Agronomic Performance of a Spanish and Runner Cultivar Harvested at Six Different Digging Intervals[1]

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ABSTRACT

In a three year study (1980-1982) at the Georgia Coastal Plain Experiment Station, Tifton, Georgia, the full-season Florunner and the short-season Pronto cultivars were harvested at six 10-day intervals beginning 90 days after planting. For the 3-year average, peanut (*Arachis hypogaea* L.) plants from Florunner harvested at 110 and each succeeding 10-day growth period up to 140 days produced greater pod yields, sound-mature kernels, large and jumbo seed, and greater calculated market value than Pronto. However, seed market grade components and maturity indexes reflecting quality and maturity were impaired when peanuts were dug too early and varied among years and growth periods.

Key Words: *Arachis hypogaea* L., growth period, days to maturity, maturation.

Traditionally in the southeastern United States, only one peanut (*Arachis hypogaea* L.) crop has been grown per year. However, the long warm growing season of approximately 240 days may be suitable for growing a peanut crop in relay with an early harvested small grain crop, or a late planted crop such as grain sorghum. The use of such a double-cropping system may be favored with the change in the peanut government support and quota program initiated in 1982. This new program allows peanut growers to contract with the processor the additional peanut poundage, above the price supported quota poundage, for marketing as non-domestic edible or for oil.

In a recent short-season double-cropping study, the pod yields of spring planted Pronto, Comet, and Florunner cultivars were greater when grown for a 114-day growth period (3282 kg/ha) than for the 99-day growth period (2250 kg/ha) (5). At the 99-day growth period, Florunner yielded less than Pronto or Comet, but at the 114-day growth period Florunner had yield and market value equal to the short-season cultivars, Pronto and Comet. Studies have shown that peanut in rotation with other crops in multiple-cropping management systems do not present a major pest management problem and may be an integral part of such a system (3,4,9).

The purpose of this study was to determine the growth period necessary for the later maturing Flourunner cultivar to exceed the earlier Pronto cultivar in pod yield, grade, and seed size qualities. Florunner, a full season runner-type, and Pronto, a short-season spanish-type peanut, have optimum pod maturation of approximately 135-140 and 120-125 days, respectively.

Materials and Methods

In 1980, 1981, and 1982 Florunner and Pronto cultivars were planted on May 27, 18, and 10, respectively, and both cultivars were dug at 90, 100, 110, 120, 130, and 140 days after planting. These tests were conducted on a Tifton loamy sand soil near Tifton, Georgia in randomized double-row plots, 6.1 x 1.8 m, and replicated three times. Each plot was seeded at approximately 13 seed per meter in rows spaced 0.8 m apart. From information obtained from a prior experiment (3), this seeding rate was considered adequate to obtain a plant population for optumum pod yield. Fertilizer was applied broadcast and incorporated into the soil at rates determined by soil test analysis. The seed bed was prepared by deep-turning and tillivating before planting. Preplant incorporated benefin and vernolate followed by ground cracking treatments of alachlor and naptalam-dinoseb were applied for weed control. All pesticide applications were at recommended rates and schedules, including fungicides for leafspot control and insecticide applications for insect control on 14-day intervals. The test area was only irrigated during drought stress conditions with 1.5 to 2.5 cm of water per application each year. Plots were dug with a peanut digger-shaker-inverter. After digging, the pods were machine picked with a small plot thresher, dried, and cleaned and subsequently weighed, shelled, and screened for yield, grade, and seed size distribution, respectively.

Pod samples of 1000 grams were processed on grading equipment similar to that used by the Federal-State Inspection Service for obtaining the percentage of total sound mature kernels (TSMK), damaged kernels (DK), other kernels (OK), seed to hull ratio (8) and grams per 100 random sound-mature seed. TSMK includes sound mature and sound split kernels. The percentages of sound and mature seed were obtained from seed riding a 0.63 x 1.90 cm slotted screen for Florunner and seed riding a 0.59 x 1.90 cm slotted screen for Pronto. Determinations of seed size distribution percentages were from slotted peanut grading screens as follows: Jumbo seed riding 0.85 x 1.90 cm; large seed (not a standard market grade size) riding a 0.79 x 1.90cm, but passing a 0.85 x 1.90 cm screen; medium riding a 0.71 x 1.90 cm, but passing a 0.79 x 1.90 cm screen; No. 1's for Florunner riding a 0.63 x 1.90 cm, but passing a 0.71 x 1.90 cm screen, and No. 1's for Pronto riding a 0.59 x 1.90 cm, but passing a 0.71 x 1.90 cm screen. Data were subjected to analysis of variance and statistical limits determined by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Table 1 gives the three-year (1980-1982) means for yield and calculated dollar value from the experiments. Since there were significant interactions of year by days and cultivar by days for both yield and value, as well as a year by cultivar by days interaction for value (Fig. 1) graphically shows the yearly variations. Dollar values were based on U.S. loan support schedules for each respective year.

