**NCERA 103** Specialized Soil Amendments and Products, Growth Stimulants and Soil Fertility Management Programs

Committee Minutes: November 6, 2019.

Holiday Inn, Des Moines, IA

Present:

Carl Rosen (Administrator) – University of Minnesota

Jim Camberato – Purdue University

Jason Clark – South Dakota State University

David Franzen – North Dakota State University

Dan Kaiser – University of Minnesota

Edwin Lentz (Chair) – The Ohio State University

Bijesh Maharjan (Secretary) – University of Nebraska-Lincoln

Emerson Nafziger – University of Illinois

Edwin Ritchey – University of Kentucky

John Sawyer – Iowa State University

Peter Scharf – University of Missouri

Absent:

Dorivar Ruiz Diaz – Kansas State University

Matt Ruark – University of Wisconsin-Madison

Kurt Steinke – Michigan State University

Administrator Report

* Carl Rosen gave the administrative report.

Annual State reports due before Department Heads meet in Jan 2020

Carl will share flyer on stating impact factors in the reports.

Rotation update

* Edwin Lentz (OSU) chair, Bijesh Maharjan (UNL) secretary, 2019-2020
* Bijesh Maharjan (UNL) chair, 2020-2021
* Dorivar Ruiz Diaz (KSU) will volunteer next, Secretary 2020-2021 and then Chair, 2022-2023

State reports

* Given by each member. Detailed written reports are included below. The state reports constitute most of the meeting time which involve recaps of current product trials, identification of new products on the market and their potential effectiveness, and extension publications and programming in the area of non-conventional products.
* Decided to arrange for online participation to this meeting for those who cannot make in person.

Previous business

* Compendium website: Iowa State will continue hosting the Compendium website even without any funding support. There were 4 reports added since the last meeting. Due to technical glitches, site visits of 118 were tracked until Dec 11, 2018. John Sawyer (ISU) is working with IT to fix it. Suggested to clarify copyright issue with journal publications before submitting to website.
* Website on “Corn N rate calculator” had over 109,000 hits last year alone.

New business

* Mid-term review. Carl Rosen will take care of the review. It is important that the minutes be completed in December for the review.
* Discussion on biostimulant section of the Farm Bill. Committee will explore ways it may assist with this part of the Farm Bill.
* Next Meeting. Dan Kaiser reported that the dates for the 2020 North Central Extension-Industry Soil Fertility Conference will be November 18 and 19 at the Des Moines Airport Holiday Inn. The Conference Committee will include the NCERA103 room with the conference contract. With these dates, the 2020 NCERA103 meeting will be November 19.

**Adjourn**

**State reports**

**Illinois**

*General Comments:*

A local co-op outlet in western Illinois had a field day event at a set of “plots” that included a treatment with spring-applied UAN with (and without) the additive “Preserve.” Preserve, as it turns out, is simply generic DCD, so is not a novel inhibitor, but is being marketed as one. This emphasizes what some as observed as the lax marketing and acceptance of “inhibitors” without regard to what they actually inhibit. Other treatments were fall NH3, with and without N-Serve. The trial in this case was poorly designed (single strips divided into “reps” down the strip.) This means that effects of field position are going to show up as treatment effects, so chances for showing an “advantage” for one or two of the four treatments is relatively high.

Although the drumbeat of adding microbial preparations to seed or soils, low commodity prices have affected the ability to market these, especially if application is difficult or costly—as, for example, treatments that require in-furrow applications, for which most planters in Illinois are not equipped. Promotion of plant growth regulators—often mixtures of cytokinin, auxin, and gibberellic acid—continue, many with novel names but no novel content. These face the same barriers as microbial products, and it is not clear that such products are gaining increased interest and acreage. Products like these are unlikely to produce visual evidence of a response, making it unclear how such products will look like good investments to producers.

