in high-biomass cover crop environments. The results from this research will give farmers fertility recommendations that will aim to maximize the ecosystem services of their cover crops while minimizing the effects of N immobilization to their corn crop.

Director's Room Morning Session: Nutrient Management, *cont.*

11:10 – Managing Nitrogen through Cover Crop Species Selection in the Mid-Atlantic

Speaker: Jason Kaye[1]*, Meagan Schipanski, Charles White, Denise Finney, Brosi Bradley, Mitch Hunter, Maria Alonso-Ayuso, Catalina Mejia[1]

Affiliations: Dept. of Ecosystem Science and Management, Penn State University

Abstract

Cover crops have the potential to be agricultural nitrogen (N) regulators that reduce leaching through soils and then deliver N to subsequent cash crops. However, regulating N in this way has proven difficult because the few cover crop species that are well-studied excel at reducing N leaching or increasing N supply to cash crops, but they fail to excel at both simultaneously. We tested six cover crop monocultures and four mixtures for their effects on N cycling in a maize-soybean-wheat feed grain rotation in Pennsylvania, USA. All cover crop species reduced N leaching compared to fallow plots, including legume monocultures. Cereal rye monocultures reduced leaching by 90% relative to fallow, but mixtures with just a low seeding rate of rye did almost as well. Austrian winter pea monocultures increased N uptake in maize silage by 60 kgN/ha relative to fallow, and conversely rye monocultures decreased N uptake into maize silage by 40 kgN/ha relative to fallow. Importantly, cover crop mixtures had larger impacts on leaching than on maize N uptake. For example, a three species mixture of pea, red clover, and rye had similar maize N uptake to fallow plots, but leaching rates were 80 % lower in the mixtures than fallow plots. Our results show clearly that cover crop species selection and mixture design can substantially mitigate tradeoffs between N retention and N supply to cash crops providing powerful tool for managing N in the mid-Atlantic, and eventually other regions.

11:40 – Root Traits of Cover Crops & Soil Organic Carbon Stabilization

Speaker: Joseph Amsili[1]*, Jason Kaye[2]

Affiliations: [1]Soil and Crop Sciences Section, Cornell University; [2]Dept. of Ecosystem Science and Management, Penn State University

Abstract

Cover cropping represents a beneficial soil management strategy that leads to increased organic carbon inputs in between cash crops with benefits for soil organic carbon (SOC) levels, soil health, and climate mitigation. While roots play an important role in increasing SOC levels, cover crop root traits remain poorly understood. Knowledge of root traits and the fate of rhizodeposition C can inform cover crop selection for increasing SOC. Root trait measurements at the field scale revealed important differences in root production, R:S ratios, between-row roots, and C:N ratios exist among these cover crops. Cover crop rhizodeposition C, while invisible, represents a significant component of root-derived organic carbon and an important source of carbon leading to the formation of mineral-associated organic carbon.

Grand Ballroom: Afternoon Keynote

1:10 - Taking Cover Crops to the Next Level to Maximize Multiple Benefits

Speaker: Ray Weil[1]
Affiliation: [1]Dept. of Environmental Science and Technology, University of Maryland

Abstract

Cover crops can liberate the farmer from the narrow dictates of the marketplace - at least for a part of the farming operation. This allows farmers to add diversity to their soil-plant community in ways that the market would never allow if these crops had to be sold. Cover crops provide a very powerful tool farmers can use to manage various challenges, not the least of which is the evermore erratic weather. If done right, cover crops will pay not cost. Any single benefit or service - carbon storage, nutrient cycling, compaction alleviation, water conservation or erosion control – may not cover the cost of cover cropping right way. But the combination of two or three of these benefits should do it – even in the short term. We know that to achieve these benefits, cover crops cannot be an afterthought but must be planned and managed just like cash crops. One decision is choosing what cover crop species to plant, as each provides different potential benefits. Another, equally important, decision is when and how to plant them. Cover crop performance is as much a function of when they are sown and terminated as by what seeds are used.

Grand Ballroom Afternoon Session: World Cafe

2:00 – 3:00

Participants will divide into groups to discuss a topic of interest for thirty minutes, then move to another group to discuss another topic for thirty minutes. Synthesized results will be posted by moderators for discussion during the evening social.

Grand Ballroom Afternoon Session: CC Adoption, Education, Outreach

3:30 – Cover Crop Decision Support Tools
Speaker: Ankita Raturi[1]*, Steven Mirsky[1]
Affiliations: [1]USDA ARS Sustainable Agricultural Systems Lab, Beltsville, MD
Abstract
We are currently developing a prototype of the DSP to demonstrate feasibility through the integration of three decision support tools for sustainable agriculture. In the long term, we intend to create an integration pathway to allow other motivated tool creators to modularize and connect their tools into the DSP. Both modules and the integration pathway would ideally be co-developed with independent tool creators. This would reduce redundant development efforts and encourage the development of integration pathways that work for different organizations, licensing, and development methods. Our broader vision for the DSP is one in which it exists as a self-sustaining element of an information ecology for sustainable agriculture.

