Midwest Cover Crops Council

2023 Annual Meeting – Sioux Falls, SD

Poster Session Abstracts

Poster #1 Mila Victorio Pessotto

Estimating Cereal Rye (Secale cereale) Biomass Accumulation Using Visual Obstruction.

Cover crops can bring several benefits to the environment they are in, and most of these benefits are directly related to above and belowground biomass. Cereal rye (Secale cereale) is one of the main species used as cover crops in the Midwest (US). The amount of cereal rye residue can influence corn establishment and productivity, so estimating its biomass is important for farmers. And even with all the benefits brought by the cover crop to the system, research has shown that too much cereal rye can have a negative impact on corn production when the biomass is greater than 840-1400 kg/ha. Farmers do not have an easy way to measure or estimate their cover crop biomass accumulation at the moment. This pilot study indicates the use of visual obstruction (a method commonly used for vegetation assessment in rangeland management) is a viable 'quick' indicator of cereal rye biomass accumulation. The results of this study showed using crop height as a biomass indicator is more reliable after 10 cm. In addition, there is a correlation between crop height and biomass accumulation. The use of the Robel pole as an indicator of biomass residue seems promising and could become a reliable method for farmers to use.

Poster #3 Kendra Stahl

Evaluating Cover Crops Effect on Soil Physical Properties in a Long-Term Cover Crop Study in Kansas

Cover crops and no-till have been demonstrated to improve soil physical properties, such as water stable soil aggregation; however, there has been less research on the effects of P fertilizer timing and placement. The Kansas Agricultural Watershed (KAW) field laboratory near Manhattan, Kansas was established in 2014. The soil at the site is mapped as a Smolan silty clay loam with 6-8% slope. The experiment was a 2 × 3 factorial design with two cover crop treatments (with and without) and three phosphorus fertilizer treatments (none, spring injected P, and fall broadcast P). The field lab contains 18 watersheds that are about 1.2 acres each, and each watershed contains 3 subplots that were sampled. It has been hypothesized that cover crops will increase soil physical properties and assist in the uptake of phosphorous fertilizer. Water stable aggregate samples were collected for the 0-5 and 5-10 cm depths in 2017, 2018, 2019, and 2022. The results of water stable aggregates on cover crops and P treatments will be evaluated together to determine the combined effects of soil physical properties and soil management on soil aggregation.

Poster #4 Alexis Correira

Cover Crop Selection and Nitrogen Impact Corn Yields in a Long-Term Study

Cover crops are used in large agricultural systems to promote soil health and reduce weed presence. The benefits of cover cropping are still being investigated by educational institutions, farmers, and agribusinesses nationwide. It can take several years to notice any significant differences in soil health as a result of cover cropping, but annual yield data can aid in understanding how cover cropping impacts cash crop productivity and profitability. The long-term cover crop experiment in Ashland Bottoms was established in 2007, where 6 cover crop treatments (chemical fallow, cereal rye (Secale cereale), crimson clover (Trifolium incarnatum), a mix of cereal rye and crimson clover, double-crop soybean (Glycine sp.), and a diverse seven species mix) were planted in late summer after wheat harvest. Five nitrogen fertilizer rates (0, 40, 80, 160, 240 kg N ha-1) were investigated, with 40lb applied at planting and the balance applied in season when the corn was at V5. Results of this experiment for 2021 indicate a significant interaction between cover crop and nitrogen fertilization rate. Additionally, we determined the nitrogen fertilizer replacement value for all cover crop treatments were negative except for the double-crop soybean, suggesting that some cover crop species may immobilize soil available nitrogen rather than leave legacy nitrogen for the following cash crop.

Poster #5 Tauana Ferreira de Almeida

On-farm impacts of cover crops on soil moisture, temperature and crop yield in Nebraska