Nothing specific to report, but with a lot of activity in marketing of new (or newly-renamed) products one can assume that there are a lot of these coming and going, with some likely to attract some attention.

*Accomplishments:*

Wet spring weather and record-late planting dominated the 2019 cropping season. This followed the wet fall of 2018 in which very little N fertilizer could be applied. As a result, many, if not most, fields were planted before N fertilizer was applied, and we used previous N timing research results to provide information on the need to have some of the N in the row as the crop emerged. With more than half the corn in Illinois planted after June 1 in 2019, other issues such as additives and supplements attracted little attention.

Several that contained some of the data generated in our N timing/form trials. These included speaking at the Illinois Fertilizer and Chemical Association annual meeting, at four regional UI Extension Crop Management Conferences, and at several other meetings in Illinois.

*Impact Statement:*

Low prices for corn and soybean persist, and in 2019 were exacerbated by late planting and reduced yields in Illinois. Our information on N timing was widely used to help manage N, given that planting was so late and so much of the N still needed to be applied after planting. Our ongoing work with IFCA in on-farm N rate trials continued in 2019, and will provide data on N responses in late-planted corn. Yields were generally quite good given the late planting, however, with an expected average of 179 bushels per acre for Illinois. It is not clear that “non-traditional” inputs are widely used when issues like late planting are so widespread, but with the aggressive marketing that’s often used, those who use such products might be convinced that they will help allay the effects of such production challenges. The value of the Compendium and other information about how such products perform is a valuable counter to marketing information that is not based on research.

**Iowa**

*General Information:*

I did not keep a listing of specific products this year. Several non-traditional products, microbials, and products that contain DCD or NBPT. Efficacy is a continued question.

Also, questions about N fixation in corn, like N-Fix/Envita (Azotic Technologies), PROVEN by Pivot Bio, and corn that oozes slime at nodes and harbors N fixing microbes. Question is, does do they work and why would they increase yield (as promoted). Research is underway (2019) at Iowa State University (researchers in Agronomy) with PROVEN, and some field strip trials by the ISU FARM program. No results to date.

*Accomplishments:*

The compendium web site continues to be housed at Iowa State University, Department of Agronomy. However, the support is limited.

*Impact Statements:*

The compendium web site (Compendium of Research Reports on Use of Non-Traditional Materials for Crop Production, <http://extension.agron.iastate.edu/compendium/index.aspx>) has 248 research reports, with four new reports added since the last committee meeting. Clientele use of the site was tracked, but that stopped in December 2018. The reason is being investigated and hopefully fixed. From the last committee meeting to December 11, 2018 there were 118 page views.

**Kansas**

*General Comments:*

We continue to see new products defined as “biologicals” that might include inoculants applied with the seed, or with starter fertilizers, in-furrow.

* Many of the questions are related to the “biologicals” currently offered in the market.
* Also “enhanced” fertilizers with the addition of humic acids.
* Many questions on “liquid calcium” as a source of Ca for crops.

*Accomplishments:*

Ongoing study evaluating urease inhibitor (ANVOL)

*Impact Statements:*

Results from our research on non-conventional products were used for extension educational programs providing local information to producers to improve efficiency and reduce cost. This information also helps to adapt new technologies and products for local produces.

**Michigan**

*General Information:*

Fewer inquiries in 2019 regarding soil amendments and non-conventional products on conventional field crops with some increased interest in specialty crops. Tissue testing inappropriately used to identify which nutrient(s) to apply to cropping systems garnered significant attention. Starter and foliar fertilizer products saw increased marketing presumably due to the state of the agricultural economy. There continues to be greater emphasis on biologicals and biologicals combined with starter fertilizer applications for improved soil health. Co-granulated products including sulfur continue to gain momentum and market share. Previously many of the co-granulated products were dominated with phosphorus as primary nutrient but multiple alternatives now being tested. There also continues to be multiple alternative S products experimented with to compete with currently available P+S co-granulated fertilizers.