4:00 – Survey of Costs, Constraints, & Benefits of Cover Crops in NY State
Speaker: Cedric W. Mason[1]*, David Wolfe[1]
Affiliations: [1] School of Integrative Plant Science (Horticulture Section), Cornell University
Abstract
A broad survey of farmers in New York state was conducted during the winter of 2017-18 to 1) prioritize the most common economic costs and benefits experienced by farmers who use cover crops; 2) explore how these costs and benefits change over time; and 3) evaluate the ability of cover crops to mitigate the effects of drought and heavy rainfall. Based on the results of 149 survey responses, we identified the most prevalent farm expenses incurred by farmers who use cover crops, and also the most common benefits and changes to income. The results show that the expenses and benefits of cover crops in vegetable systems are different from those seen by growers using cover crops in corn and/or soybean systems. Using statistical tests, we illustrate that some benefits of cover crops, greater yields for example, are associated with practices that have been in place for long periods of time. The extent to which cover crop practices help mitigate the effects of drought and heavy rainfall was evaluated and compared to the performance of reduced tillage. The findings of this survey-based study will be useful for farmers considering the economic aspects and affordability of cover crops, and informative for those guiding agricultural policies and research priorities in the Northeast U.S.

Grand Ballroom Afternoon Session: CC Adoption, Education, Outreach, *cont.*

4:30 – Farm-Based Research to Boost Cover Crops & Grow Healthy Soils

Speaker: Franklin Egan

Affiliation: Pennsylvania Association of Sustainable Agriculture

Abstract

PASA's Soil Health Benchmark Study is a farm-based research project that helps farmers measure soil health on their farms and collaboratively develop new ideas for cover cropping, reducing tillage, and managing nutrients. In 2017 we worked with 24 organic vegetable and 4 no-till row crop farms to measure soil health using the Cornell Soil Health test and to track management practices through farmer surveys. Participating farmers receive detailed benchmark reports that show their soil health outcomes and practices relative to their peers. For instance, organic vegetable farmers learned that peer farms showed 221 "days of living cover" on average, with several farms exceeding 300 days, and some farms lagging below 150 days. We use learning circles, field days, and outreach publications to highlight the techniques that top performing farmers are using and to inspire lower performing farms to make adjustments. Our data also show many examples of excellent soil health on both organic vegetable and no-till row crop farms, suggesting that interactions between tillage, cover crops, and soil health are complex and that there can be multiple successful pathways to growing health soils.

Chairman's Room Afternoon Session: CCs and Livestock Production

3:30 – Cereal Rye Cover Crop vs. Silage Removal and Losses

Speaker: Jonathan Binder[1]*, Heather Karsten[1]

Affiliation: [1]Dept. of Plant Science, Penn State University

Abstract

Differences between N and P uptake of winter rye managed as a cover crop versus managed as rye silage and associated differences in losses to the environment in a liquid dairy slurry manure-applied rye-corn silage system. Losses were observed in surface and subsurface water flow measured on field lysimeters at Penn State's Rock Springs Agronomy Research Station.

Chairman's Room Afternoon Session: CCs and Livestock Production, *cont.*

4:00 – Management of Sunn Hemp in the Northeast for Feed and Fertilizer

Speaker: Sam Corcoran[1]*, Masoud Hashemi[1]
Affiliation: University of Massachusetts Amherst

Abstract

Crotalaria juncea, common name Sunn Hemp (SH), is a drought-tolerant tropical legume of increasing interest to growers in the United States. We have studied SH in Massachusetts for five years. SH fixes as much as 280 kg/ha of nitrogen in as little as 90 days and can also serve as animal feed with the potential for multiple cuttings and dual-purpose use. Plant growth is highly dependent on planting date and demonstrates a strong response to day length. In severe and extreme drought conditions of 2016, SH planted in early July produced 15 Mg/ha biomass at 90 days after planting (DAP), while planting four weeks later in mid Augusts resulted in less than 3 Mg/ha biomass before winterkill at 60 DAP. In 2017, we successfully achieved seed set; viable seeds from this collection are currently growing. We have also identified a pathogen of SH not previously reported in the Northeast, and a second pathogen not previously reported in the United States; our disease analysis of incidence and severity, as well genetic confirmation of morphologically identified pathogens, remains in progress. Future work includes processing SH as an organic source of nitrogen fertilizer that can be applied in-season to cash crops, as well as assessing said processing methods for their effectiveness in killing overwintering or necrotrophic pathogens.

4:30 – n/a

Executive Forum Afternoon Session: Vegetables and Row Crops

3:30 – Rye Cover Crop Impacts the Squash Phyllosphere Community and Plant Expression: A Sustainable Tool to Fight against *P. syringae*

Speaker: Remi Maglione[1]*, Marie Ciotola[2], Martin Laforest[2], Vicky Toussaint[2], Steven Kembel[1]

