TITLE:
Irrigation Management Strategies for Peanut Production in the Texas Southern High Plains

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INTRODUCTION AND OBJECTIVE:

Coordinated irrigation research activities focused upon peanut irrigation management have been conducted at the Western Peanut Growers Association Research Farm over the last three years. Primary objectives are to improve efficiency and effectiveness of limited irrigation resources by identifying irrigation methods and management strategies that offer the best combinations of irrigation efficiency and crop yield and quality. The work at WPGRF expands upon related studies conducted at other sites, testing the recommendations under a more broad range of conditions. Equipment, labor, and funding for costs of farm operations are provided through cooperation of Western Peanut Growers Association, Texas Agricultural Experiment Station, and additional research funding support.

METHODS AND MATERIALS:

Planting Date: April 25-30, 2002
Varieties: Florunner, Tamrun 96, FlavorRunner 458
Irrigation: LESA and LEPA application methods; 50%, 75%, and 100% ET target replacement rate (see below for further details)
Precipitation: 0.9 inches pre-season; 1.8 inches in-season
Soil: Brownfield loamy sand
Fertilizer: 48 lb/ac N (split into 2 applications)

Table 1. Summary of irrigation treatments.

Application Rate	**MESA (I-Wob™ nozzle)**	**LESA (LDN™ nozzle)**	**LEPA (drag hoses)**	**LEPA-LESA-LEPA (managed LEPA)**
100 % ET			X	
75 % ET	X	X	X	X
50 % ET		X	X	

(Manufacturer and product names are provided for information purposes only, and are not intended as endorsements.)

Irrigation treatments, summarized in Table 1, included irrigation methods and irrigation rates. Irrigation methods include low energy precision application (LEPA) and two types of spray application nozzles: 1) Senninger LDN™ low drift spray nozzle, a true low elevation spray application (LESA) method and 2) Senninger I-Wob™ "wobbler" nozzle, a mid-elevation spray application (MESA) method. A LEPA-LESA-LEPA or “managed LEPA” irrigation strategy has been added as a refinement to take advantage of the benefits of both LEPA irrigation (higher application efficiency) and LESA irrigation (better near-surface soil wetting pattern for pegging and pod development). Irrigation rates included 50%, 75%, and 100% ET replacement through LEPA application. These target irrigation rates represent varying levels of irrigation capacity,

from deficit irrigation to full irrigation. All irrigation treatments were delivered through the same center pivot irrigation system at low pressure; pressure regulators were used on every irrigation drop to improve uniformity of application. Planting and tillage operations were in a circle pattern, consistent with the travel of the center pivot irrigation system and with recommended standard LEPA practice.

Precipitation included approximately 1.6 inches pre-plant and 1.8 inches in-season. In-season irrigation applications were approximately 20, 30, and 40 inches for the 50%, 75%, 100% ET target treatments, respectively. In an effort to accommodate various planting dates of projects on the site, an excessive amount of pre-plant and early-season irrigation was applied. Irrigation applications during the remainder of the season were more consistent with target irrigation application rates.

Peanuts were harvested by hand (plot samples 4 rows by 20 ft) and by combine equipped with a Peanut Yield Mapping System (PYMS). Hand harvested samples were retained for grade and quality analyses.

RESULTS AND DISCUSSION:

Results from Irrigation Application Rate Study

Irrigation application rates targeting 50%, 75%, and 100% evapotranspiration replacement were applied through LEPA irrigation during the 2002 cropping season. Standard LEPA practice included application by drag hoses in alternate furrows, circular planting pattern to match traffic of the center pivot irrigation system, and furrow dikes (to the extent practical) to improve in-furrow water application uniformity. Furrow dikes are extremely difficult to maintain in the sandy soils at WPGRF. Yield was determined through small plot sampling (4 rows by 20 ft. for each treatment and replication block) and with the PYMS-equipped peanut combine. Samples were graded in the laboratory to determine whether different irrigation treatments effected differences in product quality. Table 2 summarizes the yield responses of each variety to irrigation application rates using the two data sources, as well as the grades obtained from the small plot samples. When comparing the small plots and yield mapping, the mean yields for each variety-irrigation level combination are fairly similar. With only four values for each treatment forming the basis for statistical comparison, there are no significant differences among the irrigation levels for any variety. Uncontrolled variability among replicate samples was simply too large to obtain statistical certainty that the differences among treatment means are real. When the numerous observation points from the PYMS were compared, we found that yields for all cultivars were lowest with 50% ET, but not significantly improved by increasing the 75% ET replacement to 100% ET replacement. Results are summarized graphically in Figure 1. Grades were not affected by differences in irrigation rate.