Cover crops are known to improve soil physical conditions, such as increasing water infiltration. However, their effects on water use and retention in the subsequent cash crop growing season vary between sites and seasons, often causing concern for producers in less humid regions. The objective of this study was to investigate the influence of cover crops on the volumetric water content (VWC) and soil temperature under two soil depths (5 and 15 cm), as well as to evaluate the crop yield following cover crop and bare soil treatments at two on-farm locations in Nebraska during 2021. Moisture sensors were installed two to five days after planting the cash crop and removed from the field two to four days before harvesting. Soil temperature at 5 and 15 cm of soil depth, and VWC at 5 cm of soil depth were recorded throughout the cash crop growing season at two farms. While VWC at 15 cm of soil depth was recorded at one farm. There was no difference in the soil temperature between treatments and farms in either of the depths. The VWC also did not differ between treatments and farms at 5 cm of soil depth. However, we found the cover crop treatment to have higher VWC at the 15 cm of soil depth when compared to the bare soil treatment. The soil under the cover crop treatment retained water longer after the rain events when compared to the bare soil treatment. There was no difference in the cash crop yield following the cover crop and bare soil treatments in no one of the farms. This research showed that the incorporation of cover crops in the system can improve soil water retention without affecting corn and soybean yield in Nebraska.

Poster #6 Dale Penner

Exploring the On-Farm Agronomic and Economic Impacts of Fall Season Cover Crops in Manitoba

Exploring the On-Farm Agronomic and Economic Impacts of Fall Season Cover Crops in Manitoba.

Penner D.E.1,2, Lawley Y.E.1, Zhao J.2. 1Department of Plant Science, University of Manitoba, Winnipeg, MB; 2Agriculture and Agri-Food Canada, Ottawa, ON.

Cover crops are grown to protect and improve soil during periods when cash crops are not being grown. Cover crop adoption in Manitoba has increased in recent years, largely due to farmers increased interest in soil health building practices. Limited on-farm research on the agronomic and economic impact of growing cover crops in Manitoba is a barrier to further adoption. On-farm experiments with four replicates of paired field length plots were conducted at six sites across southern Manitoba from 2019 to 2021. Participating farmers followed their standard annual grain rotation and added complimentary fall season cover crops for each site year. Fall cover crop treatments were compared to the farmer's standard management practice without cover crops. The accumulation of fall aboveground biomass, ground cover, and the subsequent cash crop yield was measured. Cover crop and subsequent crop management data was collected from participating farmers to calculate the short-term on-farm economic impact of cover crops. Fall season cover crops had a mean cost of $179 ha-1 with a median cost of $125 ha-1 from twelve site-years. Normalized cash crop yield was significantly lower in the cover crop treatment when cover crops were grown in the preceding fall. The normalized cash crop yield mean was 0.98 in the cover crop treatment and 1.02 in the control treatment. Fall cover crop establishment and growth during the study period was challenged by both dry and excess moisture conditions. Mean fall aboveground biomass from eleven site-years was 788 kg ha-1 in the cover crop treatment, while fall volunteers in the control treatment produced 701 kg ha-1. Mean fall ground cover from eleven site-years was 29% in the cover crop treatment versus 16% in the control treatment. This research will provide cover crop cost and impact information to potential adopters. These results can also be used by policymakers to help guide future program development.

Poster #7 Callum Morrison

Cover Cropping on the Canadian Prairies

Cover crops have the potential to bestow numerous agronomic, environmental, and economic benefits on the Canadian Prairies. Despite this, they are often viewed with skepticism by farmers in the region, in part due to local climatic limitations. The recent uptake in cover crop use by farmers in neighbouring US states and Eastern Canada has encouraged Prairie farmers to experiment with cover crops. This makes it an important time to hear from farmers about how they are adapting cover crops to fit Prairie rotations and listen to their needs for research and knowledge transfer. Farmers want to know how to use cover crops to meet their goals, and policy makers want information to design conservation BMP programs to meet environmental targets. To fill these knowledge gaps the 2020 Prairie Cover Crop Survey was developed to provide information to farmers, agronomists, researchers, policy makers, and government organizations. A total of 528 farmers took part, or whom 281 were early adopters of cover crops. Respondents grew 102, 539 acres of cover crops across every major agricultural region of the Prairies. This poster provides information about the current state of cover cropping on the Canadian Prairie including why farms are using cover crops, cover crop agronomy, and what benefits and challenges farms have experienced. This survey of early adopters compliments on-farm and traditional small plot research at the University of Manitoba to understand the short and long-term effects of cover crops on soil health and crop productivity in Prairie Cropping Systems.