Affiliations: [1]Universite du Quebec a Montreal; [2]Agriculture Agrifood Canada

Abstract

Pseudomonas syringae, is considered one of the most important bacterial plant pathogens. There are limited control methods and consumers are more and more concerned over the environmental consequences of using copper for disease control. Soil conservation practices, such as cover crops, are amongst tools that can contribute to reducing disease pressure caused by bacteria. A recent experiment has shown that cover crops reduce P.syringae populations on squash leaves. The goal of this work was to describe the taxonomic composition of the squash phyllosphere. We hypothesized that a change in leaf bacterial community structure, driven by the use of a cover crops, explains the decrease in P.syringae populations. A two-year field study was set-up where squash was seeded and grown using four different agricultural practices: bare soil, rolled rye cover crop, chemically terminated rolled rye cover crop and plastic mulch. Bacterial populations on squash leaves were sampled at 3 different dates during the growing season for both 2016 and 2017. Total DNA was extracted from sample washes and its 16S rDNA sequenced. Ordination and permANOVA analysis has shown strong effect of the cultural practice for the first sampling date. The most striking difference was observed for the cover crops treatments where the diversity was the highest at the first sampling date. Our current work involves the investigation of specific taxon correlated to the decrease in P.syringae populations. We also measured gene expression from squash leaves. Plant expression profiles display strong correlation with treatments. The exploration of marker genes related to plant resistance is in progress.

Executive Forum Afternoon Session: Vegetables and Row Crops, *cont.*

4:00 – Planting Green: *Glycine max* Benefits, *Zea mays* lets you down

Speaker: Heidi Myer[1]*, Heather Karsten[2], William Curran[2], John Tooker[3], Sjoerd Duiker[2]
Affiliation: [1]Penn State University Extension; [2]Dept. of Plant Science, Penn State University; [3]Dept. of Entomology, Penn State University

Abstract

Planting green (PG), or delaying cover crop termination until cash crop planting, is growing in popularity and may allow farmers to get more biomass and ecosystem services out of their cover crops. However, the impacts of this practice on mid-Atlantic grain production are not well quantified, so we examined PG at four sites with corn (Zea mays, L.) and five sites with soybean (Glycine max, L.) for three years in central and southeastern Pennsylvania. Treatments were early-killed cover crops or PG. We hypothesized that PG would i) increase cover crop biomass, and cool and dry soil at planting; ii) reduce slug damage on cash crops; and iii) not reduce cash crop yield. Our results partially supported our hypotheses. Planting green increased cover crop biomass 94% to 181% compared to early-kill. Except for two site-years, soil was 8% to 24% drier, and 0.7 to 2.4°C cooler at planting in PG compared to early-kill. Slug damage was not different, lower, or higher in PG corn, and not different or lower in PG soybeans compared to early-kill. Corn yield was reduced by PG in higher yielding environments, but there was no difference in low yielding environments; conversely, soybean yield was stable across environments, and not affected by treatments. We conclude that corn was more vulnerable to yield losses from conditions created by PG than soybeans; therefore, growers can plant soybeans green and get more benefits out of their cover crops with lower risk than corn.

Executive Forum Afternoon Session: Vegetables and Row Crops, *cont.*

4:30 – Improving Cover Crop Performance when Interseeding into "Big Corn"

Speaker: Ron Hoover[1]*, William Curran[1], Greg Roth[1], John Rowehl[2]

Affiliation: [1]Dept. of Plant Science, Penn State University; [2]Penn State University Extension

Abstract

Interseeding cover crops into an establishing row crop is one way farmers can ensure that fields enjoy the benefits of cover cropping after the row crop is harvested. Most of the focus of interseeding has been in corn, especially corn planted for grain production, as grain harvest in most of Pennsylvania is often so late that few cover crop species are able to be successfully established via full-width drilling after corn harvest and before winter commences. The practice has been found to be very successful when cover crops are interseeded when corn is at the V-5 to V-6 stages of development in central and northern PA. However, the practice is less successful in southern and eastern PA where the growing season is longer and corn yields are greater. We speculate that greater stress that is imposed on the establishing cover crop necessitates earlier interseeding, relative to the development of the corn, to allow it to become better established prior to the onset of the stresses associated with surviving under a high-yielding corn crop. Several on-station and on-farm trials have shown that when the competition from the corn crop and environmental stresses are greater, interseeding at an earlier stage of corn development allows the interseeded cover crop to better establish. This additional time allows the cover crop to become larger and better able to recover after a heavy corn canopy senesces, without so much competition from the cover crop that row crop yields are reduced.

Director's Room Afternoon Session: CC Mixtures

3:30 – Planting date and nitrogen availability drive cover crop mixture expression

Speaker: Barbara Baraibar[1]*, Brosi Bradley[1], Charlie White[1]
Affiliations: [1]Dept. of Plant Science, Penn State University

Abstract

Mixing cover crop species in a mixture can be a way to expand the number of functions or services a cover crop can provide. Cover crop mixtures are becoming more popular among crop grain farmers who look for multiple services from their cover crops, such as weed suppression, nutrient supply and retention or increase organic matter. However, seeding a mixture does not always result in getting a mixture established in the field. The same five species cover crop mixture (triticale, Austrian winter pea, canola, crimson clover and red clover) was planted in 20 ft by 45 feet plots at 3 different planting dates (August 7th, August 22nd and September 12th 2017) and with or without the addition of Chilean Nitrate in an organic field in central Pennsylvania. The experiment was a randomized split – plot design with 4 replicates. Biomass of each cover crop species and weed biomass were measured in the fall and in spring by clipping all plants in two 0.25 cm quadrats per treatment. In the fall, increasing growing degreed days significantly increased cover crop biomass but did not alter mixture composition except on the mixtures planted in September. Nitrogen addition changed the composition of the mixture decreasing the biomass of legume cover crops and of triticale and favoring canola. Our results suggest that if cover crops mixtures are planted too early, dominant species such as canola can outcompete any other species in the mixture and may jeopardize the provisioning of some of the functions the mixture was designed for. Similarly, high soil nitrogen content can favor non-legume cover crop species and may decrease nitrogen provisioning for the following crop.

