Western Illinois University- School of Agriculture
Organic Research Program
2013 Dry Humate/Fertility Studies

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Introduction

Organic grain farmers generally use less purchased inputs than conventional grain farmers or organic vegetable farmers, but some organic grain farmers are supplementing traditional animal and green manure based nutrient management strategies with specialty products such as Chilean nitrate, pelletized manures and humate products.

Some of these farmers are achieving very high yields leading to questions about the relative impact of specialty products on crop yield and profitability, and ultimately whether these effects can be enhanced through integration of multiple products.

In 2013, 2 studies at the WIU/Allison Organic Research Farm were conducted to answer some of those questions. The 3 specialty products used in the study were Anderson's Humic DG (dry humate) offered by SoilBiotics (Note: As of early 2014 SoilBiotics offers the same product as Soil Boost EA), Allganic™ Nitrogen Natural Nitrate of Soda Crystalline (16-0-0) (Chilean nitrate) from SQM North America Corp., and OPC (5-3-2) pelletized chicken litter from Unlimited Renewables LLC.

Humic DG was the only treatment to be randomized and replicated in these studies. The other products were applied uniformly within respective fields to create contrasting background fertility programs. Field 4-3 received the higher input program with OPC pelletized chicken litter broadcast and incorporated pre-plant. Field 4-3 received the low input program with low rates of OPC pelletized chicken litter and Chilean nitrate applied with the planter.

Methods

The studies took place at the WIU Organic Research farm in southwest Warren County, Illinois in adjacent fields (4-3 & 4-4). Both studies had complete randomized block designs with 4 replications of 8 row x 1200' plots. Both fields were planted to Prairie Hybrids 5879 (target population = 28k/a) on 6/13/13 using a Buffalo 4 row planter.

Field 4-3 was planted to winter wheat in the fall of 2012, but due to a thin stand and significant weed pressure, the wheat was terminated on 5/15/13 using a disk. Field 4-4 was planted to a warm season cover crop mix in July 2012 that was incorporated in fall 2012 using a vertical tillage tool.

On 4/15/13, field 4-4 received a broadcast application of OPC pelletized chicken litter (5-3-2) at a rate of ~ 2,600 lbs of product per acre. Three passes with a 4-wheel floater truck (same wheel tracks) were required to achieve the desired rate. The soil was relatively dry at the time of application but soil compaction was evident in the wheel tracks.

Both fields were tilled with a soil finisher on 5/24/13, a field cultivator on 6/11/13, and a vertical tillage tool on 6/12/13. The vertical tillage tool was set slightly too deep for the 1st round (~65' wide) on the east side of field 4-4, resulting in some soil slabbing in the area identified as rep 1 and the east half of rep 2 (Map 1).

Weed control practices during the production season consisted of 1 pass with a rotary hoe (field 4-4 on 6/14/13 and field 4-3 on 6/21/13) and 1 row crop cultivation on 7/5/13 using a modified IH 153 cultivator. The row crop cultivation provided a high level of weed control but areas with less than optimal corn populations (particularly on the east side of 4-4) allowed the growth of some late season weeds. In-row weed pressure was slight to moderate at the end of the season.

The humate treatment plots in both fields 4-3 and 4-4 received Humic DG applied over the row (10 lbs/a) during planting.

All plots in Field 4-3 received OPC pelletized litter (~120 lbs/a or ~ 6 lbs N/a) placed 2"x2" during planting and Chilean nitrate (~43 lbs/a or ~ 7 lbs N/a) applied directly over the row during planting. Because the insecticide boxes had 2 compartments with separate rate levers, the Chilean nitrate and Humic DG were able to be delivered simultaneously.

The treatment plots were harvested by a John Deere 9570 combine on 11/14/13. Each harvest swath was 6 rows wide and ~ 1,150' long. Yields were calculated using the yield monitor results and a correction factor determined from weigh wagon weights.

Results

The field average for field 4-3 was 140.4 bu/a while the field average for field 4-4 was 117.5 bu/a, almost a 23 bu/a difference. Since field 4-4 received a much higher rate of nitrogen from the chicken litter, we would have expected the opposite to occur. While this data is independent from the humate product studies, it is still worth noting and will be discussed later in the report.

In field 4-3, the average corn yield for the Humic DG plots was 4.9 bu/a higher than for the control plots, but this numerical difference was not large enough to be considered statistically significant at any of the alpha levels we tested (Table 1).

In field 4-4, the average corn yield for the Humic DG plots was 2.3 bu/a lower than for the control plots, but this numerical difference also was not large enough to be considered statistically significant at any of the alpha levels we tested (Table 2).

The average corn stands in the control plots were numerically higher in the control plots than the humate treatment but were not significantly different (Table 1).