Poster #8 Lucas Oliveira Ribeiro Maia

Impact of simulated rainfall on atrazine wash off from roller crimped and standing cereal rye residue onto the soil

The application of soil residual herbicides at cover crop termination is often recommended as part of an integrated weed management strategy. However, cover crop biomass accumulation significantly reduces the amount of residual herbicide that reaches the soil at the time of application. Once intercepted by cover crops, these herbicides can only move to the soil with rainfall or irrigation. To date, limited research has been published on the effect of rainfall on residual herbicide wash off from cover crops onto the soil. A field trial was established at the Throckmorton Purdue Agricultural Center to investigate the influence of rainfall on atrazine wash off from cereal rye (Secale cereale L.) residue onto the soil. The experiment followed a split-plot design with rainfall volumes (0, 12.5, and 25 mm) as the main plot and cover crop orientations (standing and roller crimped) and a fallow control as the subplot. Cereal rye was roller crimped at flag leaf growth stage, the day before herbicide application and rainfall simulation. Atrazine was applied 30 minutes before rainfall simulation. Rainfall was simulated for 20 minutes for all treatments. Filter paper samples were collected one minute after atrazine application to determine how much atrazine reached the soil at the time of application. Plant and soil samples were collected 90 minutes after rainfall simulation to assess how much of the herbicide was washed out from the residue onto the soil. Atrazine concentrations from all samples were measured in a UHPLC. Roller crimped cereal rye resulted in 59% reduction in the amount of atrazine that reached the soil at the time of application. Rainfall simulated at 25 and 12.5 mm reduced atrazine concentrations from standing cereal rye residue by 67 and 38%, respectively, compared to cereal rye that was not subjected to rainfall. Concentrations of atrazine measured in the soil under roller crimped cereal rye subjected to 12.5 mm of rainfall (3.7 ppm) were 90% greater than that measured in the soil under standing cereal rye subjected to 25 mm of rainfall (1.95 ppm). Results from this research suggests that the physical barrier created by the roller crimped cereal rye is intercepting a significant amount of the applied atrazine, however, that residue is providing a “slow release” of the herbicide onto the soil during rainfall. Moreover, under a heavy rainfall event, the roller crimped cereal rye residue protects the soil and reduces herbicide leaching to the groundwater which would, in turn, lead to reduced herbicide efficacy.

Poster #9 Raksha K Thapa

Evaluation of Planting Dates in Winter Pea (Pisum sativum L.) to Optimize Winter Survival and Biomass Production

Winter pea (Pisum sativum L.) is commonly used as a winter annual cover crop with several advantages such as capacity for biological nitrogen fixation, large biomass production, and adaptation across a wide range of environments. While peas have the potential to overwinter in northern regions of the US, they do not consistently do so. While other winter annual legumes perform better at earlier planting dates, winter peas can experience a transition from rosette to upright growth habit leading to reduced winter survival. This study explores interactions between pea genotype and planting date to optimize survival and biomass production in northern locations. The study was planted in Fall 2021 at three locations (Ithaca, NY, St. Paul, MN, and Carrington, ND) representing plant hardiness zones 4a to 5b. The experiment was planted as a split plot design with planting date as the whole-plot treatment (four planting dates between late August and early October) and four varieties (Blaze, Icicle, Windham, WyoWinter). New York and Minnesota sites also planted plots as either monoculture or as biculture with triticale. Traits such as fall emergence, fall vigor, spring vigor, spring stand count, winter damage, biomass, disease incidence and severity, and seed yield were recorded.

Poster #11 Srinadh Kodali

INFLUENCE OF COVER CROP COMPOSITION ON CORN NITROGEN (N) FERTILIZER NEEDS AND CROP (CORN, SOYBEAN) YIELDS Cover crops are often recommended as a valuable practice to develop more sustainable cropping systems. However, interseeding cover crops may change the amount and timing of nitrogen (N) provided to the crop from decomposition (mineralization), which may increase or decrease the N fertilizer required to optimize corn grain yield. This study aims to understand the effect of cover crop composition (single and multispecies) on soil biological measurements, corn N requirements, and corn and soybean yield. A long-term corn-soybean rotation study was established in 2019 in Brookings and Beresford, South Dakota. Treatments consisted of three cover crop treatments (No cover crop, single grass species, and grass/broadleaf mixture) with 4 or 6 N rates for corn ranging from 0-250 lbs.ac-1. Results from 2019 to 2021 indicate that corn with grass cover crop required anywhere from 40 lbs. ac-1 less to 25 lbs.ac-1 more N compared to when no cover crop was grown. In 2 of 4 N responsive site years including a grass/broadleaf cover crop reduced corn yield at EONR (Economical Optimum Nitrogen Rate) by 15-30 bu.ac-1 compared to the grass or no cover crop treatments. In two of three responsive site years including a grass cover crop significantly increased corn yield (15-30 bu.ac-1) at EONR compared to the grass/broadleaf mix and no cover crop and required less N without any significant yield losses. For soybean, interseeding grass or a grass/broadleaf mixture had little to no influence on soybean yield. These results demonstrate that cover crops regardless of composition can be interseeded into soybean without negative yield results, but the effect of cover crop composition on yield and N requirements of corn has been inconsistent in the first three years of this study.

