

2019 FIELD TRIAL REPORT



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BioStar  **Renewables**
Sustainable Energy Solutions

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OVERVIEW

Trials during the 2019 growing season were conducted across the Midwest, from South Dakota, to Nebraska, to Indiana and locations in between. The focus of the trials was on field corn with trials also being completed on wheat and alfalfa.

Weather in the Midwest made for difficult growing conditions in 2019, with a late cold spring complicating planting, resulting in some areas like South Dakota only being able to plant around 60% of their normal crop acres. The growing season was abnormally wet over most of the area, with some localized drought conditions, especially in central Illinois. This has led to variable data coming in from the small plot research due to some plots being flooded. The drought conditions in central Illinois also led to the failure of one farmer trial, although the initial reports were very positive on how the crop had responded to the product used as an in-furrow starter. The wet conditions continued into the fall delaying harvest by about a month or more, and therefore delaying our collection of trial data. The wet conditions resulted in the inability to harvest a vegetable trial conducted by Standard Process in Whitewater, WI.

TRENDS

The trends this year were positive despite the weather on field corn and very positive on wheat and alfalfa. Trials done in locations that have a history of being farmed organically or applied together with a microbial inoculant saw positive yield increases. In corn trials an increase of 5-10% in total yield was seen generally. In wheat a yield increase of 100% was recorded, and in alfalfa a 27% increase was recorded. Both the wheat and the alfalfa trials were implemented with foliar applications at fairly low rates, and these trials will be repeated in 2020 to verify these results.

One of the main trends observed from this year's trials conducted on non-organic ground without a biological addition did not perform well. This indicates that the product is acting in tandem with biology, as opposed to simply being a source of nitrogen. This is further supported by the best results from this year's trials coming from mixing the product with TerraFed, an organic molasses product, for either in row or foliar applications. The mixing of the two products appears to soften the salt index of SuperSix and provides a soluble carbon source for microbes simultaneously. The best result from this combination, along with a biological, can be seen in the Whitewater 14- and 28-gallons treatments in Figure 1.

The most important metric for our purposes in how the product returns money to the farmers using it. All ROI's for product trials on land with a history of organic management or including a biological on non-organic lands were positive. ROI's were depressed slightly due to continued negative pressure on organic corn prices.

Trials were also conducted on alfalfa and wheat, both with very good results. Yields on wheat and alfalfa showed significant increases over their controls, with very positive ROIs. Interestingly, both of these trials were done via foliar applications, showing the efficacy of the product as a foliar in addition to its use as a starter.

In addition to positive results, some trials also showed negative results when SuperSix was applied at too high of rates on its own as an in-furrow starter, in which case it appears to be depressing stand counts.

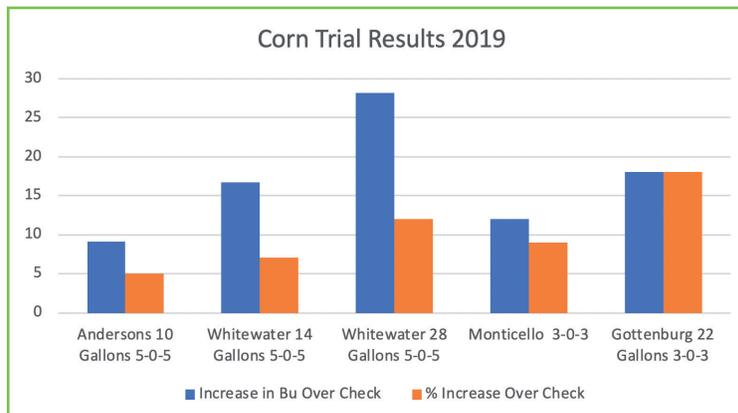


Figure 1: Corn trial result from 2019 showing increase in yield vs. the check in each study along with the calculated percentage increase.

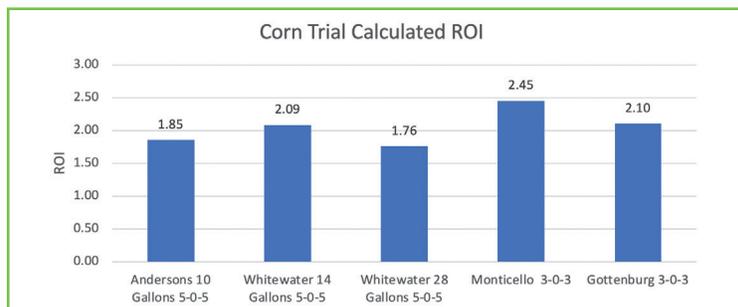


Figure 2: Calculated ROI for specified corn trials based on organic corn price.

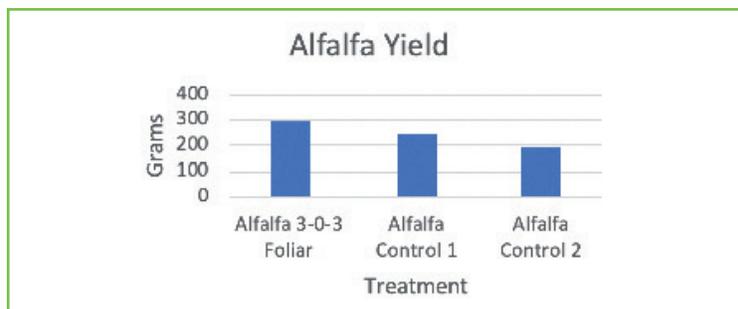


Figure 3: Yield data from 2019 alfalfa small plot trial.

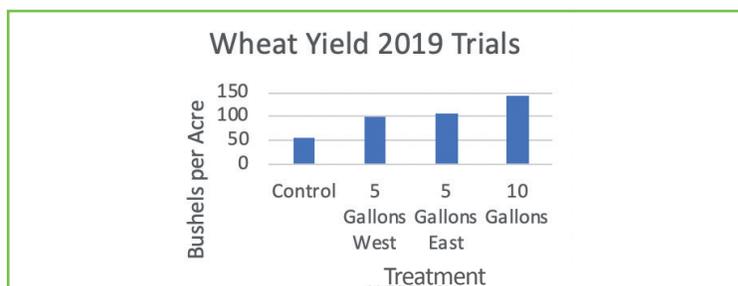


Figure 4: Yield data from 2019 wheat trial.

This can be seen well in trials conducted in Indiana and South Dakota, where stand counts decreased as SuperSix was used in higher rates on its own, but the same effect was not seen with a mixed product.

This depression in stand counts translates directly into a decrease in yield and based on this information we should not recommend SuperSix as a standalone starter and should continue working on developing a starter that includes molasses as an ingredient and perhaps a biological.

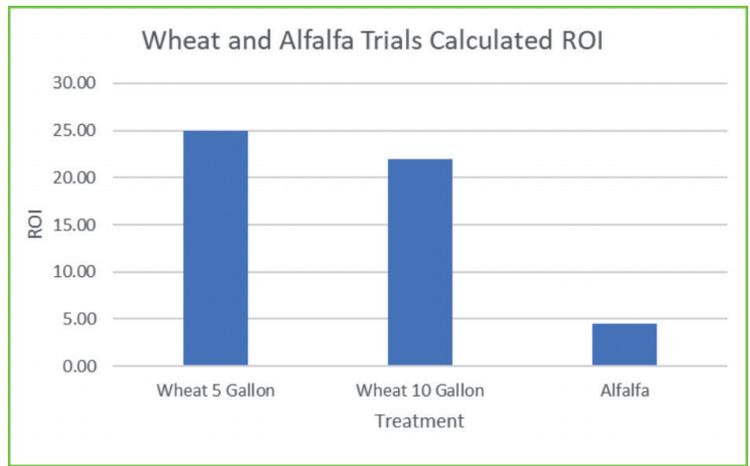


Figure 5: Calculated ROI based on contracted price for wheat and average price for alfalfa hay for 2019 wheat and alfalfa trials.

