# Early Research Finds Bright Spots for Humics

By John Dobberstein posted on April 15, 2016 | Posted in Nutrient Management, Soil Health

## Multi-site, multi-year study of humic products by USDA researchers Dan Olk and Dana Dinnes finds a clear financial benefit for corn and soybean farmers with applications of humic products.

Dan Olk and Dana Dinnes, researchers for the USDA's Agricultural Research Service in Ames, Iowa, have conducted a number of studies across the Midwest the last several years to get a better handle on how humic applications affect crops and a few soil parameters.

Their research involved products from two different companies: Enersol sold by American Colloid, a Minerals Technologies company, and Yield Igniter sold by AgLogic Distributors. Their work includes an on-farm survey done over 3 years where comparisons were made with control strips next to treated strips, as well as replicated and randomized treatment strips in farmer's fields that provided more intensive data.

Most of their research is for corn and soybeans, in conventionally tilled fields, although Olk doesn't believe the results from conventional tillage would be much different than with no-till.

For corn, they've taken samples and measurements of growth parameters, including leaf area and the harvest cob length. For corn tissue nutrients, they've taken samples at set times throughout the season, and measured grain and stover at the end of season.

They also looked at grain quality with protein, oil, and starch, and 100-kernel weight. At the end of the season, they took soil samples from every single plot to test for nutrients, organic matter and pH analyses.

For soybeans, they performed similar measures of crop growth and yield components, as well as soil nutrients, organic matter and pH.

## Grain Yield

At the Finch field in central Iowa, Olk and Dinnes found a field that allowed them to analyze humic product performance by landscape position, soil type, organic-matter content and soil moisture, with a consistent slope parallel to the rows.

The study area had upland Clarion soils with 3.5% organic matter, transitioning to Nicollet (side slope) soils at 5.5% organic matter, and Webster (lowland) soils at 6.5%.

They also measured corn grain and stover production and yield components response to humics by taking representative hand samples in an on-farm survey, covering over 30 sites per year for 2009-2011.

In 2009 — a wet, cool year in the Midwest — they found the average yield effect across all sites was 10 bushels an acre, with a range of 30 bushels to -10 bushels. This was an 83% success rate. The success rate in 2010 was 80% with 35 farmer sites.

In 2011 they took samples from 30 Iowa fields and 5 irrigated and dryland fields in Nebraska and South Dakota, where average temperatures and rainfall to start the year were followed by a dry spell. They found a success rate of 69%, but the average yield increase for these hand samples was 15 bushels per acre. For the whole 3 years, they saw an average increase in grain weight of 6.5%, which was statistically significant.

At the Finch field in Iowa, humic products were applied either as a foliar application at 34 ounces an acre at V4, or in a dual application with 27 ounces an acre at pre-emerge and 14 ounces at V4, with untreated control strips - in each of four replications of treatment strip-plots.

Their first year of results in the Finch field came in 2012 during a severe season-long drought, and the biggest yield gains with the two humic treatments occurred on the droughty upland soils with the least organic matter, at 149 and 159 bushels an acre, vs. 114 bushels on the control strips. Lowland soils had yields of 114 and 107 bushels with the two treatments, respectively, vs. the control at 101.

In the side-slope soils, control yields were 189 bushels and only increased by 2-3% with humic applications.

In 2014 with ideal growing conditions, in the exact same field and sampling areas, upland soils still gave the best yield response to the humic product over the control at 202 and 209 bushels, vs. 192 bushels in the control strip. Increases were negligible or even slightly negative for the side slope and lowland soils.

“Typically, anything that causes drought stress, the humic products will probably help more,” Dinnes says.

For soybeans, they measured grain yields at the Boyd field in 2013, with humic products foliar applied at V4, at 34 ounces an acre, or pre-emerge at 41 ounces an acre. With the growing season wet to start but finishing dry, they saw yield increases of 7.5% and 6.3%, respectively, compared to the control (45 bushels).

This was due to a 20% and 23% increase, respectively, in soybean pod counts with the humic treatments compared to the control.

In 2015, in near ideal growing conditions, the V4 application produced only a 1% increase, but the pre-emerge still provided a 7% increase.

### Corn Leaf Area

The effect of humic products on corn leaf area was another routine measure of their research. With corn being a determinate plant, the size of each leaf reflects the growing conditions that the plant experiences during the time period of that leaf's development. With healthier plants having larger leaves, the plant has greater photosynthesis potential to further improve plant growth.

In 2010, in very wet conditions at a field near Radcliffe, Iowa, a pre-emerge application increased leaf area by 6.7% over the control (7,040 square centimeters), while the V3 and V6 applications increased it by 4.3% and 3.4%, respectively. Each humic treatment was applied at 48 ounces an acre.

At the Finch field in the 2012 drought year, in combined results, an application of humics at 34 ounces an acre at V4 produced 3.9% greater leaf area than the control (6,674 square centimeters) and the split application of 27 ounces at pre-emerge and 14 ounces at V4 produced 5.5% greater leaf area.