Poster #12 Virginia Janzen

Evaluating fall shoulder season cover crop performance in southern Manitoba

Designing cover crop systems for southern Manitoba is currently underway encouraged by producer interest. The objective of this small plot study was to evaluate the performance of fall seeded cover crops and cover crop effect on a following spring wheat (Triticum aestivum L.) crop. These cover crops are grown to cover the soil between crop harvest in the fall and crop emergence the following spring (the fall shoulder season). The study was conducted from 2018 to 2020 in Carman and Glenlea, Manitoba. The fall shoulder seasons over four site-years varied in length (15 – 71 days) and environmental conditions (growing degree days from 93 – 813 and precipitation from 15 – 267 mm). The performance of cool season annuals (fall rye (Secale cereale L.), oat (Avena sativa L.), field pea (Pisum sativum L.), faba bean (Vicia faba L.), radish (Raphanus sativus L.) and mixture of the aforementioned species) and warm season annuals (Sorghum-sudangrass (Sorghum bicolor (L.) Moench var. sudanese (Piper) Hitchc.) and soybean (Glycine max (L.) Merr.)) were compared in the fall. At a targeted September 1 seeding date, cover crop establishment generally did not differ between species. Biomass production remained low across cool season species (91 to 519 kg ha-1) and low C:N (<18) of that biomass was measured as all plants remained in the vegetative stage. Challenges to optimal cover crop performance included lack of biomass growth, most notably for warm season species, and flea beetle damage to radish was detected in three out of four site-years. Fall rye cover crop negatively affected wheat establishment and growth. Wheat yield decrease following fall rye cover crop ranged from 19 – 36%. These results show that performance is similar between cool season cover crop species when seeded around September 1. The results also highlight the challenges to using fall seeded cover crops in southern Manitoba and the requirement of careful fall rye management when being used as a cover crop.

Poster #13 Grace Pacheco

Evaluating the performance of 18 cover crop varieties using aerial imagery and aboveground data in Eastern Nebraska The use of aerial imagery as a non-invasive agronomic method to assess cover crop performance has gained popularity in recent years. Through the use of cover crop variety trials set up across the state of Nebraska, we can examine the relative performance of a range of species and cultivars and determine the efficacy of this technology for predicting cover crop performance. The purpose of this study was to evaluate and compare above ground measurements with UAV imagery of multiple warm season cover crop species and cultivars. Species and varieties in the experiment included monocultures and mixture of the following: Sorghum-Sudan (Queen Bee, WS902, Super Sugar), Sudangrass (Piper), Sorghum (WS404, Bundle), Pearl millet (Tifleaf), Foxtail millet (German), Cor (BMR grazing), Sunnhemp (Sunnhemp), Cowpea (Iron and Clay), Buckwheat (Mancan), Sunflower (Black Oil). We used the drone Phantom 4 Pro with a multispectral camera, including NIR and NDRE sensors, to measure NDVI during three different times of the study: at planting time, five weeks after planting and at final biomass sampling. The cover crops aboveground measurements that were evaluated were plant count, plant height, biomass production, and total carbon and nitrogen. Cover crops were planted following wheat harvest at the Rogers Memorial Farm, a non-irrigated site in Lincoln, Nebraska in July 2022. Preliminary results will be presented as we explore the efficacy of aerial imagery technologies to gauge or predict cover crop aboveground growth and characteristics.