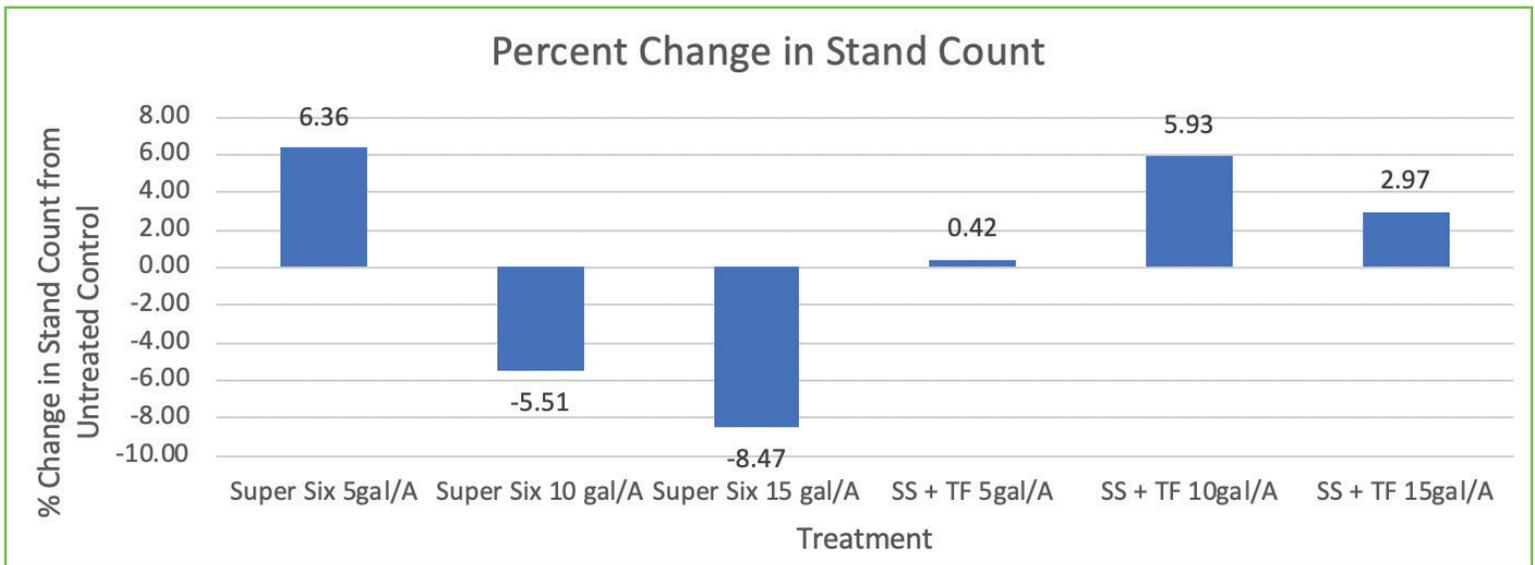


Figure 6: Stand count percentage change from the check from trial in Indiana.

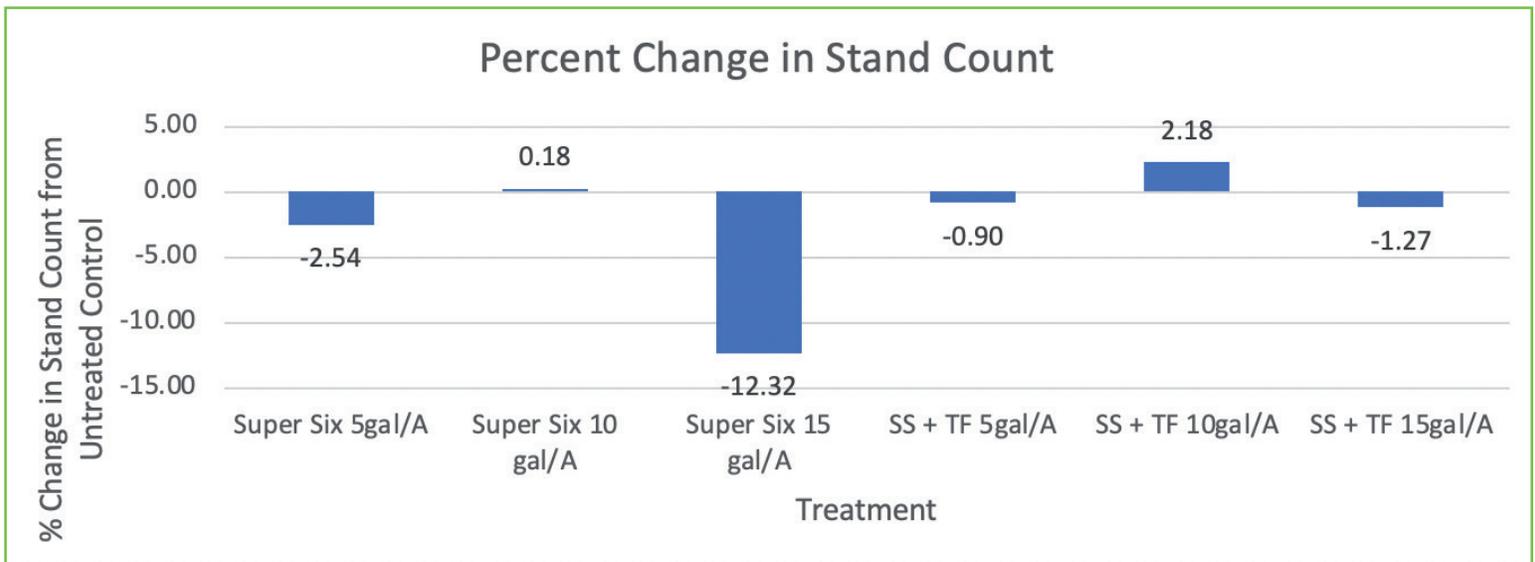


Figure 7: Stand count percentage change from the check from trial in South Dakota.

TRIALS

Trials are divided by crop. Each separate trial for that crop is listed below with the following information: Company or Farmer executing the trial, Location, Cooperating Companies (if applicable), Protocol or Method, and Summary Data. In farmer trials where anecdotal results have been communicated but where combine yield data was not available, the trial is included and described. Trials in which no report has been given or which were failures due to harvest conditions or drought have not been included.

CORN TRIAL

RESEARCH COMPANY: Agri-Tech

LOCATION: Whitewater, WI

PARTNERS: Agro-Research International, Quality Liquid Feeds

PROTOCOL: The trial consisted of applications both at planting in a 2x2 placement, and as a side dress. In addition to the control there were four treatments. BioStar SuperSix was mixed with a 20% rate of TerraFed applied at a 7 gallon per acre rate at planting and at side dress. The same mixture was applied at the same timings but doubled to 14 gallons per acre. The third and fourth treatments were the same as those listed with the addition of AgroGold, a biological inoculate, at a 16 oz/acre rate at planting and a qt/acre rate at side dress. Dried chicken litter was used as the base fertility program at a rate of 2 Tons/Acre.

SUMMARY DATA: This trial was conducted on research ground that appears to have low biological activity. Results on applications of mixed SuperSix/TerraFed products performed in line with expected nitrogen efficiency rates. Product applied with an additional biological yielded results greatly surpassing expected nitrogen efficiency rates. See the conclusion section for a more thorough treatment of these results.

	BUSHEL	BUSHEL INCREASE	% INCREASE
Control	210.82		
5-0-5-7 GAL	213.21	2.39	1.13%
5-0-5-14 GAL	215.45	4.63	2.20%
5-0-5 7 GAL + STIMULAGRO + AGRO GOLD	227.51	16.69	7.92%
5-0-5 14 GAL + STIMULAGRO + AGRO GOLD	238.96	28.14	13.35%

Chart 1: Yield result from Agri-Tech Agro-Research trial showing treatments, yield increases over treatment, and calculated percent increase over treatment.