4:00 – New Hampshire's Network for On-Farm Evaluation of Cover Crop Mixtures

Speaker: Chad Cochrane[1]*, Brandon Smith[2]
Affiliations: [1]USDA NRCS, Concord, NH; [2]National Soil Health Division, USDA NRCS, Dover, NH

Abstract

In 2017 we established a network of farmers, conservation district staff, university extension educators, and NRCS staff from NH and the Soil Health Division with the goal of evaluating cover crop mixtures on farms throughout the state. The mixes were targeted to different conservation and production systems, and varied by species and growing season. Seeding rates were determined primarily using the NRCS Cover Crop Mixture Calculator. The 5 mixes we developed included: a) late summer 6-way mix with the goal of nitrogen production for vegetable growers, b) 2 early fall 5-way mixes intended to provide high and moderate levels of biomass and ground cover after silage corn, c) early summer 6-way grazing mix, and d) a warm season 7-way mix to build soil health. We will present preliminary data and photographs of the demonstration plots. In addition, we will discuss logistics, considerations, and other "lessons learned" for conducting statewide on-farm trials with multiple partners and more complex seeding methods, including cost effectiveness, species adaptability to climate, balancing ratios between species, seeding dates, and seed distribution.

4:30 – Cover Crop Identity, not Diversity, & Agroecosystem Characteristics Affect the Occurrence of a Beneficial Soil Fungus

Speaker: Mary E Barbercheck[1]*, P. Randhawa[1], C. Mullen[1]
Affiliations: [1]Dept. of Entomology, Penn State University

Abstract

Winter cover crops add diversity to agroecosystems and can benefit regulation of arthropods. We examined the effects of crop, cover crop species and diversity, arthropods, agronomic management and soil properties on the occurrence of Metarhizium, an insect pathogen and beneficial plant endophyte. M. robertsii was the only species detected, and therefore, cover crop diversity was not related to Metarhizium diversity. Detection of M. robertsii was lower in monocultures and mixtures containing brassica cover crops compared to those with legume cover crops. M. robertsii was detected more frequently in corn than in soybean, and in standing cover crop (pre-termination) compared to post-cover crop termination samples in the corn phase of the rotation. Cover crop biomass in the previous fall, the biomass of weeds in the current season (spring), percent silt, electrical conductivity, and activity-density of ground beetles were positively associated with and together explained 28.32% of the variation of percentage mortality of sentinel insects by M. robertsii in pre-termination samples. In post-termination samples, soil labile C and electrical conductivity were positively associated, and activity-density of mites and percent sand were negatively associated with M. robertsii and together explained 21.92% of the variation in detection of M. robertsii. The complex interactions of multiple biotic and abiotic factors that shape the soil community require further research to develop an understanding of how to manage production systems and practices to promote and conserve biological control in the soil.

Poster Session

Posters will be on display all day November 15; authors will be present 9:40-10:40.

Assessing the Impact of Soil Moisture on Potassium Nutrition in an Organic Cover Cropping System

Authors: Nancy Y. Bao[1]*, Jason P. Kaye[1], Brosi M. Bradley[1]
Affiliations: [1]Dept. of Ecosystem Science and Management, Penn State University

Abstract

As one of the essential macronutrients supplied by the soil, potassium is critical in plant metabolism and defense mechanisms against abiotic and biotic stresses. In conventional and sustainable agricultural production, potassium is a crucial component in fertilization to ensure optimal crop growth and development. Crop quality is dependent on a myriad of factors corresponding to water and nutrient uptake which are linked to potassium regulated pathways. To better understand controls on soil exchangeable potassium, the main source taken up by plants, this study investigates the effects of soil moisture levels across different growing seasons on potassium acquisition in cover crops of an organic cropping system. We are conducting an exploratory data analysis linking hourly volumetric water content readings with potassium concentrations in the aboveground biomass of seven cover crop species: oat, radish, pea, red clover, crimson clover, cereal rye, canola. The data were collected from an ongoing study conducted in an organic cropping system which follows a soy-wheat-corn rotation with cover crops planted after wheat and before corn. Our goal is to understand how soil moisture, and specifically cover crop impacts on soil moisture, affect K uptake by plants. These analyses will provide further insight to how different cover crop treatments and soil conditions may alter plant potassium acquisition for fine tuning nutrient management plans and improving cover and cash crop quality and yields.

