Influence of Planting Scheme and Planting Dates on Yield and Grade of Four Peanut Cultivars

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ABSTRACT

Studies were conducted to determine the influence of planting scheme (solid vs skip-row) and planting date on three runner and one Spanish-type cultivar in a non-irrigated field near Stockdale, Texas, during the 1994 and 1995 seasons. Florunner, GK-7, Andru-93 (runner type), and Tamspan-90 (Spanish type) cultivars were planted at 25 to 30 day intervals beginning about 15 April. Although not statistically significant, the skip-row planting scheme yielded more than the solid planting scheme by 10 to 35% depending on the year. Peanut yield and total sound mature kernels (TSMK) were significantly affected by planting date. In 1994, highest yields were obtained from the June planting, while the April planting produced the highest yield in 1995. Year effects on yield are the result of rainfall distribution and temperature differences during the critical flowering and pegging period.

KEYWORDS: Solid plant, skip-row, groundnut, Florunner, GK-7, Andru-93, Tamspan-90, dryland

Many dryland peanut (*Arachis hypogaea* L.) producers in Texas question the optimum planting date and cultivars to achieve maximum yield and grade. Yearly variations in weather patterns affect the length of growing season as well as flowering date and pod development.

Court et al. (1984), using one planting date and five harvest dates, found that delaying harvest date increased yield, sound mature kernels, and value of the Spanish-type cultivar Comet and the valencia-type cultivar McRan. Knauft et al. (1986) also using one planting date and five genotypes harvested at three dates (105, 118, and 132 days after planting), found that earlier digging dates tended to reduce market grade characters. In their study, major differences were the result of genotype x digging date interactions.

Mixon and Branch (1985) conducted a 3-year study, with the full season runner-type cultivar Florunner and the short season Spanish-type cultivar Pronto, using six digging dates at 10-day intervals beginning 90 days after planting. Florunner dug at 110 days and with each succeeding 10-day growth period up to 140 days, produced greater yields, more sound mature kernels, large and jumbo seed, and greater market value than Pronto. Pod yields of both cultivars, when averaged over the 3-year period, increased with each harvest date.

Mozingo et al. (1991) in Virginia planted four large-seeded Virginia-type cultivars

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(Florigiant, NC7, NC9, and VA 81B) under dryland conditions. These cultivars were planted at four 10-day intervals. They found that cultivar selection and digging dates are more important than planting dates in normal years. They noted, however, since environmental stress conditions cannot be anticipated, early planting dates would seem to be an advantage when soil temperatures and moisture levels are conducive to good germination and seedling growth.

Pattee et al. (1980) illustrated the complexities of peanut maturity in establishing the relationship of the seed/hull ratio to yield and dollar value. With some cultivars they found that yield and value increased with later digging dates whereas other cultivars reached a peak and declined within the same year. Yearly variations were noted also for cultivars. In another study, Pattee et al. (1982) showed that the seed/hull maturity index is correlated to yield and value but this optimum index value must be determined for each cultivar.

While previous studies have evaluated peanut planting patterns and digging dates under rainfed conditions in other peanut growing regions, no work has been done evaluating digging dates in the southwestern U.S. Therefore, the objectives of this research were to determine the optimum planting and digging dates for three runner and one Spanish-type cultivar grown in Texas and the influence of planting scheme (solid vs skip-row) on peanut yield and grade.

MATERIALS AND METHODS

Two normal season runner-type peanut cultivars (Florunner and GK-7), one early maturing runner cultivar (Andru 93), and a Spanish-type cultivar (Tamspan 90) were grown in a randomized complete block split-split plot design in separate fields near Stockdale, Texas during the 1994 and 1995 growing seasons. The whole plots were two planting schemes (solid vs skip row), the split plots were four planting dates, and four cultivars were the split-split plot. Of the four cultivars used, Florunner and GK-7 have a maturity period of 140 to 150 days, Andru-93 has a maturity period of 120 to 130 days, and Tamspan 90 has a maturity period of 115 to 125 days.

This non-irrigated field study was conducted on a Wilco loamy fine sand (fine, mixed, hyperthermic Udic Paleustalfs) in Wilson County, Texas near Stockdale. In each year the study was conducted in a field which had been fallow the previous year. Whole plots were 48 rows wide, split plots were 24 rows wide, and split-split plots were 6 rows wide with 36" row spacing. Data was taken from the middle two rows of each plot. For the skip row plantings, two rows were planted and a row on each side left blank. Data was collected from the middle two planted rows. Plots were 25 ft long, with four replications. Seeding rate was 60 lb acre-1 for each cultivar.