The three-year average results indicated that Florunner exceeded Pronto in pod yield and dollar value per hectare when plants were dug at each of the successive 10-day growth periods from 110 through 140 days after planting (Table 1). These finding are in close agreement with an earlier comparison between Pronto and Florunner (5). There was no year by cultivar by digging interaction for yield. However, differences in yield response over digging dates were observed between the three years. This is thought to be partially associated with differences in annual rainfall.

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Two factors are thought to be associated with the seemingly early yield plateau that occurred in 1980 (Fig. 1). The test was planted late (May 27) which could have caused the pods to mature in a shorter period of time than in 1981 and 1982. Also, even though irrigation was applied a severe and extended drought occurred during 1980 which probably affected the fruiting distribution. The yield response in 1981 from successive digging times was similar to but less productive than in 1982. Rainfall in 1981 was more than in 1980, but was about 170 mm less than in 1982. Thus, apparently irrigation again was not adequate in 1981 to offset the limited water needed during the actual pod development. Dollar values for each year generally reflected the pattern for yield.

Table 1. Mean yield and value of Pronto and Florunner cultivars at 90 to 140 days after planting (1980-1982).

Days after Planting	Yield (kg/ha) Pronto	Florunner	Value ($/ha) Pronto	Florunner
90	2632 b[1/]	2339 c	1290 c	972 c
100	3040 b	3408 b	1475 c	1726 b
110	4274 a	4983 a	2119 ab	2784 a
120	3839 a	5081 a	1888 b	2811 a
130	4204 a	5387 a	2117 ab	3026 a
140	4087 a	5091 a	2116 a	2843 a
Cultivar Mean	3679	4381	1834	2360

1/ Means in columns with different letters are significantly different (P = 0.05) according to DMRT.

Interactions -- Year x days and cultivar x days are significant (P = 0.01) for both yield and value. Year x cultivar x days was also significant for value (P = 0.05).

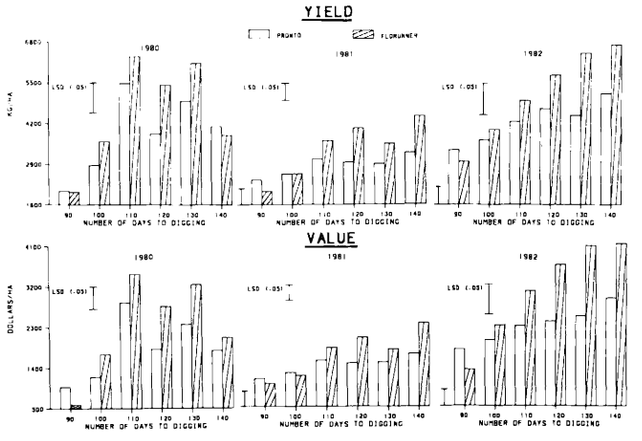

Fig. 1. The effect of growth period in number of days from planting to digging on the yield and market value of Pronto and Florunner peanut cultivars.

Three-year (1980-1982), mean percentage for four grade components are given in Table 2. Yearly mean percentages are given in Fig. 2. Significant interactions between year by cultivar by days were evident (Table 2). During the three years, the total sound and mature kernels (TSMK) percentages for Florunner, which inheritantly has a higher shelling out percentage, consistenly equalled or exceeded that of Pronto, especially when plants were dug at 110 days and each successive 10-day growth period to 140 days after planting (Fig. 2). Both cultivars had less TSMK when dug earlier than 110 days and the TSMK for Florunner was only 51% at 90 days after planting. Percentage of other kernels (OK) also reflect the year by days and the cultivar by days interactions (Table 2). Other kernels (OK) consist of a high percentage of immature seed. Immature other kernels are considered to be poor in seed quality (6). In 1980, the percentage OK from Florunner was less than for Pronto when dug at or later than 100 days after planting (Fig. 2). In 1981 and 1982, the percentages OK for Florunner were more than for Pronto at the 90 and 100 day diggings, and were equal to that of Pronto at the 110 day and each successive digging to 140 days after planting.

The year by cultivar by days to digging interactions, especially as related to percentages of TSMK and OK may be partially explained by the yearly differences in heat stress conditions during growing period for this 3-year study. As mentioned earlier, extended drought during 1980 may have caused heat stress which resulted in lesser percentages of OK's for Florunner than for Pronto for each of the days to digging from 100 to 140 (Fig. 2). A converse relationship for percentage of TSMK is likewise noted.