Crediting Cover Crops and Soil Organic Matter in a Variable Rate Nitrogen Fertilizer Prescription

Authors: Matthew Rellaford[1]*, Charles White[1]
Affiliations: [1]Dept. of Plant Science, Penn State University

Abstract

Our research addresses the challenge of spatially crediting cover crop N to a following cash crop in three production-scale fields in central Pennsylvania. First, we measured soil electrical conductivity (EC) in the fall with a Veris 3100 sensor, after which a grass monoculture cover crop was then planted. At cover crop burndown in the spring, we collected the Normalized Difference Vegetation Index (NDVI) across the field with a GreenSeeker crop sensor.

Using GIS and statistical software, these data were then interpolated and clustered into unique zones with similar NDVI and EC characteristics. Each of these zones contained at least one soil sampling site (at a 20 cm depth), from which actual soil texture and organic matter were determined. In addition, a cover crop biomass sample was taken from each zone prior to burndown enabling the determination of cover crop C:N content. Soil texture, organic matter, and C:N ratio were then factored into the respective zones from which they were taken. For each zone, these data were input into an equation predicting the N mineralization and subsequent corn yield that would result without fertilization. This predicted yield was then

subtracted from a target yield for each field, resulting in a yield gap. This yield gap was then input into a prescription map for a variable nitrogen rate. After cover crop burndown, corn was planted. Based on the projected yield gap, a variable rate side-dress application of UAN (30-0-0) was made.

Nitrogen Equivalence of Cover Crops and Corn Yields: A Statistical Review

Authors: Guillermo Marcillo[1,2]*, Resham Thapa[3], Steven Mirsky[2]
Affiliations: [1]Dept. of Crop and Soil Science, North Carolina State University; [2]USDA ARS Sustainable Agricultural Systems Lab, Beltsville, MD; [3]Dept. of Plant Science and Landscape Architecture, University of Maryland

Abstract
Nitrogen contribution of cover crops may reduce N inputs on subsequent grain crops. Nutrient cycling due to cover crops is species specific and finding management options to maximize N release and uptake by cash crops is needed. In view of largely unknown mechanisms governing cover crop abilities to provide maximum N for subsequent corn yields , we propose a statistical assessment of field experiments where N dynamics, N plant content, and production outcomes (i.e. biomass and yield) were reported across different environments and cover crop strategies. It is hypothesized that the yield difference between unfertilized corn with a cover crop against fertilized corn without covers increase as levels of plant available nitrogen also increase (Top-60 cm Soil N-NO3 + cover crop N-content). Also, it is expected strong moderation of diverse cover crop tactics in such an effect, such as planting and termination dates as well as cover crop contents in till vs. no-till systems. By elucidating how diverse cover crop systems affect N dynamics and N availability, we contribute to providing growers with better field recommendations.

Interseeded Cover Crops: Evaluating Nitrogen Retention Services Provided by Plant-Microbe Relationships

Authors: Sarah Isbell[1]*, Jason Kaye[1]
Affiliations: [1]Dept. of Plant Science, Penn State University

Abstract
Nitrate leaching from agricultural land is not only a source of pollution, but also represents an economic loss for farmers. Cover crops (CC) can be used to reduce nitrate leaching, however establishing a CC after a corn harvest can be difficult in the Northeast because of the limited window for fall plant growth. One solution to this constraint is to establish a CC by interseeding into a standing corn crop in mid-summer. There is little scientific information to document the magnitude or mechanisms of change in the nitrogen (N) cycle from this practice in organically managed systems. We hypothesize that interseeded CCs will reduce N losses in a corn cropping system through increased nutrient retention in the CC and the associated soil microbial community during periods when N is most susceptible to loss. To test this, an ongoing factorial field experiment includes three CC treatments and two rates of fertilizer application in an organic corn system. CC treatments include no CC, a post-harvest cereal rye CC, and an interseeded annual ryegrass CC. Differences in CC N retention, soil inorganic N dynamics, and microbial community composition are being measured. Additionally, analyses of soil bacterial community diversities as well as abundances of key N-cycling bacteria between treatments will allow us to better

understand the role of soil microbial communities in N dynamics.

Getting Legume Cover Crops to Work in Mid-Atlantic Field Crop Rotations: First Year Results

Authors: Cara Peterson[1,2]*, Steven Mirsky[1], Kate Tully[2], Victoria Ackroyd[1,2]
Affiliations: [1]USDA ARS Sustainable Agricultural Systems Lab, Beltsville, MD; [2]Dept. of Plant Science and Landscape Architecture, University of Maryland

Abstract
In the mid-Atlantic region, the inclusion of double-crop soybean in wheat-soybean-corn rotations limits legume cover crop adoption due to the shortened window for establishing cover crops after the soybean harvest. Double-crop soybeans are harvested in mid-November; however, legumes must be seeded by early October in this region to ensure establishment and high biomass production. This limitation is problematic because a cereal rye-legume cover crop mixture could provide erosion control in the fall and winter and nitrogen to the following corn crop in the spring. The purpose of this project is to evaluate a novel cover crop interseeder technology, which allows growers to drill cover crops into a standing soybean crop. This practice could transform growers' ability to integrate legume cover crops into a grain rotation and offset inorganic nitrogen fertilizer needs in the corn phase. However, it would require transition from a narrow-row soybean spacing (7.5 - 15 in) to a wide-row spacing (30 in). Specific objectives of this study include: 1) quantify the effect of row spacing (15 in vs. 30 in) on double-crop soybean yield; 2) evaluate the effect of interseeded cover crops on wide-row double-crop soybean yield and harvestability; 3) determine the legume species which, in combination with cereal rye in wide-row double-crop soybeans, produces the largest amount of cover crop biomass; 4) quantify nitrogen contribution of cover crop mixtures to corn yield; and 5) calculate the economic impact of cover crop inclusion during the double-crop soybean to corn phase.