Pendimethalin [N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine] at 1.0 lb acre-1 and imazethapyr {2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid} at 0.063 lb acre-1 were tank mixed and preplant incorporated prior to planting of peanut to control annual grasses and broadleaf weeds. Yellow nutsedge (*Cyperus esculentus* L.) escapes were controlled with postemergence applications of bentazon [3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-one,2,2-dioxide] at 0.5 lb acre-1. Other agronomic and production practices, including insect and disease control followed Texas Agricultural Extension Service recommendations.

In 1994, runner peanut were dug when at least 150 days old except for the last planting date. At that planting date, peanut was dug when 138 days old because of sustained cold weather. The Spanish variety, Tamspan 90, was dug when 121 to 127 days old. In

1995, runner peanut were dug when 146 to154 days old while Tamspan 90 was dug when 120 to126 days old (Table 1).

Air temperature and rainfall were recorded at a weather station located near the test site. Weather data was from a weather observation site supervised by the National Oceanic and Atmospheric Administration/National Weather Service.

The peanut plants in each plot were dug, sacked, placed in a forced-air dryer and allowed to dry 48 to 72 hours. After drying, the pods were removed from the vines using a small plot thresher. Pods were cleaned, weighed and graded according to USDA procedures for peanut. Grade data is reported as percent total sound mature kernels (TSMK) which includes a combination of sound mature kernels plus sound splits.

Analysis of variance were conducted for each year. Each year was analyzed separately because test sites were at slightly different locations and rainfall and soil temperature varied for each year.

Table 1. Planting and digging dates used in 1994 and 1995.

		1994	1995
Planting Date			
1		14 April	18 April
2		9 May	10 May
3		7 June	7 June
4		6 July	6 July
Digging Date			
1	Tamspan	17 Aug (125)[a]	17 Aug (121)
	Runner	13 Sept (152)	14 Sept (148)
2	Tamspan	13 Sept (127)	7 Sept (120)
	Runner	10 Oct (154)	11 Oct (154)
3	Tamspan	10 Oct (125)	11 Oct (126)
	Runner	4 Nov (150)	8 Nov (154)
4	Tamspan	4 Nov (121)	8 Nov (125)
	Runner	21 Nov (138)	29 Nov (146)

[a]Number in parenthesis represents number of days after planting.

Table 2. Mean squares from analysis of variance for yield (lb/A) and grade (TSMK) for 1994 and 1995.

Source	df	Yield 1994	Yield 1995	TSMK 1994	TSMK 1995
		—(X10^{-5})—		—(X10^{-1})—	
Reps	3	1.32	6.12	0.50	17.79
Skip/Solid (SS)	1	1.95	16.80	11.12	217.80*
Error A		2.05	4.23	10.81	3.79
Plant Date (PD)	3	20.20**	18.89**	397.82**	135.40*
SSXPD	3	1.64	0.38	32.51*	41.78
Error B	18	1.13	0.65	4.48	13.54
Cultivar ©	3	0.38	0.69	36.30*	75.18*
SSXC	3	0.27	0.77	52.04*	60.13*
PDXC	9	0.94	1.20	94.04*	30.20*
SSXPDXC	9	0.39	0.47	31.59*	33.48*
Error C	72	0.57	0.65	4.01	6.31

*,**Indicate 0.05 and 0.01 significance level, respectively.

RESULTS AND DISCUSSION

Planting and digging dates for the study are presented in Table 1. Mean squares from the analyses of variance for yield and total sound mature kernels (TSMK) are presented for 1994 and 1995 (Table 2).

Yield (lb/A). The skip row-solid planting scheme was based on planted area not total area required. There were no significant differences in peanut yield either year between skip row and solid planting (Fig. 1). However, each year the skip-row treatments were numerically higher than solid planting. Similar results have been reported by Schubert et al. (1983). Yields based on the total area (planted-row plus skip-row area) have generally been lower for skip-row planting, owing to inclusion in the yield determination of the fallow, skip-row area. Cotton (*Gossypium hirsutum* L.) yields of skip-row compared to equidistant-row plantings were higher based on the planted area, but similar based on total area (Hons and McMichael, 1986).

