

A little nitrogen can go a long way

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With significant increases in the price of fertilizer and grain, site-specific management - especially in variable rate nitrogen application -- can have a significant impact on yield and profitability, as reported in the latest issue of *Agronomy Journal*.

Varying the rate of crop production inputs such as fertilizer and seed makes intuitive sense, as farmers have long observed differences in crop yield in various areas of a single field. The availability of spatial yield information from combines equipped with yield monitors has provided a good resource for improved management.

So, optimizing inputs to match yield potential of different areas within fields may increase profit and reduce the environmental impact associated with over-application of fertilizer or pesticides. With recent substantial increases in grain and fertilizer prices, even small changes in management may have the potential to significantly impact profit from a field.

Scientists with the University of Nebraska-Lincoln (UNL) compared an approach to site-specific nitrogen and seed density management for irrigated maize, based on soil properties and yield potential zones, to whole field uniform management based on current University of Nebraska best management practices (BMPs).

The researchers wanted to know if the site-specific approach could increase yield or nitrogen-use efficiency (the amount of grain produced per kilogram of nitrogen applied), and the effect of site-specific

management on profitability. The study was conducted on two irrigated maize fields in Nebraska in 2003 and 2004 -- a total of four site-years.

Four treatments were then compared each year in field length strips, evaluating uniform management of nitrogen and seed density (current BMP), variable nitrogen rate plus uniform seed density, uniform nitrogen rate plus variable seed density, or both variable nitrogen rate and seed density. The variable nitrogen rate was based on yield potential within each zone, spatial patterns of soil organic matter within each zone, and zone-average residual soil nitrate-nitrogen values, using the University of Nebraska recommendation algorithm for maize.

Yield levels in both years generally followed the order of historical yield zones, though at Site 1 in 2003 average grain yields were not different among yield zones. Uniform nitrogen and seed density management resulted in high yields for all four site years, and site-specific management strategies resulted in no or small yield increases. Only at Site 1 in 2003 were there small but statistically significant yield increases with variable rate nitrogen management. There were no significant effects of seed density on yield, nor any interactions between seed density and nitrogen rate.

Fertilizer nitrogen use efficiency (NUE) was high in all site-years and well above national averages. NUE was particularly influenced by the amount of residual nitrate-nitrogen present in the soil profile prior to planting. At Site 1, NUE tended to be highest with the strategy that combined variable rate nitrogen with uniform seed density. At Site 2 in 2003, there was no advantage to variable rate nitrogen in NUE, while in 2004 a variable rate strategy which applied more nitrogen in high-yielding areas of the field resulted in the highest NUE.

At Site 1 in 2003, variable rate nitrogen management increased the gross economic return above fertilizer costs. However, for the other three site-

years, there were no significant effects of site-specific management on profitability.

The conclusion of the study was that, using the strategies the researchers selected, they could not demonstrate consistent significant economic benefits to site-specific management. One site-year did indicate an economic benefit to site-specific management, but this was before costs associated with collecting and analyzing site-specific information were included. However, this economic analysis was conducted using 2004 values of grain and fertilizer.

With significant increases in the price of fertilizer and the value of grain in 2007 and 2008, the value of using site-specific management is likely to have increased for those locations where site-specific management has a significant impact on yield, NUE, or both.

The researchers believe variable rate nitrogen application will be most profitable in situations with relatively wide maize to nitrogen fertilizer price ratios, and where a significant yield increase over uniform management is likely. They found little benefit to variable seed density, likely due to plasticity in yield components in response to different plant populations. Site-specific adjustment of seed density in irrigated environments is probably best applied to areas of known low yield potential in order to reduce seed cost.

Source: American Society of Agronomy

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