Cover Crops and Manure Incorporation

Authors: Leon Ressler[1]*, Ron Hoover[1]
Affiliations: [1]Penn State University Extension

Abstract
Penn State Extension and Sustainable Chesapeake partnered with and Jeff Zimmerman of Agri-Applicators Inc. to demonstrate the benefits of manure injection in no-till situations with a cover crop. The advantages of manure injection include nitrogen retention, odor reduction, reduction in the risk of manure runoff and related phosphorus losses to surface water. In situations where manure supplies all the nitrogen needs the nitrogen retention means less manure is needed and therefore phosphorus application will be reduced. In situations where part of the nitrogen need is from fertilizer the nitrogen retention will mean a reduction in nitrogen costs. The goal of the project was to encourage manure injection on farms where no till and cover crops are currently practiced. Funding was secured through the National Fish and Wildlife Foundation's Chesapeake Bay Stewardship Program (a partnership with EPA's Small Watershed Grants Program) to Pennsylvania. As a result of this grant, Agri-Applicators upgraded a recently purchased low-disturbance VTI manure injection system so that they can provide precision liquid manure injection services. The grant also allowed Agri-

Applicators to offer producers willing to try manure injection on a limited number of acres the opportunity to do so at the same rate they pay for surface application. This poster will review the results of the project in 2018, data from a silage plot, and photos of the minimum soil disturbance with the injection equipment used.

The Erosion Protection Potential of Different Cover Crops under High-Intensity Rain Conditions

Authors: Catalina Mejia[1]*, Jason Kaye[1]
Affiliations: Dept. of Ecosystem Science and Management, Penn State University

Abstract

Climate change pressures will likely lead to higher rates of erosion in the US due to higher rain intensities (Walthall et al. 2013). Though erosion mitigation has always been important to farmers and agricultural researchers, the observed and projected increase in precipitation intensity and frequency in the mid-Atlantic region (Shortle et al. 2015) make the need for erosion protection and pollution mitigation from agricultural fields all the more critical. Cover crops could serve as a key management tool to help farmers mitigate and adapt their fields to the precipitation challenges posed by climate change. By building a data-rich understanding of how different cover crops serve that mitigation/adaptation role, successful implementation of this tool could be maximized. We used rain simulators, built and tested by the USDA Agricultural Research Service (USDA- ARS), to apply high-intensity rain to different cover crop-covered plots and characterize the resulting runoff. Three sets of rain simulations were conducted between Fall 2017 and Spring 2018. The resulting data is being analyzed to assess whether there are significant differences in the erosion and pollution mitigation potential of the three different cover crops chosen for this study (oat, radish, and pea).

Impact of Cover Cropping Systems on Soil Health and Yield

Authors: Lindsey Ruhl[1]*, Heather Darby[1]
Affiliations: [1]University of Vermont Extension

Abstract

Starting in 2007, Borderview Research Farm in Alburg, Vermont has hosted a trial examining the impact of common forage crop systems on yield and soil health. Presented here is data from the last five years showing the effect of these systems on soil health and yield of corn silage planted in management systems employing no-till, winter cover crops, continuous corn, and continuous corn in a rotation with perennial forage. Soil health and yield of tall fescue, Festuca arundinacea, is included for comparison. Preliminary data shows perennial forage systems had the lowest yield and overall highest soil health score and despite corn systems with cover crops having overall soil health ratings, they consistently had the higher yield. Furthermore, there was no observed significant year by treatment interactions. However, yield and soil respiration did vary by year.

Cover Crop Mixtures: How Does Variation in Mixture Expression Impact Nitrogen Dynamics

Author: Brosi Bradley[1]*
Affiliation: [1]Dept. of Ecosystem Science and Management, Penn State University

Abstract
Exploring results of planting identical 5 spp. cover crop mix at 8 different organic grain farm locations across PA and Southern NY. Specifically how the mixture expression of the cover crops based on climate, soil conditions, and fertility at the farms drives the soil nitrogen dynamics in terms of both potential leaching and nitrogen supply to following corn crop.