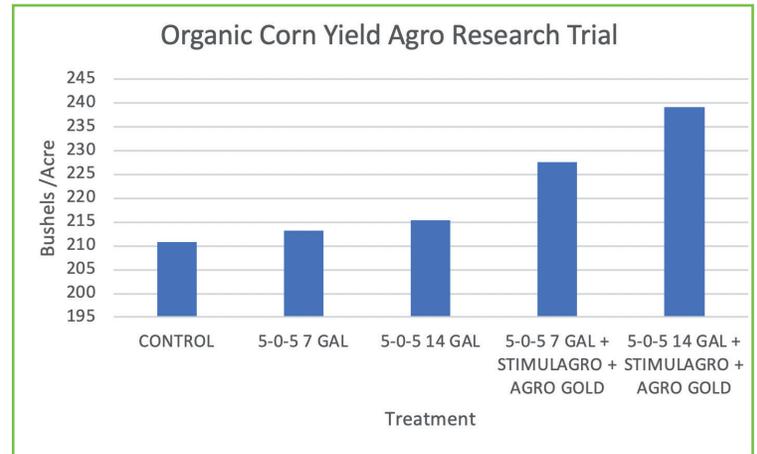


Figure 8: Yield by treatment from Agri-Tech Agro-Research trial.

CORN TRIAL

RESEARCH COMPANY: Agri-Tech

LOCATION: Whitewater, WI

PARTNER: The Andersons

PROTOCOL: SuperSix mixed with 15% TerraFed was applied at a rate of 10 gallons per acre in furrow at planting. 13 Treatments of different products including a manure only treatment and a no manure treatment were tested as well. SuperSix is product 6 in the chart below. All treatments received beef manure unless otherwise stated. Results and graphs are taken directly from The Andersons' supplied results.

SUMMARY DATA: This trial was conducted at the same farm as the trial performed in cooperation with Agro Research International. The results of this trial showed the response to the mixed SuperSix/ TerraFed product achieving approximately a %200 nitrogen efficiency rate, showing that some biological response was achieved in this trial. However, the results were below what was achieved with the addition of a biological at the same farm at similar application rates. These results have been taken into account in continued trial with The Andersons in 2020.

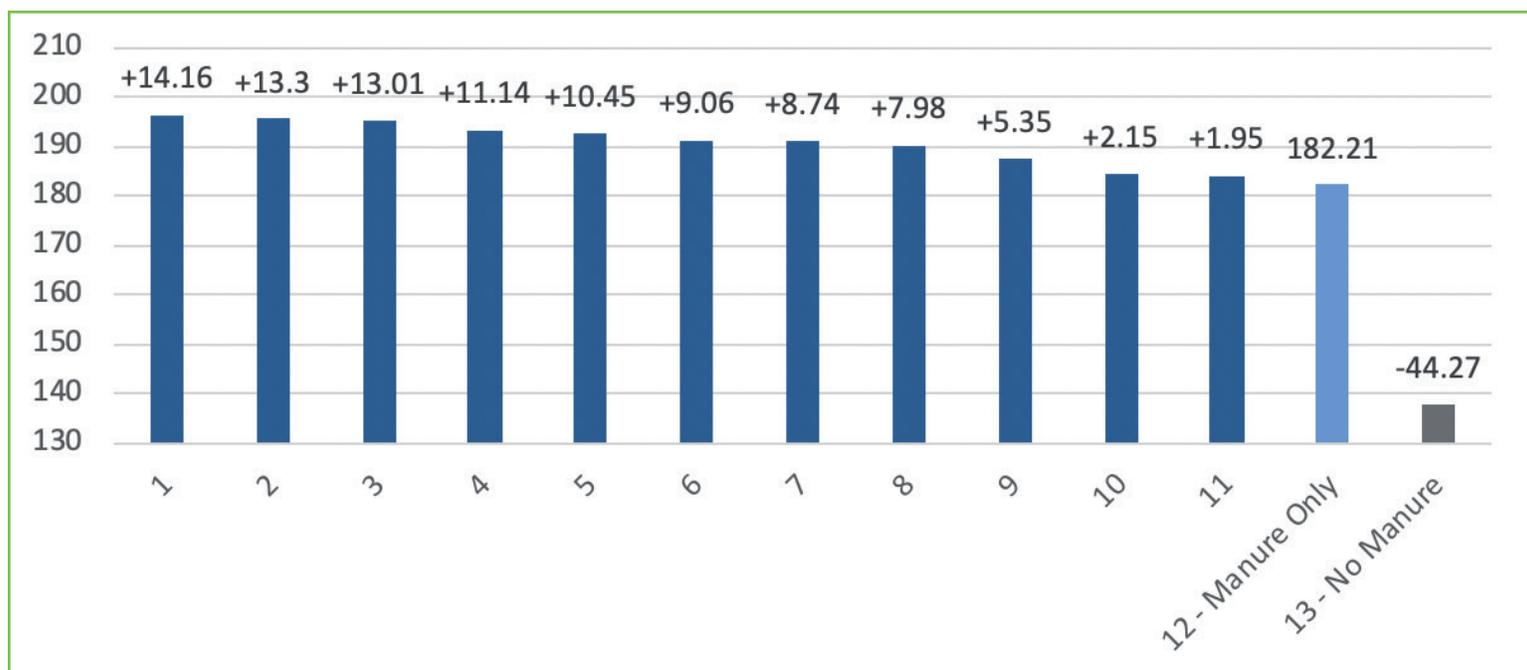


Fig 9: Agri-Tech The Andersons trial yield data by numbered treatment.

CONTROL	TREATMENT	V4-V6 LIQUID APPLIED Side-dress OR DRIBBLE
1	Organic Row Starter In-furrow / 10gal	Fulvic LQ™ / 1 qt
2	ANDE18125 / 5gal	Fulvic LQ™ / 1 qt
3	Humic DG™ dry in-furrow / 10lbs	Fulvic LQ™ / 1 qt
4	Humic DG dry in-furrow / 10lbs	-
5	Organic Row Starter in-furrow / 10gal	-
6	ANDE18126 / 10gal	-
7	Organic Row Starter in-furrow / 5gal	Fulvic LQ™ / 1 qt
8	Black Gypsum DG® broadcast pre-plant / 150lbs	Fulvic LQ™ / 1 qt
9	Organic Row Starter in-furrow / 5gal	-
10	ANDE18125 / 2gal	-
11	Black Gypsum DG broadcast pre-plant / 150lbs	-
12	Check (with manure)	-
13	Check (no manure)	-

Chart 2: Agri-Tech The Andersons trial, numbered treatments and treatment regime.

CORN TRIAL

RESEARCH COMPANY: ABG Ag Services

LOCATION: Toronto, SD & Frankfort, IN

PARTNER: Quality Liquid Feeds

PROTOCOL: Along with a control there were six treatments. SuperSix was used as a straight in furrow starter at rates of 5, 10, and 15 gallons per acre. These rates were repeated with a 50/50 mixture of SuperSix and TerraFed. Feather meal was used as the base dry fertility program.

SUMMARY DATA: This trial was conducted on conventionally managed research farms that also received abnormally heavy rains through the first part of the growing season, both in Indiana and South Dakota. There were no strong trends in the yield results from this trial, most likely because of no biological being included in the application to make up for decreased biological activity, and the heavy rains causing decreases in nitrogen availability.

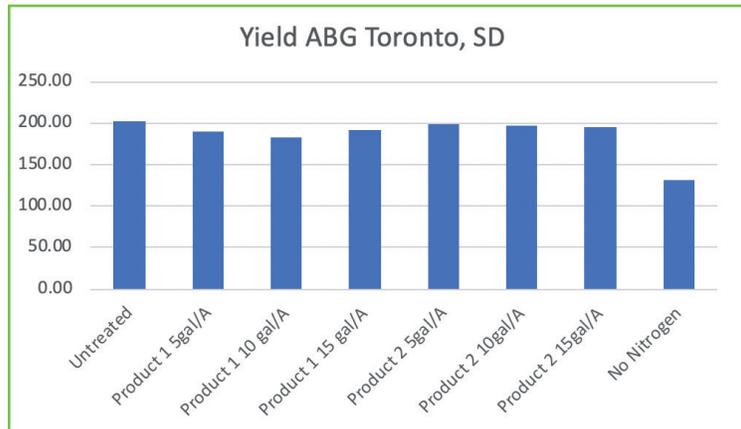


Figure 10: ABG South Dakota showing average yield by treatment.