Table 2. Mean harvested yield, small plot samples and PYMS data, WPGRF 2002.

Irrigation rate, Target %ET	50% ET	75% ET	100% ET
Small Plot Yield (lb/ac)			
Florunner	3,576 a*	4,447 a	4,792 a
Tamrun 96	3,467 a	4,392 a	4,692 a
FlavorRunner 458	3,666 a	4,556 a	4,056 a
PYMS Yield (lb/ac)			
Florunner	3,910 b	4,547 a	4,644 a
Tamrun 96	3,718 b	4,214 a	4,402 a
FlavorRunner 458	3,997 b	4,255 a	4,283 a
Grade			
Florunner	78.2 a	79.5 a	78.2 a
Tamrun 96	77.6 a	77.2 a	77.4 a
FlavorRunner 458	76.7 a	78.9 a	77.6 a

** Note: values in each row followed by the same letter are not significantly different at 0.05 probability.*

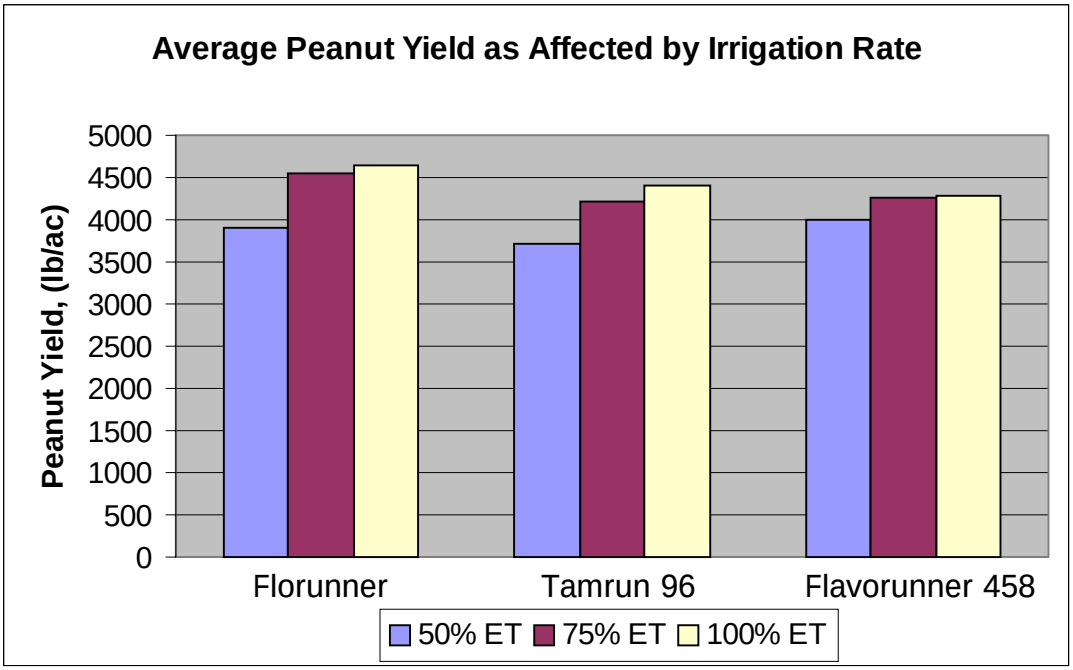

Figure 1. Effect of irrigation rate on peanut yield.

Results from Irrigation Application Method Study

Throughout the 2000 and 2001 cropping seasons two LEPA methods (drag hoses and bubbler-mode nozzles) and two spray methods (low drift spray and wobbler-type nozzles) were used at WPGRF to apply water at a base target irrigation rate of 75% crop evapotranspiration replacement. Because their results were so similar, we eliminated the bubbler applicator and used only drag hoses for LEPA applications in 2002. Yields were determined by small plot sampling (4 rows by 20 ft. for each treatment and replication block) and with the PYMS-equipped peanut

combine. Samples were graded in the laboratory to determine whether different irrigation treatments effected differences in product quality.

Effects of irrigation method and strategy are summarized in Table 3 and Figure 2. As with irrigation rate responses, relative yields among irrigation strategies were not statistically different when we used the small plot data. When the numerous GPS-referenced yield mapping points were analyzed, we were able to identify differences in the effect of irrigation strategy on each cultivar. Of all the cultivars, it appears that Florunner may have responded more favorably to LEPA, while Tamrun 96 and FlavorRunner 458 responded more favorably to the LEPA-LESA-LEPA sequence.