Table 1. Field 4-3 (Low Fertility-13 lbs N/Acre) Corn Yields

Treatment	Corn Yield (Bu/A)	Significance Groups ($\alpha = 0.05$)	Corn Stand	Significance Groups ($\alpha = 0.05$)
10 lbs/a Humic DG	142.8	a	21,625	a
Control	137.9	a	23,875	a
	LSD = 13.0		LSD = 2,382	

LSD = Least Significant Difference

Different letters in the Significance Groups column indicate significant differences in yields among treatments.

Table 2. Field 4-4 (Moderate Fertility-130 lbs N/Acre) Corn Yields

Treatment	Corn Yield (Bu/A)	Significance Groups ($\alpha = 0.05$)	Corn Stand	Significance Groups ($\alpha = 0.05$)
Control	118.7	a	22,500	a
10 lbs/a Humic DG	116.3	a	20,375	a
	LSD =6.2		LSD = 3,174	

LSD = Least Significant Difference

Different letters in the Significance Groups column indicate significant differences in yields among treatments.

Discussion

Both studies resulted in no statistically significant results. While this may seem to imply little can be learned, many valuable observations were made during the course of these studies.

The most surprising observation was the higher plot yields in field 4-3 as compared to field 4-4 (Map 1). All 8 plots in field 4-3 yielded more than the highest yielding plot in field 4-4. The average yield difference between the 2 fields was over 20 bu per acre.

Field 4-4 received ~ 10 times more total N than field 4-3 (130 vs. 13 lbs/a) but the N source (OPC pelletized litter) was applied almost 2 months prior to planting and it seems likely that a large portion of the total N was lost or rendered unavailable.

The most obvious cause of loss is the record rainfall that occurred during May 2013 leading to prolonged soil saturation and favorable conditions for loss of N by denitrification and/or leaching. Another possible loss pathway is volatilization of NH3-N because the OPC pelletized litter was left unincorporated for over a month. Some of ammonium N in the pelletized litter may have volatized, but fortunately it seems likely that most of this N was moved into the soil from above average rainfall in both April and May 2013.

Another major issue is the compaction that clearly occurred in field 4-4 during the application of the OPC pelletized litter. This compaction would have been concentrated in 2 sets of wheel tracks (a spread swath of 80 ft was assumed for the 160 ft wide field) because repeated passes used the same traffic pattern. The excessively deep passage of the vertical tillage tool (first round on east side of field 4-4) also created both compaction and poor soil structure.

In field 4-3, all fertilizer was placed strategically at planting (2”x2” and over the row) minimizing opportunity for loss or poor root access. The availability of planter applied N was clearly visible as a uniformly dark green stand of corn in field 4-3, unlike the variability of color evident in field 4-4 and other corn fields on the farm.

In addition, the wheat cover crop that was incorporated in field 4-4 may have enhanced nutrient availability, but this was probably not a large effect due to the maturity of the wheat (boot stage). An even greater effect of the wheat is likely to have been its promotion of superior soil tilth via use of water and extensive rooting.

It is difficult to say why the Humic DG did not have clear effects. One major limitation is the way that the product was applied - over the row as opposed to in-furrow. Very little rain occurred during the 2013 growing season, resulting in limited root growth in surface soil and thus limited contact between crop roots and the Humic DG granules.

Conclusion

The most interesting conclusions that can be drawn from this study are observational and suggest that low rates of planter applied N can be very beneficial. Future studies of humate products will focus on optimizing crop contact with the product via in-furrow applications or foliar applications. Application of blended mixtures of humates with Chilean nitrate or pelletized litter might also be worthy of investigation. Greater N retention and plant availability during seasons with high likelihood of N loss may be possible.

Map 1. Treatment Plots and Corn Yields

Humic DG/Fertility Study in Corn

N ↑

Field 4-3								Field 4-4							
ID 4 125 bu/a	ID 3 136 bu/a	ID 3 146 bu/a	ID 4 148 bu/a	ID 4 142 bu/a	ID 3 143 bu/a	ID 4 136 bu/a	ID 3 146 bu/a	ID 2 122 bu/a	ID 1 121 bu/a	ID 1 116 bu/a	ID 2 121 bu/a	ID 1 113 bu/a	ID 2 117 bu/a	ID 2 115 bu/a	ID 1 115 bu/a
Rep 4		Rep 3		Rep 2		Rep 1		Rep 4		Rep 3		Rep 2		Rep 1	

ID 1 = SoilBiotics /Humic DG at 10 lbs/a on top of row and high rate of fertility pre-plant from~ 2,600 lbs/a pelletized chicken litter providing ~ 130 lbs N/a

ID 2 = without humate product and high rate of fertility pre-plant from~ 2,600 lbs/a pelletized chicken litter providing ~ 130 lbs N/a

ID 3 = SoilBiotics /Humic DG at 10 lbs/a on top of row and low rate of fertility at planting of Chilean nitrate and pelletized chicken litter, both providing ~ 13 lbs N/a.

ID 4 = without humate product and low rate of fertility at planting of Chilean nitrate and pelletized chicken litter, both providing ~ 13 lbs N/a.

2/5/15