Poster #14 Varshith Kommineni

Soil Health Response to Biochar and Organic Manure Amendment's in South Dakota Cover Crop Systems

gricultural intensification is placing tremendous pressure on the soil's capacity to maintain its functions leading to large-scale soil degradation and loss of soil health in the long term. Soil health is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. Sustainable soil management practices can help in building soil health by reducing the erosion and need for fertilizers, pesticides and herbicides. This includes some practices such as planting cover crops, mulching, crop rotation, and reduced tillage. Biochar application is one of the sustainable soil management practices that is found to be effective in reducing soil loss due to erosion. Biochar can alter the many physiochemical properties of soil that can improve soil aggregate distribution, water holding capacity and soil compaction that results in improving the soil health. There are studies indicating, improving the soil microbial activity can increase the soil health. In some instances, changes in microbial populations or activity can precede detectable changes in soil physical and chemical properties, thereby providing an early sign of soil improvement or an early warning of soil degradation. The objective of this study is to determine the response of soil health and nutrient dynamics to biochar applications and improving the microbial activity in the sustainable cover crop practicing regions of South Dakota. This research was started in fall 2022 and the results are anticipated to be positive.

Poster #15 Eric Yu

Impact of Cereal Rye Cover Crop Seeding Rate and Termination Timing on Weed Management in Soybean in Minnesota

Fall-planted cover crops can outcompete weeds in the spring and provide early-season weed control. However, weed suppression is dependent on cover crop biomass, termination timing, and weed emergence periodicity. Although cover crops are gaining traction in Minnesota, data on critical cover crop biomass production for weed suppression is limited in the Upper Midwest. The objective of this study was to evaluate the effect of cereal rye (CR) cover crop seeding rate and termination timing on CR biomass production, weed suppression, and soybean yield in Minnesota. Field studies were conducted in 2021-2022 at a farmer's field in Rochester, MN. Soybean was planted on two different dates (early and late) and CR seeding rate treatments included 0, 67, 101, and 135 kg ha-1. Termination timing treatments were: 7 days before soybean planting (T1); at soybean planting (T2); at soybean planting with PRE (T2+PRE); and 7 days after soybean planting (T3). The seeding rate did not affect CR biomass production and weed control; however, differences were observed between soybean planting date and termination timing. At 42 d after planting (DAP), common lambsquarters (Chenopodium album) control was highest (89 to 99%) in termination treatments T2, T2+PRE, and T3 in late-planted soybean, which was similar to T2+PRE (91%) and T3 (87%) in early-planted soybean. Similarly, yellow foxtail (Setaria pumila) control was highest (95 to 98%) in T2, T2+PRE, and T3 in late-planted soybean, which was slightly better than T2+PRE (81%) and T3 (85%) in early-planted soybean. Despite greater weed control, soybean yield was negatively impacted in the late soybean planting date. Therefore, CR at 67 kg ha-1 terminated at T3 in an earlier soybean planting date is recommended.

Poster #16 James Matthew Hale

The Effect of Cereal Rye and Balansa Clover Cover Crops on Soil Nitrogen Bioavailability

It is common knowledge now that cover crops improve following growing season yields. Therefore, the purpose of this study was to examine through three selected cover crop treatments, which presented more efficient conversion of organic matter to inorganic plant available forms of Nitrogen. Bulk density core samples were collected in early spring post termination of Balansa Clover and Cereal Rye crops. No cover samples were taken in areas with lesser biomass to preserve accuracy of control group. Core samples were kept at 23 degrees C (plus or minus one degree) for ease of calculating GDDs in respect to development consistencies in the following corn cash crop. Core samples were also maintained to a 40% field capacity threshold moisture content.

Poster #17 Namrata Ghimire

Impacts of cover cropping and livestock integration on soil-hydro physical properties in South Dakota row-cropping systems

Impacts of cover cropping and livestock integration on soil-hydro physical properties in South Dakota row-cropping systems

Namrata Ghimirea, Poulamee Chakrabortyb, Sutie Xua*, Peter Sextona

aDepartment of Agronomy, Horticulture and Plant Sciences, South Dakota State University, Brookings, SD, 57007, USA