SymTRX20S (16-1-0-20S) and SymTRX12S (16-20-0-12S) are two N, P, S replacement products that were tested on S-deficient sugarbeet soils with STP below 30 ppm. The two N, P, S replacement products evaluated appear to perform similarly to other conventional products using MAP as a base in co-granulated fertilizers or AMS.

Starter fertilizer amended with micronutrients and combined with zinc, manganese, boron combination foliar products for sugarbeet tested in 2019. Product evaluations included: MicroZMB, Diamond 6-24-6, and Korrect; Non-significant yield and sugar improvements;

Carbon-based fertilizers with multiple macronutrients including calcium targeted at tuber crops to increase nutrient uptake and get more calcium to the tuber compared against conventional calcium sources including gypsum. TerraNu calcium increased potato yield compared to other calcium sources but wasn’t statistically significant (P = 0.12).

Potassium nitrate as alternative K source and multiple derivations of K nitrate tested in potato 2019. Some tissue nutrient concentration improvements but few yield differences; Very warm July weather impacted potato yields and results;

Multiple sulfur sources on sugarbeet and corn nutrient uptake and yield; Non-significant yield gains and losses; variability likely somewhat due to prolonged mid-summer dry period of weather;

Biologicals; Tested different bacterial and fungal solutions; humic and fulvic acids individually and in combination; humic and fulvic acids with seaweed; Products tested in-furrow on corn and soybean; No significant results with any product;

List of products tested in 2019:

* SymTRX20S and SymTRX12S
* Diamond 6-24-6, MicroCarb ZMB, Korrect
* MAP-MST, MOP-MST, AMS-MST
* Anvol, Centuro, Tribune
* Terra-Nu Calcium
* Krista K, QROP KN, Sulfate of Potash
* Humic and fulvic acid combinations and bacterial and fungal solutions

*Accomplishments:*

* 1. 2019 product trials – See above list with additional products and yield data available at soil.msu.edu
  2. Fifteen presentations involving at least some product testing data
  3. Quinn, D., and K. Steinke. 2019. Comparing high and low input management on soybean yield and profitability in Michigan. Crop, Forage, and Turfgrass Mgmt. Vol.5. doi:10.2134/cftm2019.04.0029.
  4. Rutan, J., and K. Steinke. 2019. Corn nitrogen management following daikon radish and forage oat cover crops. Soil Sci. Soc. Am. J. 83:181-189. doi:10.2136/sssaj2018.07.0269.
  5. Quinn, D., and K. Steinke. 2019. Soft red and white winter wheat response to input- intensive management. Agron. J. 111:428-439. doi:10.2134/agronj2018.06.0368.

**Minnesota**

*General Comments:*

Questions regarding specialty products have remained low again in 2019. Most contact between University of Minnesota researchers and companies for product testing has involved biologicals. Daniel Kaiser completed testing at two locations with Pivot Bio to test their product ProveN which is supposed to boost N supply from the soil. Jeff Vetch also may have had a few biostimulant products being tested in the field but I am not aware of what was tested or the results of the trials. I would suspect we will be continuing testing on biostimulant products in 2020 as there is interest from companies to partner with the University for research trials. Most of the research interest from companies is likely a result of our state nitrogen rule going in to effect and companies trying to get products labelled as enhanced efficiency fertilizer products to allow farmers to cost share products. Daniel Kaiser had two trials which included some work with the product Levesol coated on MAP fertilizer and was also contacted by West Central Inc. about testing one of their new products Trivar, which is a raw chelate mixed with boron, zinc, and phosphatase. No trials were established for 2020 in the fall but work may progress with this product for spring application.

*Accomplishments:*

Daniel Kaiser and Paulo Pagliari gave a joint presentation in December 2018 at the Crops and Pest Management Short Course to around 200 ag professionals on establishing on-farm trials and evaluating product testing data which highlighted work by the NCERA 103 committee and publicized the compendium.