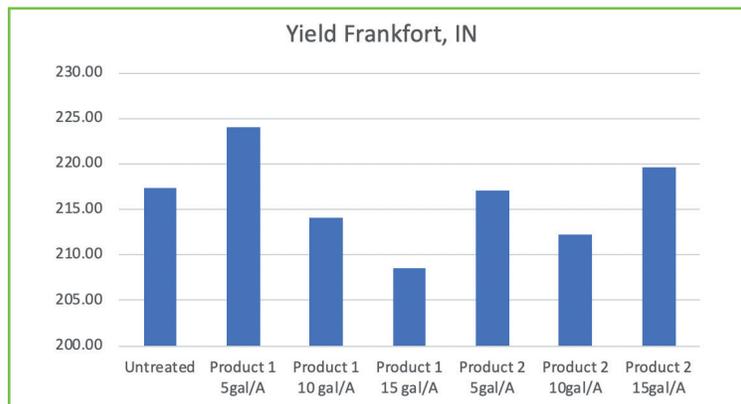


Figure 11: ABG South Dakota trial showing average yield by treatment.

	STAND COUNT PLANTS / ACRE	MOISTURE %	TEST WEIGHT LBS / BU	YIELD
Untreated	29,500	26.00	50.00	201.70
P1 5gal/A	31,375	28.00	50.10	189.90
P1 10gal/A	27,875	27.40	50.60	183.50
P1 15gal/A	27,000	28.20	49.90	191.00
P2 5gal/A	29,625	27.20	50.40	198.40
P2 10gal/A	31,250	27.10	50.30	196.10
P2 15gal/A	30,375	26.50	50.20	195.80
No Nitrogen	N/A	29.60	49.50	132.10

Chart 3: ABG South Dakota trial with treatment regimes, stand counts, moisture level, test weight, and yield data from harvest.

	STAND COUNT PLANTS / ACRE	MOISTURE %	TEST WEIGHT LBS / BU	YIELD
Untreated	30,056	23.30	52.90	217.30
P1 5gal/A	29,294	23.90	52.40	224.10
P1 10gal/A	30,111	24.20	51.70	214.10
P1 15gal/A	26,354	24.20	49.00	208.60
P2 5gal/A	29,784	24.00	50.90	217.10
P2 10gal/A	30,710	23.50	55.60	212.30
P2 15gal/A	29,675	24.20	56.30	219.60

Chart 4: ABG Indiana trial with treatment regimes, stand counts, moisture level, test weight, and yield data from harvest.

CORN TRIAL

RESEARCH COMPANY: Agres

LOCATION: Belleville, WI

PARTNER: Quality Liquid Feeds

PROTOCOL: Application rates were tested at 5, 10, 15, and 20 gallon/acre rates at planting in 2x2 with SuperSix alone. Application rates were tested at 5, 10, 15, and 20 gallon/acre rates at planting in furrow with a 50/50 mix with TerraFed. Side dress application rates were tested at 5 and 10 gallon/acre rates alone, and in combination with the starter applications listed above.

SUMMARY DATA: The results from this trial were effected by flooding in an entire set of replication blocks, as well as problems in correctly applying the base chicken manure application. There are no strong trends in these results. Some of the protocols used in this trial have been used in designing trials to be conducted in 2020 in cooperation with Quality Liquid Feeds in order to look more closely at side-dress application effects.

TREATMENT	G/A	YIELD
Check		95.6
BioStar 2x2 Starter	5	72.3
	10	85
	15	78.8
	20	63.3
BioStar/TerraFed In Furrow Starter	5	82.3
	10	68.3
	15	67.1
	20	72.6
BioStar Side-dress	5	76.5
	10	95.3
	15	93
	20	89
BioStar/TerraFed Side-dress	5	85.4
	10	90.6
	15	87.2
	20	102.5
BS Starter and Side-dress	5	87.7
BS TF Starter and Side-dress	5	89.9
BS Starter BS TF Side-dress	5	73
BS TF Starter and BS Sidredress	5	91.9
BS Starter and Side-dress	10	69.2
BS TF Starter and Side-dress	10	75.6
BS Starter BS TF Side-dress	10	90.2
BS TF Starter and BS Sidredress	10	90.1

Chart 5: Agres trial with treatment, gallons of treatment per acre, and average yield.

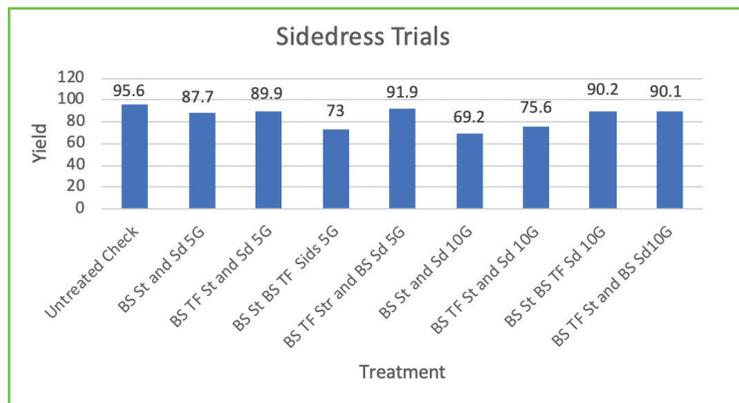


Figure 13: Summarized side dress data Agres trial.

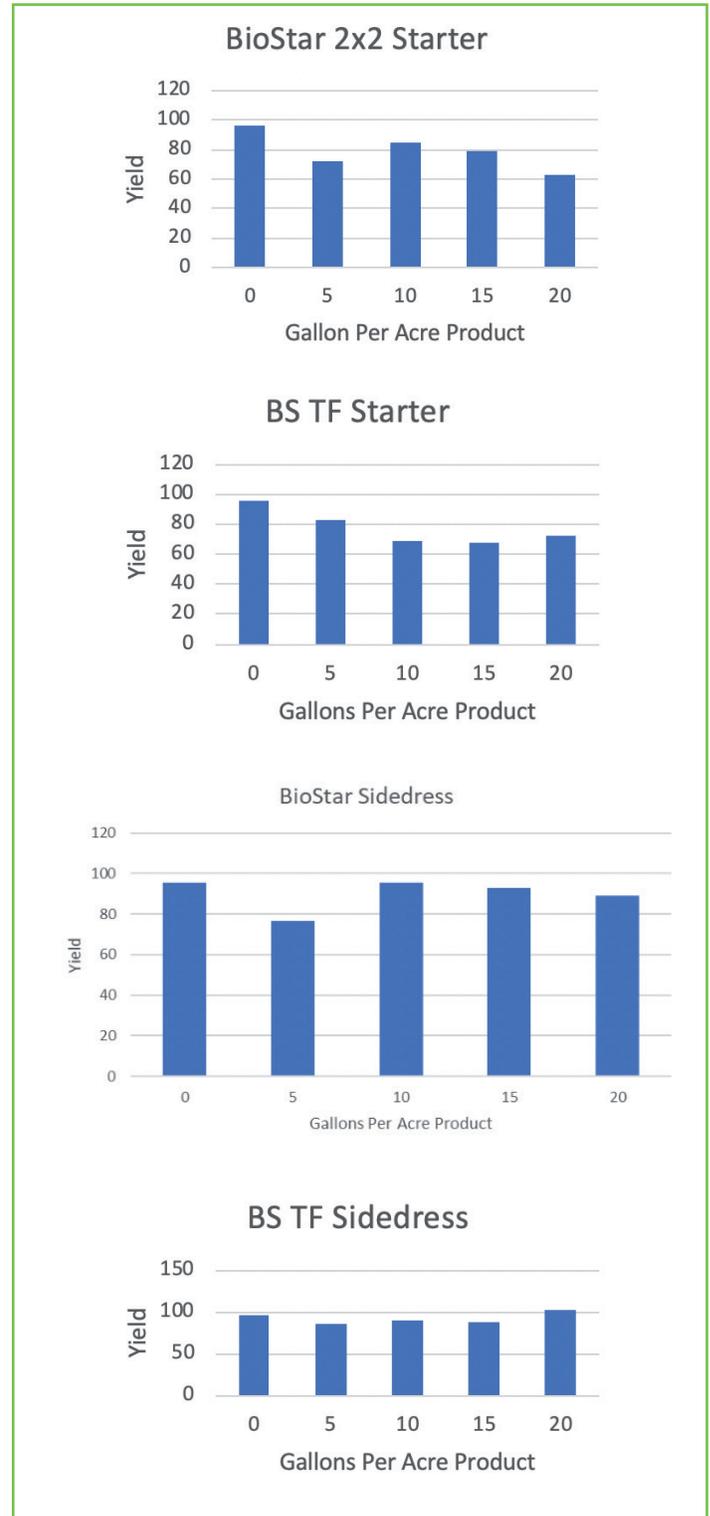


Figure 12: Agres trial showing average yield by treatment regime.