bMichigan State University, East Lansing, MI 48824, US

*Corresponding author: sutie.xu@sdstate.edu

Conversion of grassland to cropland has an adverse impact on soil and crop productivity. These conversions demonstrated a reduction in soil organic carbon and a general decrease in soil physical quality. Sustainable agroecosystem management practices, such as techniques improving diversity and livestock integration, are known to improve soil carbon, which enhances the pore structures reducing compaction. The objective of this study is to understand the impacts of integrating cover crops and livestock in rotation systems on soil hydro-physical properties. The experiment was set up at Southeast Research Farm, SD with four treatments: 1) corn-soybean-oat rotation without cover crop or livestock integration (CNT), 2) corn-soybean-oat rotation with cover crops (CC), 3) corn-soybean-oat rotation with cover crops as well as livestock integration (ICLS) and 4) Grazed pasture (GP), replicated four times. The cover crops used were a mixture of grasses, brassicas and legumes whereas cattle were integrated for grazing. Intact soil cores were collected from four depths (0-10, 10-20, 20-30 and 30-40) cm and the image analysis system called X-ray Computed Tomography (CT) scanning was used for analyzing the images of the intact cores. The physical soil health parameters like porosity, number of branches, bulk density, water retention and saturated hydraulic conductivity (Ks) were compared among treatments and depths. The treatments*depths interaction did not show significant results for the measured parameters. However, soil depth significantly impacted the pore structures which were observed higher for lower depths. The bulk density for CNT (1.30 g/cm3) was significantly higher than for GP (1.156 g/cm3). Similarly, the significant treatments effect was observed for water retention where GP, ICLS and CC significantly improved water content for all pressure potentials than CNT. Also, Ks with the value of 0.4941mm/hr. for GP was significantly higher than for CNT. Our study showed that the cover cropping had the potential to improve soil hydro-physical properties while GP outperformed the crop rotation systems in sustaining soil health.

Keywords: branches, corn, oat, porosity, scanning, soil cores, soybean

Poster #18 Bailey Tangen

Assessing the Effects of Agricultural Management Systems on Soil Architecture and Soil Moisture in Southern Minnesota

Soil health management systems that keep a living root in the ground are touted to improve soil hydraulic functions. Here, we investigated the response of soil volumetric water content to rainfall and aggregates under different agricultural management systems. Rainfall can cause physical slaking of aggregates, which can cause the loss of surface pores, reducing hydraulic functions. Soil health management systems have been shown to be correlated with increases in stable aggregates and soil pores but it's not clear if this pore increase moves water move quickly into the soil profile following a rain in fine textured soils in southern MN. Mechanisms aside, structural stability is of avid interest to farmers in temperate regions, where soil health farmers often claim they can get into the field earlier after a rain due to improved soil structure. During 2021 and 2022, we collected data from 5 replicated tillage/cover crop treatments at Southern Research and Outreach Center in Waseca, MN and 3 on-farm pairs representing conventional and soil health systems in southern Minnesota on clay loams and silt loam soils. We monitored moisture content and soil aggregate distribution 24 hours before, 24 hours following and 3 days following several rain events. Soil water behavior was inconsistent across replicated tillage and cover crop treatment plots at the Southern Research and Outreach Center. In some treatments, change in volumetric water content was increased in cover crop plots following seeding compared to no cover but response to rainfall varied across plots. Data was collected at these sites including potentially mineralizable carbon, permanganate oxidizable carbon, infiltration data, and pore distribution. Using these metrics, we hope to link soil health indicators to meaningful soil functions, finishing the analysis in Spring 2023.

Poster #19 Victor de Sousa Ferreira

Greenhouse Evaluation of Corn Preemergence Herbicide Carryover Potential for Early-Season Drill Interseeded Cover Crops