The Effect of Cereal Rye Termination Date on Germination, Growth, Density and Seedbank of Pigweed (*Amaranthus hybridus* L.) in No-Till Soybean Systems

Authors: Cara Peterson[1,2*], Kreshnik Bejleri[3], Steven Mirsky[1]
Affiliations: [1]USDA ARS Sustainable Agricultural Systems Lab, Beltsville, MD; [2]Dept. of Plant Science and Landscape Architecture, University of Maryland; [3]Dept. of Environmental Science and Technology, University of Maryland

Abstract
This study focuses on the effect of cereal rye on pigweed germination, growth and density in soybean. Two herbicide management practices were implemented, conventional and a low herbicide program to simulate a herbicide-resistant weed. Cereal rye management treatments consisted of no cover crop, early termination and late termination. Early and late terminations of cereal rye resulted in different dry biomass weights and levels of pigweed suppression. The effect of the timing of cereal rye termination on soybean yield was also studied. By terminating cereal rye at a later date, farmers will not only benefit from improving the physical and chemical properties of soil, but will have a more effective tool for controlling weeds.

Growth Promotion of Cover Crops by Beneficial Soil-borne Fungi

Authors: Imtiaz Ahmad[1]*, Mary E. Barbercheck[1], Dawn S. Luthe[2], Maria Jimenez-Gasco[3]
Affiliations: [1]Dept. of Entomology, Penn State University; [2] Dept. of Plant Sciences, Penn State University; [3]Dept. of Plant Pathology and Environmental Microbiology, Penn State University

Abstract
Organic farmers rely largely on cultural practices, such as crop rotation, cover cropping, and on biological control to manage pests. Cover crops add diversity to agroecosystems and can benefit soil conservation and health, retention and supply of soil nutrients, regulation of arthropods, and crop yields. Soil is home to millions of microbes with diverse functions. Soil-borne beneficial fungi, Metarhizium, belongs to a group of fungi that can live outside and within a variety of plants without causing harm. Metarhizium can kill susceptible insect pests, provide protection against plant diseases, and improve nutrient availability. These fungus-plant interactions can ultimately result in crop growth promotion and biological control. We conducted a greenhouse study to evaluate the degree to which Metarhizium live and grow inside the root and leaf tissues of canola, Austrian winter pea and cereal rye at 30 days after germination. Re-isolation of Metarhizium from plants grown from Metarhizium-treated seeds was more frequent from

roots than from leaves in all crop plants. Metarhizium detection frequency was greater in Austrian winter pea than cereal rye and canola plants. We also evaluated the growth promotive effects of Metarhizium on cover crop height, leaf greenness, and above-ground biomass. We found that Metarhizium seed treatment increased plant height and above-ground biomass of cereal rye and Austrian winter pea, whereas it increased biomass of canola plants as compared to non-treated plants at 30 days after germination. We did not find a significant effect of Metarhizium on leaf greenness in any of the cover crops under study. Metarhizium can help plants grow by an array of mechanisms. These newly emerging, but not yet fully understood, ecological roles hint at the potential for the further development of Metarhizium as an inundative biopesticide and protective seed coating. The complex interactions of multiple biotic and abiotic factors shape the soil microbial community and require further research to develop an understanding of management practices and environmental conditions that promote and conserve biological control for better soil health

Cover Crop Decomposition in No-till Corn Fields: Controlling Factors

Authors: Resham Thapa[1]*, Steven B Mirsky[2], Katherine Tully[1], Harry H. Schomberg[2], S Chris Reberg-Horton[3], Julia W. Gaskin[4], Miguel L. Cabrera[5]

Affiliations: [1]Dept. of Plant Science and Landscape Architecture, University of Maryland; USDA ARS Sustainable Agricultural Systems Lab, Beltsville, MD; [3]Dept. of Crop and Soil Science, North Carolina State University; [4]University of Georgia Extension; [5]Dept. of Crop and Soil Sciences, University of Geogia

Abstract

Cover crops play a critical role in nitrogen management in cropping systems, both as N scavenger while growing and as N supplier after termination. The rate of cover crop decomposition (k value) and subsequent release of N depends on several interacting factors such as latitude, climate (temperature and moisture), and cover crop quality (C/N ratio, cellulose, hemi-cellulose, carbohydrate, and lignin content). To assess the relationship between the k values and controlling factors (latitude, climate, cover crop quality), cover crop decomposition studies were conducted in 70 no-till corn fields using litter bag approach across Maryland, Pennsylvania, North Carolina, South Carolina, and Georgia during 2017 and 2018 growing seasons. Our results indicated that the k values were not affected by latitude suggesting that the k values were either cover crop (quantity and quality) or climate dependent. The k values tended to decrease with cellulose, hemi-cellulose, and lignin content but increased with carbohydrate and N content of the cover crop residues. We hypothesized that the combination of climate and cover crop quality variables would further improve estimation of cover crop decomposition rates (k values).