CORN TRIAL

FARMER: Chad Kuhlman

LOCATION: Gottenburg, NE

PARTNER: Quality Liquid Feeds

METHODS: A mixture of 50/50 SuperSix and TerraFed along with other biological products was applied to WaxyPro corn, an experimental high sugar corn for organic syrup production. The 50/50 mixture was applied at rates of 10 and 20 gallons, with total mixture rates of 11 and 22 gallons being applied. Treatment applications of all the ingredients excepts SuperSix were done at the same application rates for comparison.

SUMMARY DATA: With the addition of SuperSix, the applications of 11 and 22 gallons per acre yield 6.23 and 10.56 bu / acre, respectively, over the non-SuperSix mixture. An untreated check strip was left, but data is not available at this time.



Figure 14: (Top) Untreated corn on the left, corn treated with mixture at 10 gallons per acre on right. (Bottom) Corn treated with mixture at 10 gallons per acre on the right, 20 gallons per acre on the left. Pictures were taken on June 17th, fifteen days after planting.



Figure 15: Corn on left received 20 gallons per acre of starter mix, on right received 10 gallons per acre.

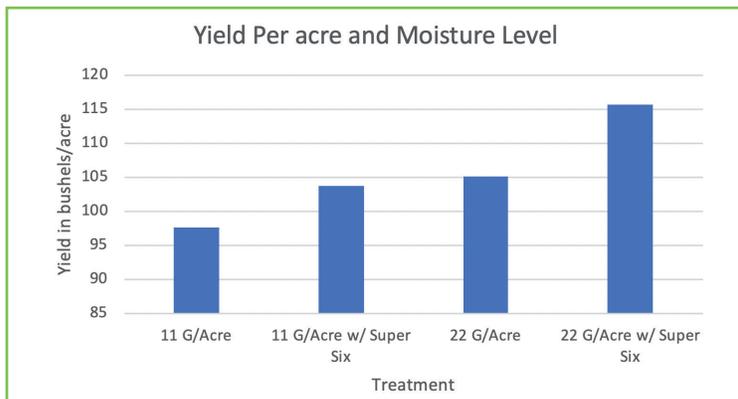


Figure 16: Yield from Chad Kuhlman field trial in bushels per acre by treatment.

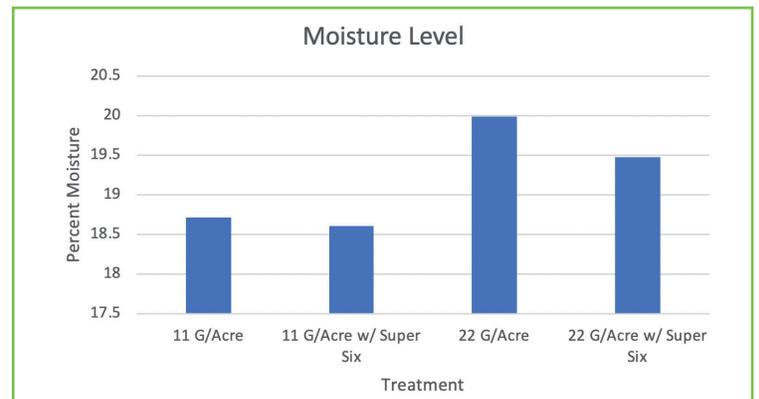


Figure 17: Percent moisture in harvested corn by treatment.

CORN TRIAL

FARMER: Bob Yanda

LOCATION: Monticello, IA

PARTNER: Quality Liquid Feeds

METHODS: Product was applied at planting at a rate of 5 gallons per acre in-furrow.

ANECDOTAL DATA: On 92 day corn there was a yield bump of 10-12 bu/acre. On 102 day corn no difference was noted.

CORN TRIAL

FARMER: Early Bird Fertilizers

LOCATION: Goodfield, IL

PARTNER: Quality Liquid Feeds

METHODS: Product was side dressed at rates of 20 lbs of N and 40 lbs of N per acre at V6.

ANECDOTAL DATA: The product performed alongside equal rates of nitrogen of other products, including Chilean Nitrate, showing that as a straight N product it performs alongside competing products.



Figure 18: Hand check of Early bird trial. BioStar SuperSix treated corn is in the middle.

ALFALFA TRIAL

RESEARCH COMPANY: Quality Liquid Feeds

LOCATION: Rockton, WI

PARTNER: Organic Valley

PROTOCOL: Terra Fed and SuperSix were applied June 7th between 1st and 2nd crop at a rate of 5 gallons per acre of each with water to second year alfalfa following corn.

Scissor cutting samples were done on July 2 representative of 2nd crop and samples sent to Dairyland Labs for analysis.

EARLY BUD	TERRA FED & SUPERSIX	CONTROL 1	CONTROL 2
Average Stem Count	83	71	56
Average Height (in)	23.5	22	20
Average Weight (g)	299	243	189
Protein	23.34	23.31	23.4
Sugar	8.08	7.4	7.7
ADF	29.23	31.83	29.85
NFC	32.25	29.42	33.55
RFV	176.86	159.5	175.07
RFQ	218.76	198.9	209.04
NDF (rate per hour)	6.59	6.33	5.86
Milk (per ton)	3,321	3,169	3,357

Chart 6: Alfalfa trial forage and yield results by treatment.

SUMMARY DATA:

Averaging together the two controls, the application area yielded 27% higher. On second cut hay this could result in a .5-1 Ton /acre increase in production, an added value of \$100-200/acre resulting in a 2.25-4.5x ROI.

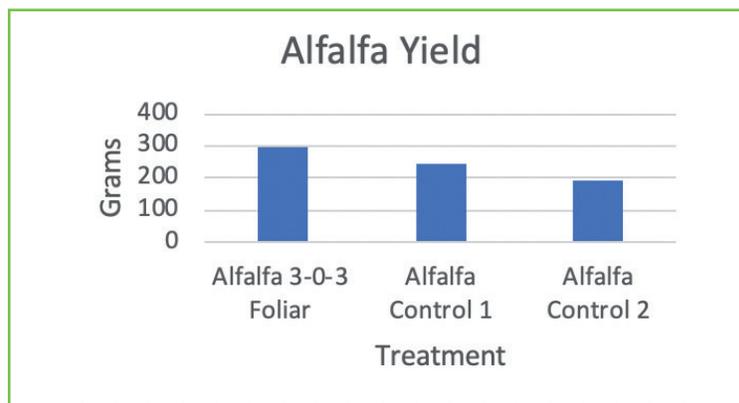


Figure 19: Alfalfa trial yield data by treatment.

WHEAT TRIAL

FARMER: Chad Kuhlman

LOCATION: Gottenburg, NE

PARTNER: Organic Valley, Quality Liquid Feeds

METHOD: SuperSix and TerraFed were sprayed as a 50/50 mixture with water as a foliar application on pre-boot winter wheat. An untreated check strip was left on the far west of the field and the bulk of the field was treated at a rate of 5 gallons per acre. Two passes were double treated about 2/3rds of the way through the field for an application rate in that section of 10 gallons per acre. The field was harvested, and the data was collected on a JD combine monitor. The data was then transferred to GK Analytics for processing. The data was broken down into 2069 separate geolocated plots then run through a SAS program for statistical analysis.

SUMMARY DATA:

Referring to figure 20 the field treatments were as follows.

Pass 1 is a checkstrip labeled Untreat, pass 2-8 is Treated-W that received 5 gallons per acre.



Figure 20: Field map of wheat field trial showing pass numbers and yield result as collected by the harvester, map prepared by GK technology..

