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VARIABLE-RATE NITROGEN AND WATER FOR IRRIGATED COTTON IN THE SOUTHERN HIGH PLAINS

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Abstract

Nitrogen fertilizer is the second constraint to cotton [*Gossypium hirsutum* (L.)] production after water in the Western USA. Soil testing to 24 inches for nitrate-N and an appropriate yield goal are how N fertilizer recommendations are derived. Little research, however has been conducted on variable-rate N management for cotton. Soil sampling in farmers' fields in four counties of the Southern High Plains revealed an average of 99 kg nitrate-N/ha in the top 30 cm. The high variation in soil nitrate within fields suggests that variable-rate N fertilization may be feasible. We tested variable-rate N fertilization on 35 acres of irrigated terminated wheat cotton at the AG-CARES research and demonstration farm in Lamesa, TX. Half-ac grid soil samples to 24 inches were taken in March of each year. Eight-row (40-inch row width) plots that were > 500 feet long were designated for either zero-N, blanket-N, or variable-rate N applications. Using a fixed yield goal across the field of 2 bales/ac, we applied 120 lb N/ac minus 24-inch nitrate-N. The one N application rate applied to the blanket-N plots was based on the average of all soil nitrate level in the blanket plots. The variable-rate N rates were based on inverse distance interpolation of the soil nitrate data. This study was in a randomized complete block design with three replicates or blocks. After two years of study, we found that the average variable-rate N application was within five % of the conventional, blanket-rate N dose. There was a greater lint yield with variable-rate-N than with blanket-rate N in 2003, but yields were similar in 2002. Lint yield responses to added N were observed in both years, and there was no N management x landscape position interaction.

During most of the last 10 years, greater lint yields have been observed in the bottomslope of the east half of the AG-CARES field. This has been attributed to runoff of rainwater down the hard, trafficked furrows. It has also been observed that the lowest yields in the eastern half of the farm are usually in the south-facing sideslope. We hypothesized that less irrigation water could be applied to the bottomslope without hurting yields, and that additional water applied to the south-facing sideslope could raise yields in that zone. Field-length, 24-row wide strip plots of three irrigation rates were used as pseudo variable-rate water treatments. In 2002 the irrigation levels were 65, 75, and 85 % ET replacement, and in 2003 the irrigation levels were 74, 80, and 86 % ET replacement. Irrigation level was in main-plots and the N management treatments described above were in split-plots. After two years of testing, no benefit to applying greater or lesser water amounts to different landscape positions was observed. We did observe a non-linear response of lint yield to irrigation level in both years, irregardless of landscape position. No interaction was observed between N management and irrigation level.

Future directions of this research may include testing variable-rate technologies for variable yield goals across the field. Field-scale spectral-reflectance based N management research is needed as well. Irrigation research needs to be done on optimizing irrigation water more drastically. Specifically, research is needed to determine where in the field to concentrate irrigation, and where irrigation can be withheld from low-producing areas.