Cover crops can increase soil organic matter content and fertility, prevent erosion, reduce nutrient leaching, and suppress weeds, thus improving soil health and agroecosystem sustainability. Such benefits are intrinsically related to the cover crop biomass production, however, the growing season in Nebraska provides limited time for cover crop growth between harvest and establishment of a subsequent cash crop. Therefore, early-season drill interseeding is a potential solution, as it allows the cover crops a wider window for establishment and growth. The use of preemergence herbicides with soil residual activity is an important management practice in corn production, as they reduce early season weed emergence, weed competition hence reducing yield loss. Nonetheless, the residual effect of such herbicides can interfere and even impede the emergence and growth of cover crops, reaffirming the importance of selecting an effective herbicide program for weed control yet compatible with the cover crops used. The main objectives of the study were 1) elucidate the impact of corn PRE herbicides on cover crop establishment and 2) determine the optimal interval between herbicide application and cover crops seeding. A greenhouse bioassay was conducted in Lincoln, NE to evaluate the effect of preemergence herbicides frequently used in corn on interseeded cover crops and common weed species. Preemergence herbicide treatments were atrazine + S-metolachlor + bicycloprione + mesotrione (Acuron) at 5.84 L ha-1, acetochlor + mesotrione + clopyralid (Resicore) at 5.84 L ha-1, saflufenacil + dimethenamid (Verdict) at 0.58 L ha-1 and the non-treated control. The cover crops were planted at 0, 7, 14, 21, 28, 35, 42, 63 and 70 days after spraying (DAS). The species used in this study were hairy vetch (Vicia villosa), cereal rye (Secale cereale), winter wheat (Triticum aestivum), radish (Raphanus sativus), red clover (Trifolium pratense) and annual rye (Lolium multiflorum), as cover crops, and palmer amaranth (Amaranthus palmeri) and giant foxtail (Setaria faberi), as weeds. Pots (6.9 x 4.8 x 6.0 cm) were filled with a silt loam field soil and seeded with 6 to 18 cover crop seeds pot-1, and 30 to 60 weed seeds pot-1. The above-ground biomass was collected 28 days after each planting time. Preliminary results showed that, at 14 DAS, regardless of the herbicide, there was over 90% of biomass reduction, and by 21 DAS, there was more variability of how species respond. For the Acuron and Resicore treatments, palmer and winter wheat had less biomass reduction at 21 DAS. Verdict, by 21 DAS, showed to have less biomass reduction for all species analyzed and more variability between different species. Additional on-farm field research will be conducted in 2023 and 2024 to validate the results of this greenhouse bioassay prior to sharing the information with growers that are or intend to interseed cover crops in corn.

Poster #20 Bridget McKinley

Determining the Performance of Different Cover Crop Cultivars Grown as Monocultures or Mixtures

Interest in and the potential benefits associated with cover crop mixtures necessitates determining the best management for selecting optimal varieties and species in different locations. Limited research in the Northern Great Plains has explored the performance of cover crops grown in mixtures, specifically the potential benefits of unique species variations. A University of Nebraska-Lincoln partnership with NRCS seeks to determine optimal mixtures (i.e., establishment, winter survival, fall, and spring biomass) across multiple sites across the state. Fall cover crops were planted in three locations, including Haskell Ag Lab in Concord. All experiments included 33 treatments:27 species of monocultures and 6 polycultures or mixtures. Each mixture may include up to one grass, one legume, and one brassica of varying varieties. The first sampling, taken approximately seven weeks after planting, included plant counts and fall biomass of all species grown in monocultures and mixtures. This presentation will include the initial data from one site to determine relative establishment and whether certain species perform better in mixtures than in monocultures.

Poster #21 Sainfort Vital

Impacts of cover crop mixtures on soil organic carbon, water extractable carbon and dry aggregate distribution.

Cover cropping is a conservative practice that is known to provide several environmental benefits, such as suppressing weeds, improving microbial diversity, fostering nutrient and moisture availability, and soil health. These benefits can positively affect the productivity of the following cash crops. C4 species are good at using nutrient and moisture availability in summer, especially after wheat harvest, to produce high biomass but can be affected by cold weather. C3 species can struggle to establish in summer but can offer desired adaptation to the cold weather until seeding grain the next spring. Thus, C4 and C3 species combination is a feasible option to optimize high productivity in summer and adaptation to cold weather until seeding grain in the next spring. Therefore, this study aimed to understand the effects of low, medium, and high proportions of C4 species used as cover crops on soil health indicators such as soil organic carbon, moisture dynamic, and dry aggregate distribution.

Poster #22 Mehmet Ozturk

Effects of cover crops on wind erosion and soil health in pre- and post-beet on-farm and station experiments under strip-till

This study aims to investigate the impact of cover crops (CCs) on wind erosion and soil health in sugar beet production in Minnesota. The research is conducted at the North West Research and Outreach Center (NWROC) station and on various farms across the state, using both pre- and post-beet methods. The study employs strip-till as a tillage technique and employs big spring number eight (BSNE) samplers to measure the spatial and temporal variations of horizontal sediment mass flux under cover crop and control treatments. The preliminary results from the first data collection showed no significant difference in the amount of horizontal dust mass transportation under cover crop and control treatments. As expected, lower heights collected more dust mass and the amount of dust collected from BSNE boxes was high, highlighting the severity of wind erosion in Minnesota. Future research plans include evaluating the effects of different types of cover crops on wind erosion over a longer period of time and assessing their impacts on soil health in more detail, in both pre- and post-beet experiments