Obs	TREATMENT	Estimate	Standard Error	Letter Group
1	TreatDou	142.49	1.2190	A
2	TreatedE	104.90	0.6594	B
3	TreatedW	97.9641	0.9459	C
4	Untreat	54.7871	1.8868	D

Chart 7: SAS output data from analysis of wheat field trial. Estimates column is yield in bu/acre, followed by standard error. Treatments with the same letter grouping are not statistically different from one another, all treatments here have separate letter grouping indicating statistically significant differences for all treatments.

SAS output estimate indicates mean (average) yield. Separate letter groups indicate that all treatments were statistically different from one another, as shown in Figure 13.

Yield Map showing moisture differences in harvested grain, treatment areas are the same as above, shown in Figure 17.

SAS output estimate indicates mean (average) moisture of grain at harvest. Separate letter groups indicate that all treatments were statistically different from one another, shown in Chart 8.

The average increase over the check strip mean yield in the areas treated at a rate of 5 gallons per acre was 46.6 bu/acre and in the area treated at a rate of 10 gallons per acre was 88 bushels per acre. Grain was contracted at a rate of \$11/bushel. The application rate at 5 gallons per acre was \$22, and at 10 gallons per acre was \$44. This results in a calculated ROI on the lower treatment rate section of 25x, and in the higher treated section 21.95x.

Figure 19 is a picture taken as wheat is maturing between the check strip and the west treatment area. The wheat has matured more rapidly where product was applied resulting in the wheat starting to turn color faster.



Figure 21: Field map of wheat field trial showing moisture levels in harvested grain as collected by the harvester, map prepared by GK technology.

Obs	TREATMENT	Estimate	Standard Error	Letter Group
1	Untreat	14.9053	0.1462	A
2	TreatedW	13.7221	0.07330	B
3	TreatedE	12.7855	0.05110	C
4	TreatDou	12.0928	0.09447	D

Chart 8: SAS output data from analysis of wheat field trial. Estimates column is % moisture in harvested grain followed by standard error. Treatments with the same letter grouping are not statistically different from one another, all treatments here have separate letter grouping indicating statistically significant differences for all treatments.

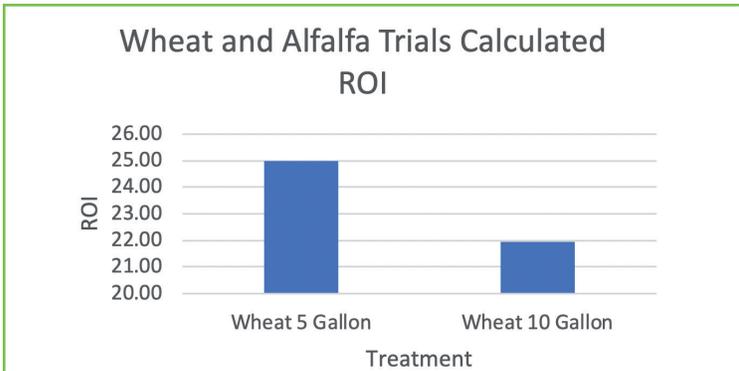


Figure 22: Calculated ROI on wheat trial based on \$22 per acre treatment for 5 gallon rate and \$44/acre treatment for 10 gallon rate with a sale price on the wheat of \$11/



Figure 23: Picture of wheat field trial, the untreated control labeled pass 1 in Figure 16 is to the left of the red line, to the right are treatment passes 2-5 in Figure 16.



Figure 24: Wheat on the left was in a treatment area, wheat on the right was in the checkstrip. The treated wheat on the left shows better root formation and higher levels of root exudates indicated by more soil sticking to the roots.

CONCLUSION

CORN

While results in terms of corn yields fell off from what the 2018 field trials produced, a lot of other valuable data was gathered from trials in 2019. First, early response of the crops to the application of SuperSix and combination SuperSix products was noticeable across the board. All farmers trials found that the early growth in these crops was marked and notably better than untreated check strips. While treated crops continued on to give higher yields with acceptable ROIs, it is apparent that something in the entire plant/soil system was not operating at the same level as in 2018. The most likely source of this difference is the weather between the two years. 2019 was much colder and wetter than 2018 and many conventional crops finished late. Nitrogen in systems was in short supply since much of it washed out with the heavy rains early in the year. Something similar may have acted as a drag on the system in our trials. Colder soil temps suppress biological activity, and, as our product seems to be working in tandem with biology, this may have resulted in less N being liberated from base fertility applications of manure. Also, soluble nitrates and ammonium in applied manures may have leached early in the year reducing the total supply of nitrogen to the plants.

Even with these difficulties yield increases were still in the 7-10% range on average. The consistency of this increase in terms of a percentage of crop yield, as opposed to a straight bu/acre increase, points again to the product working in tandem with biology and not on a per lbs of N basis. An excellent example of this is present in the study done at Agri-Tech in Whitewater, WI. This particular study illustrates the product working as a traditional nitrogen fertilizer, and also as a food source for biology, leading to an increase in yield above and beyond what would be expected in a simple lbs of N to bushels of corn model. The Agri-Tech research farm has been used for years for conventional pesticide, herbicide, and fertility testing. It appears that as a result of this, biological activity has been suppressed, providing an excellent testing ground to see how products perform with and without biological inoculates. The analysis below assumes that without a biological being applied there is little to no added benefit to fertilizer and food source applications beyond their stated fertilizer value.

The first two treatments of 5-0-5, which is made by mixing 5-parts SuperSix and 1-part TerraFed together, yielded as would be expected off of the total amount of N applied in the treatment. A seven gallons per acre rate of the 5-0-5 mixture amounts to approximately 3.15 lbs of N per acre. If we calculate the N use efficiency at 75%, this would predict a yield increase of 2.37 bu/acre, within 1.2% of the actual yield increase. With the 14 gallons per acre application rate approximately 6.3 lbs of N were applied per acre. Using the same efficiency calculation, a yield increase of 4.73 bu/acre is predicted, within 2.1% of the measured yield increase.

Instead of getting .75 bu of corn for every 1 lbs of N, a 75% efficiency rate, with the addition of a biological and a rate of 7 gallons per acre, every pound of N is yielding 5.29 bu of corn, a 529% efficiency rate. At 14 gallons, 1 pound of N is yielding 4.46 bu of corn, a 446% efficiency rate. It is obvious that this kind of yield increase is more than just from the amount of nitrogen being applied, and that the combination of SuperSix and TerraFed is providing a food source that is promoting biological growth and nutrient liberation pathways, leading to the mobilization of nitrogen from other sources in the soil, such as animal manures applied pre-plant. This helps to explain the steady 7-10% yield increases as it appears we are boosting natural plant soil processes with the application, effectively speeding up these natural process around the same amount on a percentage basis as we are seeing the yield increase. In other words, we are creating a higher/faster functioning overall system with these product applications, not just feeding particular nutrients to get linear yield responses.

ALFALFA

The alfalfa trials in 2019 were of limited scope and were more a proof of concept than an actual field trial. The results were surprisingly positive, and again point to increasing plant function generally with these applications and not simply feeding N as a nutrient. In this case the plants were foliar fed, but these small application rates were still yielding good returns of yield and ROI. Follow up trials will be done in 2020 in order to attempt to replicate 2019 results and expand to looking at changes in root structure, possible carryover to further cuttings of hay, and other plant health related measurements to better understand how our product is working.

	BUSHEL	BUSHEL INCREASE	% INCREASE
Control	210.82		
5-0-5-7 GAL	213.21	2.39	1.13%
5-0-5-14 GAL	215.45	4.63	2.20%
5-0-5 7 GAL + STIMULAGRO + AGRO GOLD	227.51	16.69	7.92%
5-0-5 14 GAL + STIMULAGRO + AGRO GOLD	238.96	28.14	13.35%

Chart 1 (Repeat): Yield result from Agri-Tech Agro-Research trial showing treatments, yield increases over treatment, and calculated percent increase over treatment.

WHEAT

The wheat yields were very surprising, no one involved in the trials expected results of this magnitude off of a single foliar spray pass. Again, this points to the treatment working to enhance not only nutrient availability, but general plant health and biology associated with the plant. This can be seen also by looking at the pictures of the changes in root structure of the wheat, and the way in which the soil clings to the wheat roots in the treated sections, indicating higher levels of biological activity and stronger biological glues holding the soils in place.