Table 3. Mean harvested yield, small plot samples and PYMS data, WPGRF 2002.

Irrigation Method	LESA	Wobbler	LEPA	LEPA-LESA- LEPA
Small Plot Yield (lb/ac)				
Florunner	3,530 a*	4,383 a	4,292 a	3,866 a
Tamrun 96	3,766 a	3,875 a	4,392 a	3,648 a
FlavorRunner 458	3,775 a	4,383 a	4,556 a	3,666 a
PYMS Yield (lb/ac)				
Florunner	4,271 a	3,996 b	4,547 a	4,397 a
Tamrun 96	4,131 b	4,181 b	4,214 b	4,569 a
FlavorRunner 458	4,057 b	4,298 a	4,255 a	4,319 a
Grade				
Florunner	78.7 a	79.5 a	79.5 a	78.7 a
Tamrun 96	78.4 a	79.2 a	77.2 a	78.2 a
FlavorRunner 458	79.5 a	79.7 a	78.9 a	79.1 a

** Note: values in each row followed by the same letter are not significantly different at 0.05 probability.*

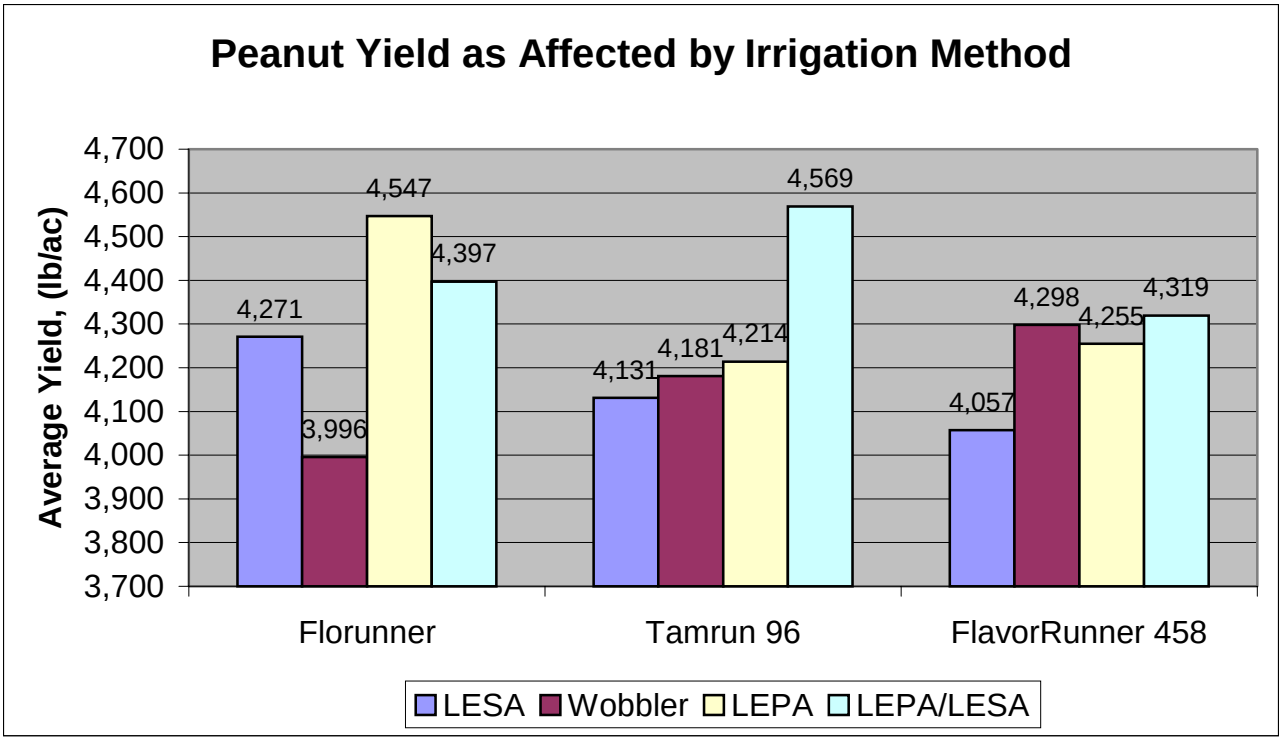

Figure 2. Effect of irrigation method on peanut yield.

ACKNOWLEDGEMENT

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