Planting date had a significant effect on yield in both years (Fig. 2). In 1994, peanut yields were highest with the June planting while the lowest yield was with the April planting. In 1995, highest peanut yields were from the April planting while the lowest yield occurred with the June planting.

Soil temperature during reproductive development, may have a significant impact on final yield. In a study of soil temperatures in the pegging zone, Ono et al. (1974) found an optimum temperature of 88° to 92°F for pod development. High soil temperature (99° to 102°F) and low soil moisture (6 to 8%) indicated that a critical stage in pod development occurred 20 to 30 days after the peg entered the soil (Ono et al., 1974). This would be approximately 90 to 100 days after peanuts were planted since pegging period usually begins when peanuts are approximately 60 days old. In 1994, high temperature along with low soil moisture was observed 90 to 103 days after the first (April) planting (Fig. 3). The first planting had the lowest yield in 1994. This difference in yield pattern may have been the result of rainfall distribution (Fig. 3) and temperature differences throughout the growing seasons during the critical flowering and pegging period.

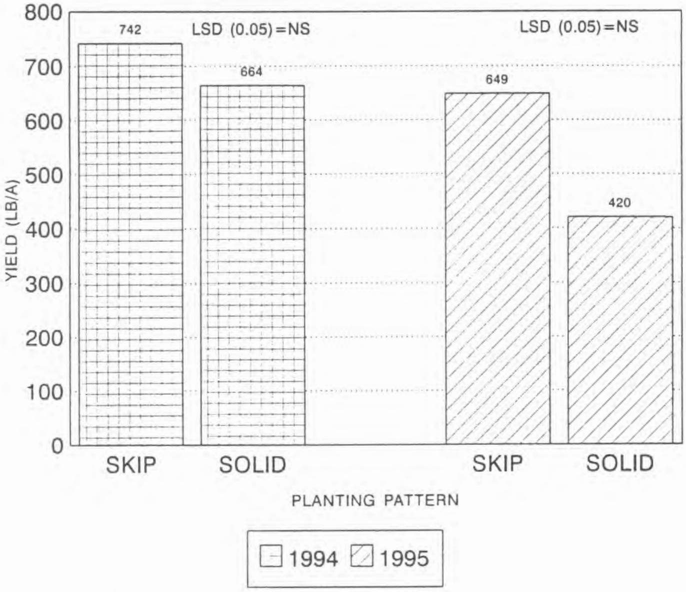

Figure 1. Peanut yield comparing skip-row versus solid planting patterns. NS=not signifiant.

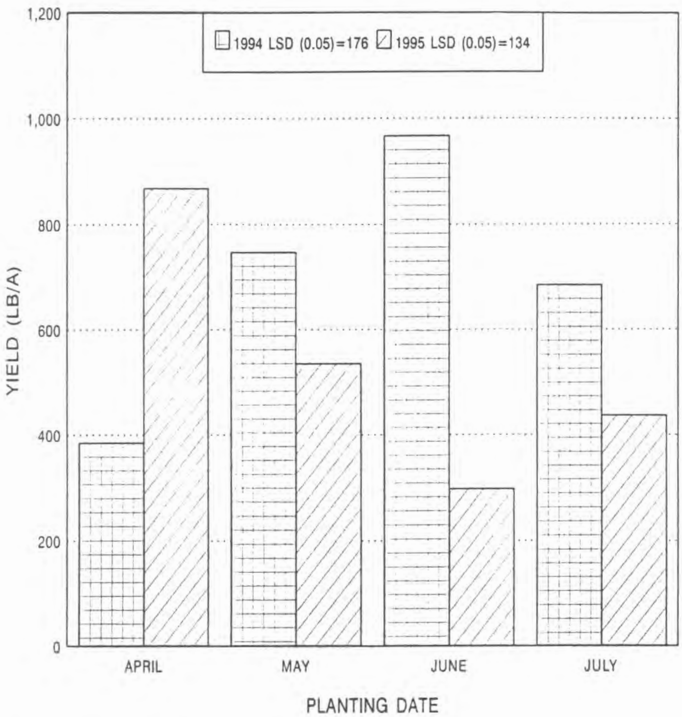

Figure 2. Influence of planting date on peanut yield.