These positive results should be viewed with a certain level of circumspection. It is not likely that we will consistently see such strong results as they are most likely the results of multiple factors working in sync at optimal levels. These factors include: timing of application, growing conditions after application, soil conditions at timing of application, latent soil fertility levels, wheat variety and most likely others that have not been identified. Much of this result theoretically is from latent fertility being present in the field in the form of undigested application of manures and other organic fertilizers that had not yet been utilized. Even if these results were to be repeated in this field or fields of similar composition and fertility status, it is likely that over time the yield results would moderate as the latent fertility in the field is drawn down. In order to properly confirm these results and better understand them, further trials need to be conducted both on the farm where they were done and other farms, along with beginning to track over the course of time how fertility levels in these soils are changing as a result of repeated applications of our product.

TRIALS 2020

Trials in 2020 are designed to build off of what we learned in 2019, expand into new crops, and continue to bolster our ability to give advice to distributors and farmers about how to best use our product. In addition to corn, alfalfa, and wheat, trials are being done or are scheduled to be done on greens mix, spinach, celery, broccoli, barley, and rice. Corn, alfalfa, barley, and wheat trials are all being continued with an eye towards expanding production into the Midwest and East Coast areas. Vegetable trials are designed to give information on use rate ROIs, as well as look at the possibility of offering combined products to the vegetable industry. Rice has been added as a result of a market analysis identifying it as a uniquely suitable crop for our product due to its physiology.

Below are listed trials alphabetically by crop; both running, scheduled, and prospective for 2020. Protocols listed out are subject to change in field trials as conditions dictate.

ALFALFA

PARTNER: Quality Liquid Feeds

TYPE: Field Trial

SUMMARY: Trials will be done a second year in a row as a foliar feed on a similar timing schedule with a more in-depth look at changes in root structure, and carryover into later cuttings.

CONCLUDES: Fall 2020

BARLEY

PARTNER: Chad Kuhlman

TYPE: Field Trial

SUMMARY: Barley will be foliar-fed pre-boot at two different application rates.

CONCLUDES: Late Summer 2020

BROCCOLI

PARTNER: RD4AG

TYPE: Small Plot Trial

SUMMARY: Crop has three treatments plus the control, all treatments received two tons of compost as a base.

Treatments are as follow:

TREATMENT 1: 6-0-0 applied as 25% of crop needs.

TREATMENT 2: 6-0-0 applied as 50% of crops needs.

TREATMENT 3: 6-0-0 as 25% of crop needs with equal vol molasses

CONCLUDES: May 2020

CELERY

PARTNER: RD4AG

TYPE: Small Plot Trial

SUMMARY: Crop has three treatments plus the control, all treatments received two tons of compost as a base.

Treatments are as follow:

TREATMENT 1: 6-0-0 applied as 25% of crop needs.

TREATMENT 2: 6-0-0 applied as 50% of crops needs.

TREATMENT 3: 6-0-0 as 25% of crop needs with equal vol molasses

CONCLUDES: May 2020

CORN

NAME: Agri-Tech

PARTNER: Agro-Research International, Quality Liquid Feeds

TYPE: Small Plot Trial

SUMMARY: Protocol for this trial is not laid out fully here due to its complicated nature. This trial is an in furrow starter trial and is designed to build off of the trial done in 2019 by including a second biological treatment, and separating out treatments in ways that will let us pick apart how the pieces of this possible starter package is working together. Specifically we will be looking at how the biologicals act on their own with no food sources or supplemental liquid fertility, and by including different parts of the food and liquid fertility in separate replications.

CONCLUDES: Fall 2020

CORN

NAME: The Andersons

PARTNER: Agri-Tech, AgriCenter International

TYPE: Small Plot Trial

SUMMARY: Product will be applied as an in-furrow starter at a rate of 10 gallons per acre. This builds off of last years trials with The Andersons. This year we have included a biological in our starter mix as a way of offsetting low biological levels at research farms. The Andersons have expanded their trials to include a site in Tennessee as well as Wisconsin and we are at both locations.

CONCLUDES: Fall 2020

GREENS MIX

PARTNER: RD4AG

TYPE: Small Plot Trial

SUMMARY: Crop has three treatments plus the control, all treatments received two tons of compost as a base. Treatments are as follows:

TREATMENT 1: 6-0-0 applied as 25% of crop needs.

TREATMENT 2: 6-0-0 applied as 50% of crops needs.

TREATMENT 3: 6-0-0 as 25% of crop needs with equal vol molasses

CONCLUDES: May 2020

SPINACH

PARTNER: RD4AG

TYPE: Small Plot Trial

SUMMARY: Crop has three treatments plus the control, all treatments received two tons of compost as a base. Treatments are as follows:

TREATMENT 1: 6-0-0 applied as 25% of crop needs.

TREATMENT 2: 6-0-0 applied as 50% of crops needs.

TREATMENT 3: 6-0-0 as 25% of crop needs with equal vol molasses

CONCLUDES: May 2020

RICE

PARTNER: AgrolInnovations

SUMMARY: The full protocol is not listed here due to its complicated nature. This trial is designed to look at pre-planting applications of SuperSix, inclusion in flood waters, and foliar applications.

CONCLUDES: Fall 2020

WHEAT

PARTNER: RD4AG - pending

SUMMARY: As a follow up to the Nebraska wheat trial these trials are being designed to see if those results are replicable in a different environment. Full protocols are yet to be determined but application on irrigated and dryland wheat both as foliars, pre-plant applications, and fall foliars are being designed. This would be a two part trial due to winter wheat pre-plant and fall foliar application result not being available until 2021.

PART 1 CONCLUDES: Fall 2020

PART 2 CONCLUDES: Fall 2021

REFERENCES

Saxton, A.M. 1998. *A macro for converting mean separation output to letter groupings in Proc Mixed*. In Proc. 23rd SAS Users Group Intl., SAS Institute, Cary, NC, pp.1243-1246.

APPENDIX A

SAS Output Dependent Variable-Dry Yield Average

APPENDIX B

SAS Output Dependent Variable-Moisture Average

The SAS System

The Mixed Procedure

Model Information	
Data Set	WORK.TEST
Dependent Variable	YLDDRYAVG
Covariance Structure	Diagonal
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Residual

Class Level Information		
Class	Levels	Values
PASSNUMB	17	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
TREATMENT	4	TreatDou TreatedE TreatedW Untreat

Dimensions	
Covariance Parameters	1
Columns in X	5
Columns in Z	0
Subjects	1
Max Obs per Subject	747

Number of Observations	
Number of Observations Read	747
Number of Observations Used	747
Number of Observations Not Used	0

Covariance Parameter Estimates	
Cov Parm	Estimate
Residual	170.88

Fit Statistics	
-2 Res Log Likelihood	5948.1
AIC (Smaller is Better)	5950.1
AICC (Smaller is Better)	5950.1
BIC (Smaller is Better)	5954.7

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
TREATMENT	3	743	569.14	<.0001

Least Squares Means						
Effect	TREATMENT	Estimate	Standard Error	DF	t Value	Pr > t
TREATMENT	TreatDou	142.49	1.2190	743	116.89	<.0001
TREATMENT	TreatedE	104.90	0.6594	743	159.09	<.0001
TREATMENT	TreatedW	97.9641	0.9459	743	103.57	<.0001
TREATMENT	Untreat	54.7871	1.8868	743	29.04	<.0001

Differences of Least Squares Means							
Effect	TREATMENT	_TREATMENT	Estimate	Standard Error	DF	t Value	Pr > t
TREATMENT	TreatDou	TreatedE	37.5886	1.3859	743	27.12	<.0001
TREATMENT	TreatDou	TreatedW	44.5272	1.5429	743	28.86	<.0001
TREATMENT	TreatDou	Untreat	87.7042	2.2463	743	39.04	<.0001
TREATMENT	TreatedE	TreatedW	6.9386	1.1530	743	6.02	<.0001
TREATMENT	TreatedE	Untreat	50.1157	1.9987	743	25.07	<.0001
TREATMENT	TreatedW	Untreat	43.1771	2.1106	743	20.46	<.0001