In 2014, in ideal growing conditions, leaf areas were about 3% higher for the applications over the control.

### Cob Length

During their 3-year on-farm survey across Iowa and parts of Nebraska and South Dakota, Olk and Dinnes evaluated 100 sample pairings of cobs from corn treated with humics vs. a control with no treatment and saw a 3% greater cob length.

"That was a half-centimeter difference. So at about every 0.4 centimeters, that's about a 6-bushel-per-acre gain," Dinnes says.

At the Finch field, in 2012 during the drought, humic applied at V4 produced about 4.5% greater cob length than the control of 16 (upland) and 16.7 centimeters (lowland), while the split application produced 3-7% greater cob length.

Two years later, in ideal conditions, the V4 application produced an increase in cob length of 2.4-2.8% compared to the control, while the increase via split applications was negligible.

## Stover Yield

In their 3-year on-farm survey, Olk and Dinnes saw an increase in stover yield of 6.3% compared to the controls on 100 paired comparisons, which corresponds with trends in grain yield, they note.

On the Finch field, during the drought, ground with the V4 application showed a 3-6% increase in stover yield, while the split application went from 2% to 11%.

Two years later, in ideal growing conditions, the increases in stover were 3-4.5% for V4 and showed a little loss in the upland transect for the split application (-1.2%) with a slight gain (3.2%) in the lowland.

## Application Rates

Olk and Dinnes undertook another study in 2014 examining how corn growth and yield was affected by different application rates of humic products. They questioned whether yield would flat line at rates beyond that which maximizes production, like is often seen with nitrogen. Or, would increasing rates actually damage plants and reduce yield at a certain point?

In 2014, they started with the manufacturer's recommended rate of 48 ounces per acre applied in furrow (netting a 7.8 bushel-per-acre increase over the control), then moved to 48 ounces in-furrow with an additional foliar application at V5 of 24 ounces — which still increased yields by 4.2 bushels. They also tried 48 ounces in furrow with an additional 48 ounces applied at V5 and saw yields decease by 5.2 bushels.

"If you do anything more than what might be recommended by the company, you may have a disaster on your hands," Dinnes says. "Don't be doing that in whole fields. Restrict it. If you want to tinker, tinker on a small area. Don't do anything crazy."

## Root Effects

Olk says it is "common knowledge" in the humics industry that humic products help plant produce bigger roots, but there is a lack of supporting data. So for the last three summers Olk and Dinnes have dug corn roots at multiple fields for each of the two products being studied, excavating blocks of soil that contained three corn plants per sample to a depth of 12 inches.

They took the block out of the field, washed off the soil to isolate the roots and put them on a scanner to determine root length and cross-sectional area for 10 classes varying in root diameter.

They didn't see much of an effect of the humic product at the first two samplings at V8 and at V14. It was only at their third and final sampling, the R2 growth stage in corn, where they measured positive effects of the humic products on root growth.

When compared to the control roots, they saw a 20-30% increase in total root length with humics, whether it was applied once at V4 or a split application at pre-emergence and V4. The increases in root length occurred across all differing root diameter size classes that had increases ranging from 20-50%. Therefore, it was not just the small, fine roots that were increased with the humic products — it was the small, large and everything in between.

"Even though visually what strikes you is the hairiness of these roots — those finer roots — in reality all of the roots are responding in length," Olk says. "We were seeing more well-developed big roots coming off the stem. And each of those primary roots had more secondary roots attached to them."

They also looked at nodal roots in corn. In the second and third year of their root measurements, they counted how many nodal roots that were longer than about 1 inch and came up with numbers for the three plants that they dug out of the field per plot.

At the V14 sampling is where they saw the biggest difference, a proportional increase with humic product. "Minus humic product, the control, there were 21 nodal roots at the fifth node and we got a nearly twice that number with the humic product being applied," Olk says.

"By R2, the control had caught up to the humic treatments in the number of nodal roots. But there was this time in the season when perhaps the nodal roots got started a little earlier with the humics."

Looking at the sixth node they found an even starker difference at V14, with a several-fold increase in the number of nodal roots longer than 1 inch with humic products applied, as opposed to the control.

"Maybe what we're seeing is the root system gets going a little faster with this humic product," Olk says. "Even if the untreated control may eventually catch up in number of nodal roots, by the end of the season the control roots did not extend and develop side roots as much as the treated roots did, so there is still 20-something percent more root length with humic product than without."

**Soil, Organic Matter, pH**

In their studies on soils with relatively high organic matter contents, Olk and Dinnes say they haven't found any statistical or numerical trends for differences in tissue nutrient concentrations at the end of the season, and no consistent difference on corn grain quality or 100-kernel weight.

They also didn't find any difference in grain quality or 100-grain weight in soybeans. And there wasn't anything to report on soil nutrients, organic matter or pH, either.

"That may change in time, particularly with the soil, as we maintain some of the longer-term studies and we can look at crop responses in addition to measuring soil properties," Olk says.