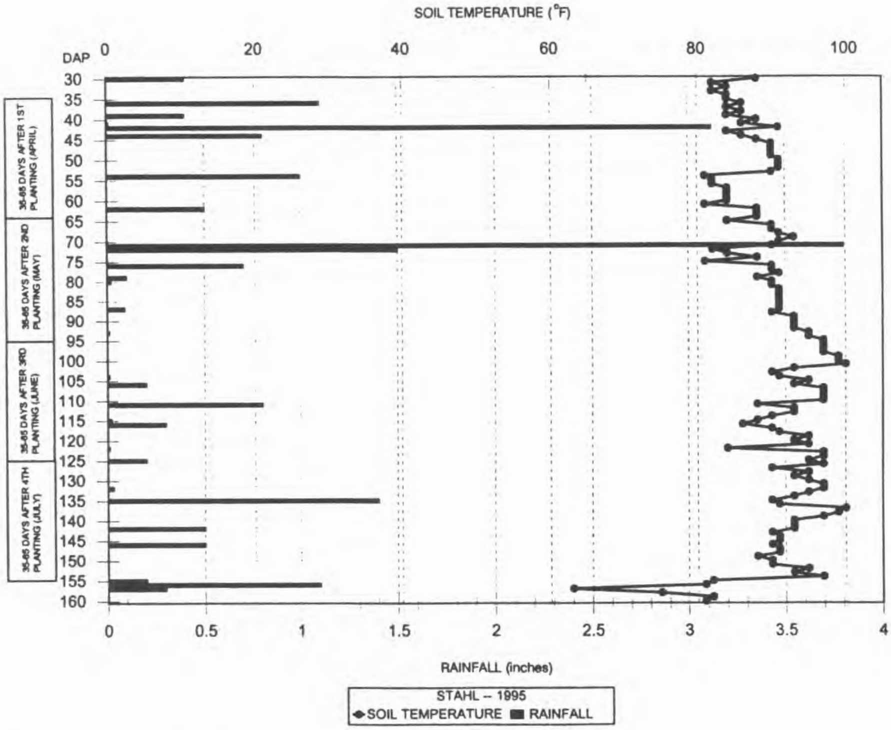

Figure 3. Soil temperature and rainfuall during the 1994 growing season.

The lower yield observed in 1995 for the June planting may be due in part to the high temperatures observed (Fig. 4) during the initial flowering (35 to 50 days after planting) and pegging (60 to 70 days after planting). However, moderate rainfall was received during this time period. The optimum temperature is different for each phase of peanut development and may not always occur in relation to the sequence of events from planting to harvest, i.e., vegetative growth occurs during the cool spring and early summer planting season while reproductive growth takes place during the hot summer relative to the latitude at which the crop is grown (Ketring et al., 1982).

Mozingo et al. (1991) found that in years which lacked moisture, vegetative growth of the later plantings was slowed and once rain was received, the peanuts did not mature as rapidly as the earlier planting. April and May rainfall was above average in 1994 with only a trace received in July, while in 1995, extremely heavy rains were received in May and June (Table 3) which resulted in waterlogged conditions thereby delaying peanut emergence.

Cultivars selected for the study possess differing yield potential; however, no yield differences within years were noted (Fig. 5). Florunner produced the highest yields in 1994 (745 lbs acre-1) while Tamspan 90 was the top producer in 1995 (597 lb acre-1). Florunner has been the most common runner cultivar grown in the Southwestern U.S. for the past ten years. Approximately 45% of Texas peanut runner acreage is planted to Florunner (authors personal observation). Tamspan 90 is a typical Spanish-type peanut cultivar with an erect growth habit. Tamspan 90 has sustained less yield loss than other Spanish and runner cultivars under natural infection of Sclerotina blight (*Sclerotina minor*) and pythium pod rot (*Pythium myriotylum*) (Smith et al. 1991).