The SAS System

Effect=TREATMENT Method=LSD(P<.05) Set=1

Obs	TREATMENT	Estimate	Standard Error	Letter Group
1	TreatDou	142.49	1.2190	A
2	TreatedE	104.90	0.6594	B
3	TreatedW	97.9641	0.9459	C
4	Untreat	54.7871	1.8868	D

The SAS System

The UNIVARIATE Procedure
Variable: residYLDDRYAVG (Residual)

Moments			
N	747	Sum Weights	747
Mean	0	Sum Observations	0
Std Deviation	13.0458827	Variance	170.195055
Skewness	-0.5936479	Kurtosis	5.10996435
Uncorrected SS	126965.511	Corrected SS	126965.511
Coeff Variation	.	Std Error Mean	0.47732389

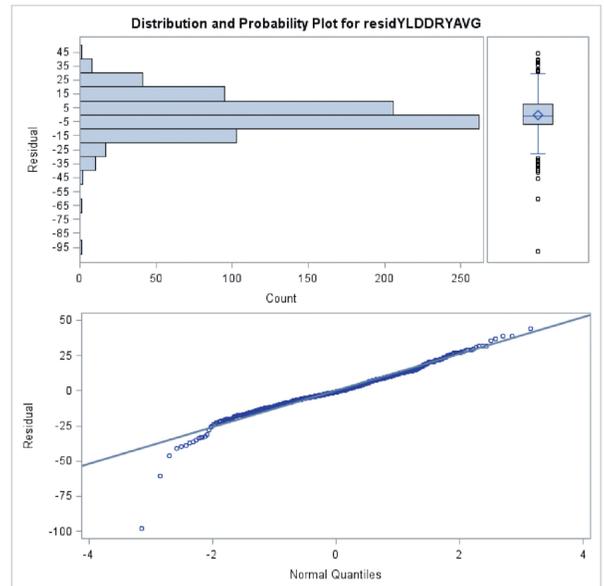
Basic Statistical Measures			
Location		Variability	
Mean	0.00000	Std Deviation	13.04588
Median	-0.79923	Variance	170.19506
Mode	.	Range	142.06291
		Interquartile Range	15.01447

Tests for Location: Mu0=0			
Test	Statistic	p Value	
Student's t	t 0	Pr > t	1.0000
Sign	M -22.5	Pr >= M	0.1074
Signed Rank	S -1286	Pr >= S	0.8276

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.957441	Pr < W	<.0001
Kolmogorov-Smirnov	D	0.048886	Pr > D	<.0100
Cramer-von Mises	W-Sq	0.629166	Pr > W-Sq	<.0050
Anderson-Darling	A-Sq	3.977468	Pr > A-Sq	<.0050

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
-97.9641	731	35.7252	464
-60.4979	530	37.1125	426
-45.9525	335	38.8766	702
-41.1146	532	39.1587	121
-39.6066	407	44.0988	231

Quantiles (Definition 5)	
Level	Quantile
100% Max	44.098783
99%	31.491877
95%	21.896077
90%	14.861516
75% Q3	7.936977
50% Median	-0.799225
25% Q1	-7.077495
10%	-14.100484
5%	-18.258597
1%	-36.606357
0% Min	-97.964123



The SAS System

The Mixed Procedure

Model Information	
Data Set	WORK.TEST
Dependent Variable	MOISTAVG
Covariance Structure	Diagonal
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Residual

Class Level Information		
Class	Levels	Values
PASSNUMB	17	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
TREATMENT	4	TreatDou TreatedE TreatedW Untreat

Dimensions	
Covariance Parameters	1
Columns in X	5
Columns in Z	0
Subjects	1
Max Obs per Subject	747

Number of Observations	
Number of Observations Read	747
Number of Observations Used	747
Number of Observations Not Used	0

Covariance Parameter Estimates	
Cov Parm	Estimate
Residual	1.0263

Fit Statistics	
-2 Res Log Likelihood	2147.7
AIC (Smaller is Better)	2149.7
AICC (Smaller is Better)	2149.7
BIC (Smaller is Better)	2154.3

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
TREATMENT	3	743	124.83	<.0001

Least Squares Means						
Effect	TREATMENT	Estimate	Standard Error	DF	t Value	Pr > t
TREATMENT	TreatDou	12.0928	0.09447	743	128.01	<.0001
TREATMENT	TreatedE	12.7855	0.05110	743	250.19	<.0001
TREATMENT	TreatedW	13.7221	0.07330	743	187.19	<.0001
TREATMENT	Untreat	14.9053	0.1462	743	101.93	<.0001

Differences of Least Squares Means							
Effect	TREATMENT	_TREATMENT	Estimate	Standard Error	DF	t Value	Pr > t
TREATMENT	TreatDou	TreatedE	-0.6927	0.1074	743	-6.45	<.0001
TREATMENT	TreatDou	TreatedW	-1.6293	0.1196	743	-13.63	<.0001
TREATMENT	TreatDou	Untreat	-2.8125	0.1741	743	-16.16	<.0001
TREATMENT	TreatedE	TreatedW	-0.9366	0.08936	743	-10.48	<.0001
TREATMENT	TreatedE	Untreat	-2.1198	0.1549	743	-13.69	<.0001
TREATMENT	TreatedW	Untreat	-1.1832	0.1636	743	-7.23	<.0001

Effect=TREATMENT Method=LSD(P<.05) Set=1

Obs	TREATMENT	Estimate	Standard Error	Letter Group
1	Untreat	14.9053	0.1462	A
2	TreatedW	13.7221	0.07330	B
3	TreatedE	12.7855	0.05110	C
4	TreatDou	12.0928	0.09447	D

The SAS System

The UNIVARIATE Procedure
Variable: residMOISTAVG (Residual)

Moments			
N	747	Sum Weights	747
Mean	0	Sum Observations	0
Std Deviation	1.01104961	Variance	1.02222131
Skewness	-2.3235962	Kurtosis	54.5994123
Uncorrected SS	762.577099	Corrected SS	762.577099
Coeff Variation	.	Std Error Mean	0.03699237

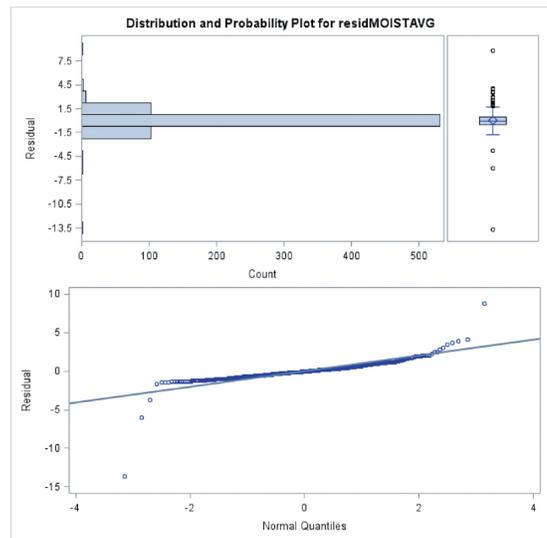
Basic Statistical Measures			
Location		Variability	
Mean	0.00000	Std Deviation	1.01105
Median	-0.05083	Variance	1.02222
Mode	0.28448	Range	22.50915
		Interquartile Range	0.91417

Tests for Location: Mu0=0			
Test	Statistic	p Value	
Student's t	t 0	Pr > t	1.0000
Sign	M -21.5	Pr >= M	0.1243
Signed Rank	S -6837	Pr >= S	0.2468

Tests for Normality			
Test	Statistic	p Value	
Shapiro-Wilk	W 0.74403	Pr < W	<0.0001
Kolmogorov-Smirnov	D 0.105019	Pr > D	<0.0100
Cramer-von Mises	W-Sq 3.181768	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq 20.66403	Pr > A-Sq	<0.0050

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
-13.72214	731	3.49786	143
-6.02319	48	3.64216	698
-3.76731	47	3.92786	732
-1.72170	652	4.05575	43
-1.49325	186	8.78701	699

Quantiles (Definition 5)	
Level	Quantile
100% Max	8.7870094
99%	2.5165014
95%	1.2624814
90%	0.9978614
75% Q3	0.4011455
50% Median	-0.0508317
25% Q1	-0.5130245
10%	-0.9232145
5%	-1.1330486
1%	-1.3890586
0% Min	-13.7221386





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