**Missouri**

*General Comments:*

Mostly what I heard about in terms of non-traditional amendments in 2019 were “biologicals”. This is an area that is receiving a lot of investment dollars and attention from mainstream ag companies. I am not aware of any research that has been done in Missouri (or other states for that matter) to test these products.

In my opinion, there is a need for more independent trials of biological products and this committee should consider expanding our scope to include them so that any trials we conduct can go into the compendium.

Although many are seed treatments, I know of one farmer who included a biological in his mid-season nitrogen fertilizer application for his corn crop.

I conferred with Central Valley Ag in Nebraska this summer about a field trial they were doing with Envita, a microbial product that is supposed to “enable every cell in the plant to fix its own nitrogen.” In their field-scale trial with different N fertilizer rates, with and without Envita, the plots with zero N stood out in satellite images and looked equally N-deficient whether they had received the Envita treatment or not. It appeared that the Envita did not have a noticeable impact on crop N supply or N-fixing capacity. They said that the crop appearance on the ground supported the same conclusion.

As a Certified Crop Adviser, I used to receive many ads for non-traditional soil amendments by email. That seems to have dropped off significantly. Perhaps the NCERA-103 committee deserves some credit for this? Our educational efforts with Crop Advisers may have reduced the profitability of that sales path for products that had not been shown to give a return in research.

*Accomplishments:*

My program conducted a test this year for AgXplore to test the effect of their NZone Max product on corn yield and on nitrate concentration in drainage water. Neither yield or nitrate results are analyzed at this date.

**Nebraska**

*General Comments*

Growers have questions on inhibitors, humic acid products, coal char and other soil amendments. A unique type of coal combustion residue (coal char, henceforth) that has up to 30% C is available to farmers in NE Panhandle. Several trials are underway monitoring and documenting soil and yield benefits of applying coal char to crop fields.

*Accomplishments:*

1. Between 2010-2018, 17 soil microbial inoculation or stimulation products were evaluated in 76 on-farm trials conducted by the Nebraska On-farm Research Network with yield increases for 8% of the trials.

Products evaluated:



Yield increases were seen in 6 or the 76 studies, so 8% success rate (92% of sites had no yield difference or had a yield decrease). No product was consistent in increasing yield. The products that contributed to the 8% success are: Torque (1 time out of 7), Commence (1 time out of 8), Quick roots (1 time out of 4), Amplify-D (1 time out of 4), Soil X-Cyto (1 time out of 2), RyzUp on soybean (1 time out of 8).

1. The trial was conducted on University of Nebraska research farm in Scottsbluff, Nebraska in 2019 to evaluate AgConcept products. This experiment used a randomized complete block design in four replications with fertilizer treatment as the main plot. Fertilizer treatments included
2. Check – Grower standard practice (GSP) fertilization
3. Control – No fertilization
4. Full GSP fertility + 12.8oz/a at planting
5. Full GSP fertility + 4qts/a at planting
6. Full GSP fertility + 12.8oz/a + 4 qts/a at planting
7. 20% GSP reduction + 12.8oz/a + 4 qts/a at planting
8. 40% GSP reduction + 12.8oz/a + 4 qts/a at planting

Nitrogen fertilizers need was determined based on spring soil test and were hand broadcast and incorporated (disking ~ 10 – 15 cm depth). Corn stand was counted after corn emergence. Best agronomic practices including irrigation, insect scouting, and other were same all across the plots. Treatment plots were georeferenced to determine locations with varying fertility rates, and to be used in subsequent years for product evaluation. Crop yields were measured to evaluate effects of the fertilizer treatments.This year the trial was severely damaged by hailstorms.

1. In 2019, KOCH products were evaluated in corn fields. In one trial, one of the inhibitor products was used with anhydrous ammonia to evaluate its potential in improving grain yield. The trial evaluated effectiveness of using three inhibitor products in reducing nitrate leaching and improving corn grain yield when used with UAN. and three with UAN in two different trials.