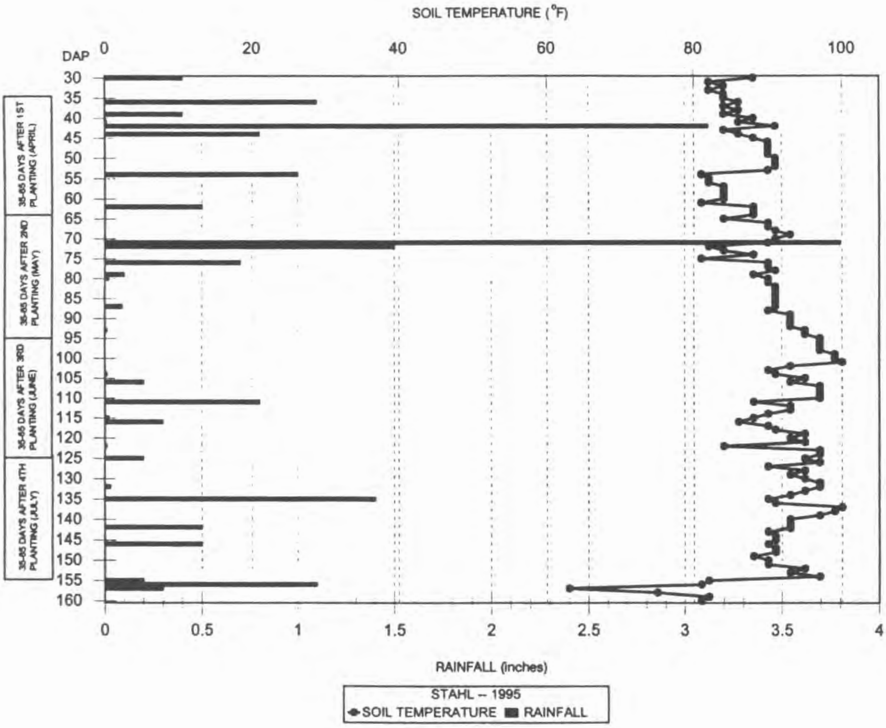

Figure 4. Soil temperature and rainfall during the 1995 growing season.

Total sound mature kernels (% TSMK). In both years cultivar effects were significant for TSMK (Fig. 6). However, TSMK were extremely low in each year. The low percentage TSMK can be attributed to lack of maturity with each cultivar. Andru 93 had the highest percentage in both years, GK-7 and Tamspan 90 were intermediate, and Florunner was inconsistent. In 1994, Florunner had one of the highest percentage TSMK whereas in 1995 Florunner was among the lowest (Fig. 6.).

Later planting dates resulted in a larger percentage of TSMK in 1994 (Fig. 7). In 1994, the early planting resulted in an extremely low percentage of TSMK whereas in 1995 the early planting date produced a much higher TSMK. This can be related to the lower soil temperatures at the earlier planting in 1994 which resulted in delayed maturity. In 1995, the May and June planting resulted in lower percentage TSMK (Fig. 7). However, the July planting resulted in a significant increase in TSMK.

Table 3. Monthly precipitation for 1994 and 1995 (planting to harvest).

	Precipitation (inches)		
Month	Normal*	1994	1995
April	2.36	3.23	1.95
May	3.41	5.39	6.12
June	2.91	2.57	7.53
July	1.93	0.00	0.89
Aug	2.35	2.69	2.92
Sept	3.64	1.43	2.59
Oct	2.65	6.28	0.45
Nov	5.03	0.55	1.32
Total	24.28	22.14	23.77

*Eighty year long term average rainfall for Floresville, Texas.