Poster #23 Frank Johnson

Impacts of nitrogen application timing and cover crop inclusion on soil N2O emissions in a tile-drained system. Agricultural soils are responsible for a majority of anthropogenic nitrous oxide (N2O) emissions. Thus, there is a need to explore management practices that can aid in meeting current greenhouse gas reduction goals. However, incorporating cover crops in tile-drained systems in the Midwest may have contrasting effects on soil N2O emissions. The objectives of this research were to 1) assess the effects of spring and fall dominated fertilization on cumulative and daily soil N2O emissions in a tile-drainage system and; 2) evaluate the magnitude of cumulative and daily soil N2O emissions with and without the inclusion of cover crops in a tile-drainage system. The five treatments consisted of a fall-dominated nitrogen application with and without cover crops, a spring-dominated nitrogen application with and without cover crops, and a zero control, which did not receive any fertilization or cover crop. The cover crop used in this experiment was a cereal rye (Secale cereal L.) and radish (Raphanus sativus L.) blend. Each treatment was replicated three times in tile-drainage plots established in Lexington, IL and this study was conducted over the 2017 and 2018 growing seasons. Overall emissions were significantly higher in 2018 compared to 2017. Treatment was not identified as a significant factor. In 2017, cumulative emissions were highest in the zero control, yielding 5.0 kg N2O-N ha-1. In 2018, fall dominated fertilization with the inclusion of a cover crop produced 7.4 kg N2O-N ha-1 cumulative emissions and was highest compared to the other treatments. Results here suggests incorporating cover crops in the field management plans does not significantly increase soil N2O emissions.

Poster #24 Rashelle Matthiesen

Comparison of winter rye cover crop termination timing on seedling disease of corn across 16 locations in the United States Corn following a winter rye (Secale cereale) cover crop (CC) can be susceptible to seedling disease caused by Pythium spp. In a field experiment conducted in different regions of the United States, we investigated the effect of CC termination timing on the susceptibility of corn to seedling disease. There were four treatments: (i) no CC, (ii) early termination (CC terminated 2 to 4 weeks before corn planting), (iii) late termination (CC terminated 3 to 7 days before corn planting), and (iii) after planting (CC terminated 3 to 7 days after corn planting). Ten corn seedlings at V2 to V5 growth stages were collected at 16 locations (DE, FL, IL, IA, KS, KY, MD, NE, NY, OH, PA, TX, VT, VA-AREC, VA-B, and WI). The root system from each seedling was washed and photographed. Percentage root rot severity for each seedling was assessed based on the photographs. Root rot severity was greatest for all treatments in IA and TX, while at the remaining locations root rot severity was less than 15%. Root rot was most severe when the CC was terminated after planting at 13 locations. Pythium was quantified in the roots of seedlings from DE, KY, IA, and TX. Greater populations were detected in roots from the after planting treatment in TX only. These data indicate termination timing of a rye CC impacts corn seedling disease severity. Consequently, farmers planting corn following a winter rye CC should consider management practices to reduce the impact of seedling disease on corn yield loss.

Poster #25 Andrea Basche

Executing a Multi-Institution Cover Crop Challenge Activity Cover crop mixtures have increased in use and interest across the United States, and future agriculture professionals benefit from exposure to selection and management considerations. In a newly developed cover crop management course, executed concurrently at six Land Grant Universities, students engaged in a “cover crop challenge” to optimize the growth and diversity metrics of a cover crop mixture. In this poster, the instructors will describe how the activity was executed and lessons learned from the first year of execution. In 2021, 97 graduate and undergraduate students participated in the challenge, including activities woven throughout the semester. Beginning in week two, students were tasked with selecting a mix of at least two cover crops species from a set of twelve potential species. Students then converted the same seeding rate to plant their experiments in an indoor greenhouse pot as well as a five foot square area at a field site in their respective locations. In week eight, students harvested cover crop biomass while taking measurements of roots, weeds, pollinators, earthworms, and more. After biomass was dried and weighed, students responded to a series of questions assessing their selection and observations. Overall results were addressed during a remote synchronous multi-site session, and top performers were determined for indoor and outdoor biomass, species evenness and efficiency (most biomass per seed cost). After the first year’s successful implementation, in 2022, we will assess student learning outcomes, and hypothesize students will gain skills and confidence in cover crop species selection, seed costs and planting, and experimental design. These management skills support professionals who are competent in diversified management systems that support soil conservation.