Evaluation of 10 Cover Crop species for Productivity and Shade Tolerance when Inter-Seeded into Continuous Corn Using a High-Clearance Drill at the V5 Stage

Authors: Van Ryan Haden[1]*, Christopher Yost[1], Bernard Keuther[1]
Affiliations: [1]Agricultural Technical Institute, Ohio State University

Abstract
In the northern regions the US Corn Belt, the narrow planting window between corn harvest and the arrival of winter can pose a significant barrier to the establishment of many cover crops. Recent studies show that inter-seeding cover crops into corn at the V3-V6 stage may allow farmers to overcome this constraint and thus allow for a broader range of cover crop species to be planted on more acres. In order for cover crops to be successful when inter-seeded at the V3-V6 stage, an ideal species must be able to establish quickly and then tolerate several months of shade beneath the corn canopy. For farmers it is also crucial that the yields of their corn crop are not adversely impacted by the presence of the inter-seeded cover crop. In this study we present the results of a 2-year field trial conducted in northcentral Ohio, which evaluates the productivity of 10 cover crop species (red clover, crimson clover, balansa clover, berseem clover, subterranean clover, hairy vetch, radish, collard, annual ryegrass, and cereal rye) when inter-seeded into continuous corn at the V5 stage using a high-clearance drill. For each cover crop species we measured fall and spring biomass, percent green cover and grain yield for continuous corn over the 2016 and 2017 seasons. We also present the findings of a greenhouse experiment which examined the growth of each of the 10 cover crop species over a 60-day period, when subject to 4 levels of shade (100%, 70%, 50% and 10% of ambient light) applied using various grades of polyethylene shade cloth. The implications regarding which cover crop species are most compatible with inter-seeding practices will be discussed.

Cover Crop Mix Seeding Rate Calculator for the Systematic Development and Evaluation and Development of Cover Crop Mixes

Author: Paul Salon[1]*
Affiliation: USDA NRCS, Big Flats, NY

Abstract
An excel cover crop mix calculator will be demonstrated which uses competition factors to adjust seeding rates of species within mixtures for specific purposes. Rates for similar species are reduced to avoid increasing seeding rate. The competition factor is a percentage multiplied against a set monoculture rate which determines: 1) the seeding rate in lb/ac and seeds/ft2 for each species, and 2) percent by lb/ac and seeds/ft2 for the mix. This calculator is designed to be transparent so that species ratings and competition factors can be modified for different regions, new purposes and seeding methods. Species and exact costs can be easily added and adjusted.

Assessment of a Tool for Cover Crop-Based Nitrogen Management

Authors: Anthony Colin[1]*, Charles White[1]
Affiliations: [1]Dept. of Plant Science, Penn State University

Abstract

Although legume, non-legume species, and mixtures of the two are now routinely used to supply and retain nitrogen (N) within cover crop rotations, effective utilization of these practices necessitates access to an accurate and robust means of estimating their services. White et al. (2017) reports the development of a graphical tool that utilizes routine measures, such as soil fertility testing, publicly available weather data, and easily-obtained measures of cover-crop performance to estimate N retention and supply. We aim to evaluate and improve the performance of this tool in estimating adjusted N-requirements, especially in comparison to some other commonly used methods such as Pre-Sidedress Nitrogen Testing, and other conventional methods of crediting in-field nitrogen contributions. While this tool is currently calibrated for corn grain and silage, there remains the possibility of expansion to other economically important agronomic and horticultural crops. Such tools will become increasingly vital as farmers continue to adopt environmentally and economically considered N management practices.

Increasing Cover Crop Adoption in Maine Corn Silage Systems: Lessons Learned from On-Farm Research and Demonstration

Authors: Caragh Fitzgerald[1]*, Richard Kersbergen[1], Laura Lecker,
Affiliations: [1] University of Maine Cooperative Extension; [2]Somerset County Soil and Water Conservation District

Abstract

This three-county, collaborative project was conducted from 2014 – 2017 by the Soil and Water Conservation Districts from Kennebec, Waldo, and Somerset, as well as the University of Maine Cooperative Extension. With the help of cost-share funds, on-farm research, and education/outreach, 16 cooperating farmers planted over 900 acres of winter cover and used no-till for the first time on over 700 acres. Of the 18 fields with paired treatments (cover crop and no cover crop), only 7 made it to the second year of the project. These did not show statistically different yield (AOV, p=0.05) or improved soil quality (organic matter, active carbon, potentially mineralizable N, particulate organic matter, water-stable aggregates, and plant-available water) (one-tailed t-test, p=0.05), in part due to poor cover crop stands. We will discuss challenges with this type of on-farm, farmer-managed research. Observations of and challenges with fall-seeded and inter-seeded cover crops in Maine's short growing season will also be discussed.

Comparative Analysis of Cover Crop Incentive Programs in the Northeast

Authors: Barbara Chami[1]*, Matthew R. Ryan[1]
Affiliations: [1]Soil and Crop Sciences Section, Cornell University

Abstract

Farmers are increasingly interested in planting cover crops to improve soil health, reduce nutrient losses, and enhance pest suppression, and government agencies support the use of cover crops by offering cost-share programs. This research seeks to compare cover crop incentive programs and adoption rates in Maryland, New York, Pennsylvania, and Vermont and

to understand the relationship between farmer adoption and incentive program structure, payment, and restrictions. I will examine existing literature on the barriers to adoption, cover crop incentive programs, and conduct a series of interviews with key stakeholders to understand the various benefits and challenges of participating in cover crop incentive programs. New knowledge generated in this project will be used to develop recommendations to improve incentive programs with the goal of increasing the number of farmers who use cover crops and the amount of farmland that is cover cropped in the Northeast. Because cover cropping can improve soil health, help farmers to manage pests and weeds, this research will tackle one of the most significant challenges facing the United States: regenerating soil health and increasing crop viability.

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