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## Challenges associated with the integration of variable rate irrigation and variable rate nitrogen management on highly variable soils

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Water is the most limiting factor for agricultural production in the semi-arid environment of central and western Nebraska USA. Dry climate conditions combined with a large availability of ground water has led to crop production systems that are highly dependent on irrigation for maximum yields and sustainability. Increased emphasis on water use efficiency has led to the adoption of variable rate irrigation (VRI) technologies that greatly enhance the potential for increasing water use efficiency (WUE). Nitrogen (N) management is directly affected by water management due to the solubility of N. Water and N are inter-related and how one is managed directly affects management of the other. In an attempt to better understand what is needed for the integration of VRI and variable rate N (VRN) management a research study was conducted at the UNL Water Resources Laboratory (WRL) near Brule NE USA. A split-plot treatment design was used with irrigation level as the main plot, and fertilizer N rate as subplots. Irrigation levels were set at 40%, 70%, and 100% of ET requirement. Nitrogen levels were set at 84, 140, 196, 252 kg N ha<sup>-1</sup>. Results vary with years 1 and 2 showing no significant crop response to N application and a significant response to irrigation. In year 3 this trend reverses with significant crop response to N application but no response to irrigation. The reason for this reversal is unknown. This site has significant spatial soil variability and significant landscape variation with significant potential for N and water run-on and run-off. This site demonstrates the challenges associated with integrating variable rate N and water management due to the variability that exists.

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