Irrigation Variable Rate Development

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BACKGROUND

The Texas High Plains is the most intensively irrigated region in the state and accounts for the majority of the state's agricultural water use, production and gross crop receipts. Over time, the primary agricultural irrigation practice has changed from surface flow to center pivot irrigation. Subsequently, engineers have designed these efficient application and management systems, as they tried to do with surface flow systems, to apply irrigation water uniformly over the entire irrigated area of the field. However, it has been known by producers that fields are not uniform in production, and thus the need for assessing the concept of variable rate irrigation (VRI). Past research assessments have approached the effort through the use of an on-off type governing of the application nozzles. Many of past research systems utilized a surface-base water source with a centrifugal pump or a pressure-absorbing device to prevent excessive pipeline pressures when the flow was restricted. This has resulted in variations in both pressure and flow and thus an essential wasting of energy while these application variations were performed. Given the higher costs of energy today, this past approach seems neither energy conscientious nor profitable to address the concept from this perspective for field applications. With the advent of microcomputers, faster processors, increased memory and miniature servo mechanisms and personal computer board-based controllers available today, the control architecture to investigate the development of a true variable rate nozzling system and balancing algorithms for a center pivot system is not only warranted, but seemingly feasible.

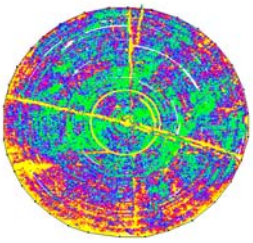
A VRI prototype being lab-tested for use with center pivot systems.

OBJECTIVES

1) Investigate an indexed discharge and pressure relationships of commercially available nozzles.
2) Assess the prototyping of a true variable rate irrigation nozzle.
3) Develop a computer-based controlling and balancing algorithm for a system of variable rate nozzles.
4) Construct and evaluate the performance of a VRI nozzle system on a research-based center pivot system.

RESULTS

Laboratory test efforts have yielded performance characterization relationships of commonly available nozzles used on center pivot systems. Engineers have developed a suitable VRI nozzle prototype and an indexed system for the variable performance. Current efforts are to expand the performance characterization of the prototype to be used for field testing. Lastly, a state-of- the-art center pivot irrigation system is being installed at the North Plains Research Field near Etter with the support of the North Plains Water District near Dumas for preliminary implementation and field testing of the VRI system.



A producer's field that is a good candidate for VRI application.

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