Reports were submitted to industry partners. Some of the research results are made available to growers through extension publications.

*Impact Statements:*

The University research is providing necessary knowledge base and tools to Nebraska Natural Resource Districts that govern and manage state ground water in their efforts to ensure better nutrient management and water quality. Growers have sustained confidence in the university research and use our products in informing their decisions with respect to input in their farms.

**North Dakota**

*General comments:*

The number of calls related to non-conventional amendments and additives was less than in 2018. However, there was still substantial activity related to less than effective nitrogen amendments claiming to have urease inhibitor or nitrification inhibitor properties. There were also widespread sales, usually as part of the seed treatment of ‘biologicals’. These products contain organisms of various kinds that claim to prime the young plants with early resistance to diseases and environmental stresses. These products are numerous and it is impossible to evaluate even a small percentage of them. The companies continue to place the burden of proof on their customers (farmers).

*Accomplishments:*

I provided 6 presentations in 2019 to North Dakota farm audiences on nitrogen additives and amendments, to a total of 700 attendees, including 210 CCA’s at the annual Soil and Soil Water Workshop, January, 2019 in Fargo. Two presentations on this topic were also provided to Minnesota audiences with attendance of about 300. In addition, 15 presentations in North Dakota cautioned farmers about untested products, urging them that if they choose to try them, they should apply them on small replicated test strips for evaluation within a field rather than treat many fields and acres with no standard for comparison. The searchable index of non-conventional additives and amendments housed at Iowa State University was shared with all audiences mentioned previously in this report.

**Ohio**

*General Comments:*

More marketing push on biostimulants. Farmers continue to ask questions about starter fertilizers, sulfur, and micronutrients in Ohio. Big topic was on the efficacy of nitrogen stabilizers and biostimulants*.*

*Accomplishments:*

Plots were not planted or abandoned because of weather at most Ohio research sites in Ohio.

1 report, 3 year study on NZone – no benefit for corn

20 presentation given on reducing P and N losses from fields in the Lake Erie watershed

1 international presentation given on reducing P in the Western Basin Watershed of Lake Erie

2 national presentation given 1) on sulfur utilization in soft red winter wheat and N rates for Ohio soft red winter wheat production

Corn, Soybean, Wheat and Forages Field Guide

Draft completed on the Universities’ Tri-State Soil Fertility Recommendations for corn, soybean, and wheat production

*Impact Statements:*

Completed research on non-traditional products has assisted Ohio growers in determining the efficacy potential of these products for their production systems and assisted them in their purchasing decisions for these products.

Producers have reduced their total fertilizer rates and reduced nutrient losses from fields based on the 4R Principles by participating in one of the 20 soil fertility programs given in Ohio.

Producers have confidence in university recommendations as the new Tri-State Fertilizer Recommendations is being rolled out at meetings this coming year. The Tri-State is a multistate publication from Michigan State University, Ohio State University, and Purdue University.

Producers have most recent information on nutrient management, diagnosing nutrient deficiencies, and field methods to measure nutrient availability for corn, soybean, wheat and forages in the updated and expanded publication: Corn, Soybean, Wheat and Forages Field Guide. This is the first year that the publication is multi-state with Penn State University partnering with Ohio State University. Publication received the 2019 First Place Award in educational publications from the American Society of Agronomy.

**Purdue**

*General Comments:*

Large plot field experiments were conducted by PhD student Jason Lee over 3 years and 5 locations to examine 5 commercially-available plant growth stimulants’ effects on corn growth and development, nutrient uptake, and yield . Results of these studies were summarized at the 2019 North Central Extension-Industry Soil Fertility meeting. Biostimulants included bacterial and/or fungal organisms in 4 products. One tested product was a plant growth regulator. Briefly, effects on corn growth and development were rare and minimal when they did occur. Effects on nutrient uptake at V6 were uncommon, but when they did occur were more often negative than positive (especially for potassium content). Yield effects occurred in 8 of 42 comparisons (6 positive and 2 negative) ranging from -5 to 8 bushels per acre. Some products had both positive and negative impacts on yield. Yield effects appeared unrelated to differences in plant growth and development or nutrient uptake. For more details see the proceedings of the conference.