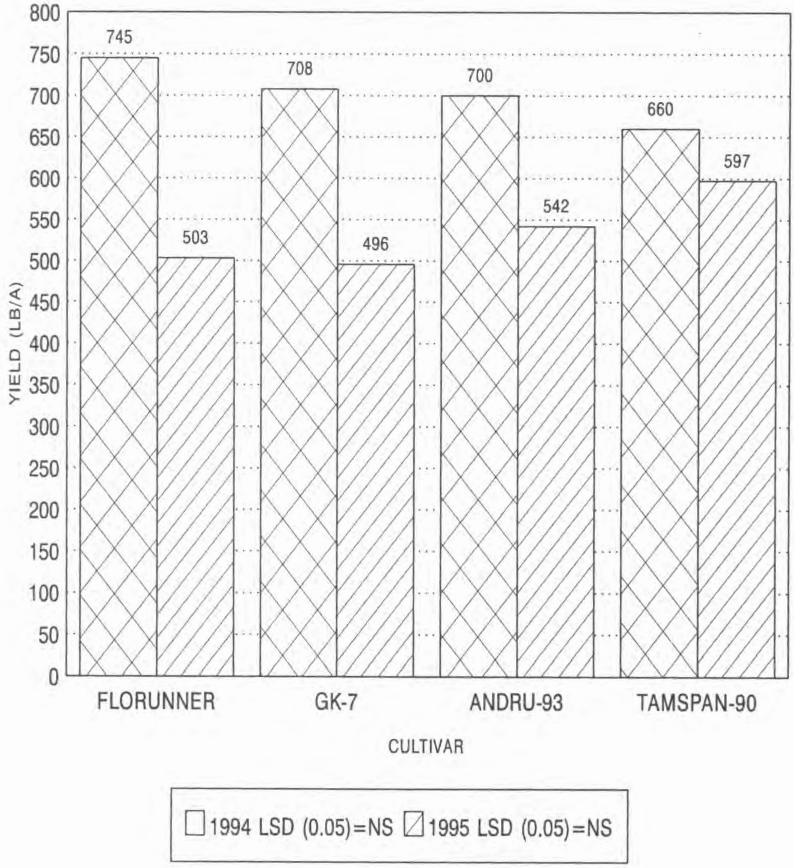

Figure 5. Peanut cultivar yield response by years. NS=-not signficant.

Planting date x cultivar interactions for TSMK occurred each year (Fig. 8). In 1994, TSMK for Florunner were high for the three later planting dates whereas in 1995 the April and July plantings resulted in the highest percentages TSMK. For GK-7, the later planting resulted in a higher percentage TSMK in both years. With Andru 93, the May planting in 1994 and the July planting in 1995 resulted in the highest total kernels. With Tamspan 90, the later plantings generally resulted in the highest percentage TSMK. This disagrees with the work of Mozingo et al. (1991) in Virginia. They found that a lower percentage of TSMK was obtained with delayed planting dates. They attributed this to environmental conditions which delayed maturity.

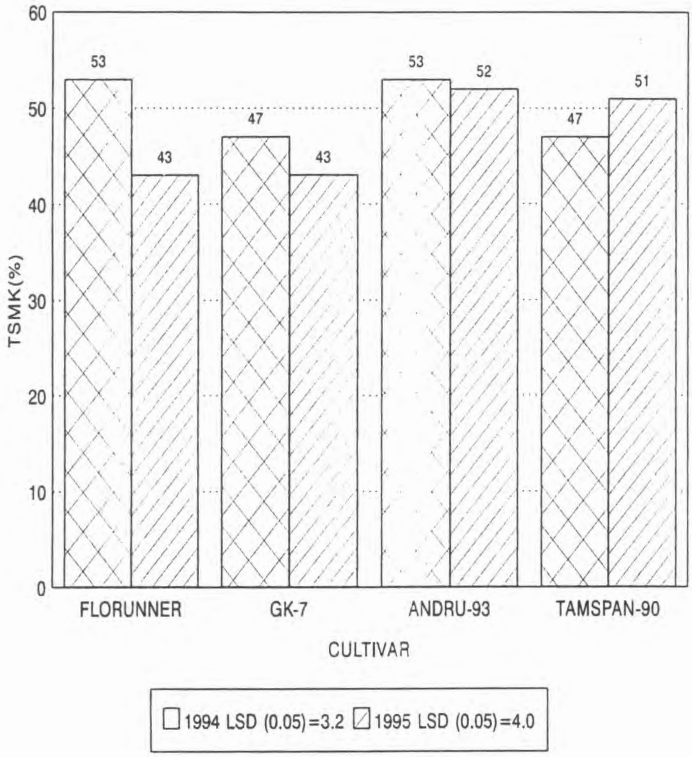

Figure 6. Influence of cultivars upon percentage total sound mature kernals (TSMK).

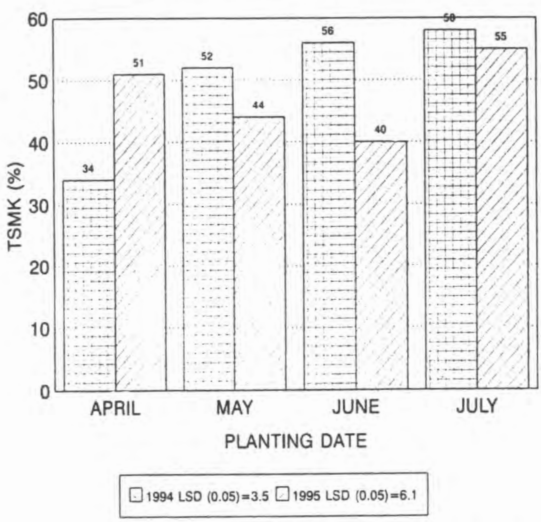

Figure 7. Effect of plantıng date on percentage total sound mature kernals (TSMK).

