

VARIABLE-RATE IRRIGATION MANAGEMENT FOR PEANUT USING IRRIGATOR PRO

K. C. Stone, P. J. Bauer, W. J. Busscher, J. A. Millen, D. E. Evans, and E. E. Strickland

*USDA-ARS
Coastal Plains Soil, Water, and Plant Research Center
Florence, South Carolina*

ABSTRACT

Variable-rate irrigation has the potential to save water. These savings become more important as urban, industrial, and environmental sectors compete with agriculture for available water. To help save water, methodologies are needed to precision-apply water for maximum agronomic and economic efficacy. In this study, we conducted irrigation experiments on peanut to compare variable-rate irrigation management using traditional soil water potential measurements with an expert system (Irrigator Pro) for spatial crop management. We conducted experiments in 2007, 2008, and 2009 to evaluate Irrigator- Pro as a potential tool for variable-rate irrigation of peanut using a site-specific center pivot irrigation system developed by the USDA-ARS at Florence, SC. Treatments were irrigation of whole plots based on the expert system, irrigation of individual soils within plots based on the expert system, irrigation of individual soils within plots based on soil water potential (SWP) measurements, and rainfed. Irrigator Pro managed treatments initiated irrigation earlier in the season than for treatments managed with SWP measurements.

Keywords: variable rate irrigation, expert system, precision irrigation.

INTRODUCTION

Variable rate irrigation systems provide a tool to spatially allocate limited water resources while potentially increasing profits. Although technology for spatial water application is available and it has high grower interest, farmers that have retrofitted their center pivot systems to precision apply are basing application rates on their past experience and knowledge of variability in their fields. A decision support system could provide farmers with a tool to manage spatial water applications. In this research, we evaluated the potential of using Irrigator Pro to spatially manage irrigation under a site-specific variable rate irrigation system. Our specific objective will be to compare spatial irrigation management using both Irrigator Pro and traditional soil water potential measurements.

METHODS

Experiments were conducted under the variable rate irrigation system located at the USDA-ARS Coastal Plains Soil, Water, and Plant Research Center in Florence, South Carolina (Camp et al., 1998). In 2007-2009, irrigation experiments were conducted using peanut to evaluate three spatial irrigation scheduling methods. Four irrigation treatments were used in the study: 1) using Irrigator Pro to spatially manage irrigation based on the predominate soil in a management zone; 2) using Irrigator Pro to spatially manage irrigation based on individual soils in a management zone; 3) using soil water potential (SWP) measurements in management zones to maintain acceptable soil water potentials (<30 kPa) in the surface 30 cm of each soil; and 4) a non-irrigated treatment.

RESULTS

Peanut yields differed among the treatments for the three years of the study (Table 1). The yield differences in 2007 were mainly attributed to the weather conditions that saw an extended drought condition for the latter part of the growing season. The three irrigated treatment yields were not significantly different from each other. In 2008 and 2009, there were not significant differences among the irrigated and rainfed treatments. In 2008, there was adequate rainfall and all yields were similar. In 2009, a failure of the irrigation systems midway through the growing season limited yields and impacted the experimental results. In general the Irrigator Pro expert system called for irrigation earlier each year than the soil water potential based treatments.

Table 1. Irrigated and non-irrigated peanut yields using Irrigator Pro and soil water potentials to schedule irrigations.

Treatment	2007	2008	2009
	Yield (kg/ha)		
Rainfed	2389 a ± 274	6949 a ± 918	3210 a ± 502
Irrigator Pro	4961 b ± 538	7005 a ± 920	3930 b ± 774
Irrigator Pro (by soil)	4640 b ± 650	-	4082 b ± 628
SWP	5172 b ± 944	7239 a ± 1144	3713 ab ± 508

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