**South Dakota**

*General Comments:*

Following products are under trial.

* Palisade: Growth regulator to reduce lodging in oats
* Valent or mico-apply: inoculant to increase mycorrhizae and their relationship with plants
* Nitrification and urease inhibitors from various companies

*Accomplishments:*

Influence of Palisade on Oat Yield

Nitrogen response trials were conducted with six nitrogen rates (0, 20, 40, 60, 100 and 140 lbs ac-1) at two locations (SDSU Southeast and Northeast Research Farms near Beresford and South Shore, South Dakota). The effect of a plant growth regulator (Palisade EC (trinexapac ethyl)) on oat height and lodging was also evaluated at these sites. The pre-plant soil test results plus soybean legume credit (40 lbs ac-1) was approximately 84 lbs ac-1 at Beresford and 96 lbs ac-1 at Southshore. Nitrogen was applied as Urea at planting. A split plot design was used with N treatment as the main factor and growth regulator the split factor. All treatments were arranged in Randomized Complete Block (RCB) design with three replicates. The plot size was 15’ x 30’. The variety ‘Hayden’ was planted on April 23rd in Beresford and April 30th in Southshore. The plant growth regulator was applied at 14 oz ac-1 at Feekes 6 (first node stage) growth stage at both locations. At harvest, we measured height and determined the lodging score (percent lodged plants) for each plot.

At Southshore, yields were significantly affected by N rates but not by the plant growth regulator (Figure 1). Although, the inclusion of the plant growth regulator did generally increase oat yield compared to without. This result likely occurred because the plant growth regulator reduced lodging and improved harvest efficiency (data not shown). Oat yield averaged from 108–159 bu ac-1 and yield was optimized between 90–140 lbs ac-1 of total N (pre-plant soil NO3–N + fertilizer N). The current recommended N rate for the Southshore site with a yield goal of 159 bu ac-1 was 206 lbs ac-1. This research study indicates that the current recommendation is over-estimating oat N fertilizer recommendations and needs to be reevaluated.

Figure 1. Average Oat Yields under Various Nitrogen levels and Plant Growth Regulator ‘Palisade’ at SDSU NE Research Farm in 2018.

At Beresford, N rate significantly affected oat yield by reducing it as N rate increased until the 120 lbs ac-1 rate when yield began to increase again (Figure 2). It is unclear what caused this yield response pattern. Oat yield ranged from 54–94 bu ac-1, which was extremely low compared to the Southshore location. Reduced yield may have been caused by the delay in planting (April 30th) and extremely warm May temperatures Beresford experienced in 2018. The application of the plant growth regulator did effect the height and lodging of the oats. The Palisade showed significant effects on height and lodging, but did not clearly influence the total available N rate needed to optimize oat yield. The continuing research efforts to update N recommendations for oats in conjunction with a plant growth regulator will help improve our understanding of how to improve current oat recommendation with and without a plant growth regulator.

Figure 2. Average Oat Yields under Various Nitrogen levels and Plant Growth Regulator ‘Palisade’ at SDSU SE Research Farm in 2018.

Twenty-two presentations given regarding soil fertility (in-person, radio, and magazine)

1 proceedings paper and 2 peer-reviewed publications were produced.

*Impact Statements:*

-Potential use of Palisade as a growth regulator to reduce lodging of oats

**Wisconsin**

*Accomplishments:*

Two field day presentations related to biological soil additives

*Impact Statements:*

Wisconsin farmers and crop consultants were educated about the potential benefits of biological soil additives.