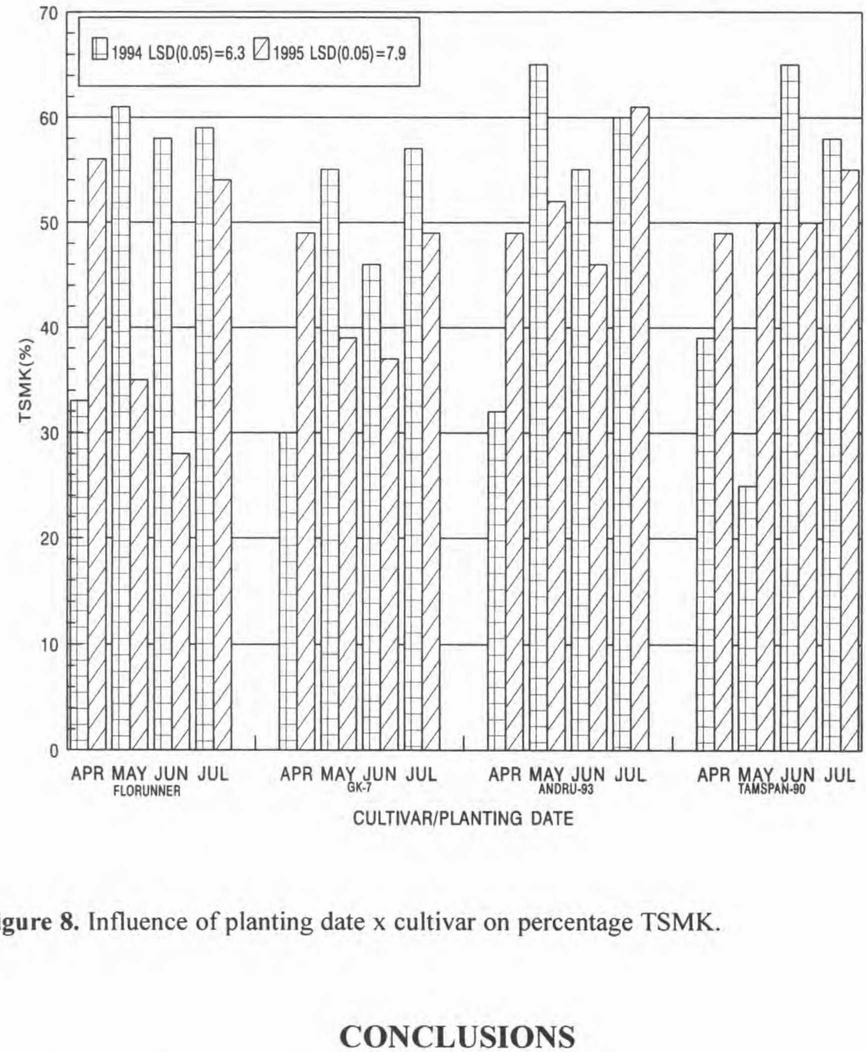

Figure 8. Influence of planting date x cultivar on percentage TSMK.

CONCLUSIONS

The results of this study indicated that under dryland conditions, skip-row patterns have the potential to increase yield. However, producers must realize that this planting scheme will require more total acreage to obtain acceptable production. Also, weed control in the fallow rows will be necessary in wet years to prevent weed/crop competition, especially for valuable soil moisture.

Planting date interacts directly with available soil moisture in a given year. In most years, South Texas normally receives rainfall in April and May which provides adequate soil moisture for planting of dryland peanut. However, in 1996, very little rainfall was received from January through June severely hampering optimum dryland peanut production. Rainfall in August and September were above normal but it was too late in the growing season to produce a peanut crop before the onset of cold temperatures.

Varietal differences were not noted in this study. Soil moisture is such an important factor under dryland conditions that Spanish-type cultivars often produce higher yields than runner-type. Spanish-types can take advantage of late-season rainfall, setting a crop near the crown of the plant that matures 20 to 30 days sooner than runner-types. Longer-season runner types often do not accumulate enough heat units to mature.

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