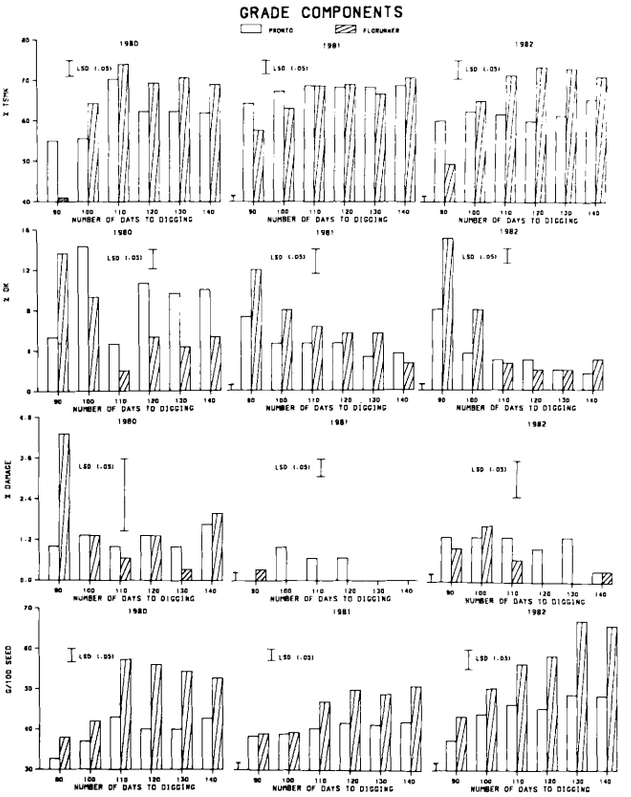

Fig. 2. Grade percentages of total sound-mature kernels (TSMK), other kernels (OK), damage kernels (DK), and grams per 100 seed of Pronto and Florunner peanut cultivars at 90-140 days after planting.

In 1980, the percentages of damaged kernels (DK) for Florunner was more than for Pronto at the 90-day dig-

Table 2. Mean grade percentages of total sound-mature kernels (TSMK), other kernels (OK), damage kernels (DK), and grams per 100 seed for Pronto and Florunner peanut cultivars at 90 to 140 days after planting (1980-1982).

Days after Planting	(% TSMK)		(% OK)		(% DK)		(g/100 seed)	
	Pronto	Florunner	Pronto	Florunner	Pronto	Florunner	Pronto	Florunner
90	63.7 b[1/]	51.1 c	6.9 ab	13.6 a	0.8 a	1.9 a	36.1 c	40.1 d
100	63.4 b	64.8 b	7.6 a	8.4 b	1.2 a	1.0 a	40.0 b	43.9 c
110	69.9 a	73.1 a	4.1 d	3.7 c	1.0 a	0.4 a	43.2 a	53.5 b
120	67.7 a	73.3 a	6.1 bc	4.3 c	1.0 a	0.4 a	42.3 a	54.8 ab
130	68.7 a	73.9 a	5.0 cd	4.0 c	0.8 a	0.1 a	43.3 a	56.8 a
140	69.5 a	74.1 a	5.1 cd	3.7 c	0.7 a	0.8 a	43.3 a	56.4 a
Cultivar Mean	67.2	68.4	5.8	6.3	0.9	0.8	41.4	50.9

1/ Means in columns with different letters are significantly different (P = 0.05) according to DMRT.

Interactions -- Except for year x day and year x cultivar x day means for damage kernels (DK), there were year x days, cultivar x days, and year x cultivar x days interactions for TSMK, OK, DK, and g/100 seed (P = 0.05).

ging, but not significantly different from Pronto at the other five growth periods (Fig. 2). In 1981, the percentages of DK for the two cultivars was equal when dug 90, 130, and 140 days after planting, but Pronto seed had more DK than Florunner when dug at 100, 110, and 120 days after planting. In 1982, the percentages of DK for the cultivars was equal at 90, 100, 110, 120, and 140 days after planting, but Florunner seed had less DK at 130 days. However, when averaged for the three years (Table 2) no significant differences were apparent for seed damage between digging dates.

As expected, the gram weight per 100 seed for Florunner was more than for Pronto for plants dug at all six growth periods when averaged over three years (Table 2). The seed weight of Florunner is inheritantly larger than for Pronto. The seed weight reduction was much greater for Florunner than Pronto when the plants were dug earlier than 110 days after planting.

Table 3 and Fig. 3 gives the seed size distribution for the percentages of jumbos, large, mediums, and No. 1 seed during each year. Even though there was a significantly year by cultivar by days to digging interactions, the percentages of jumbo and large seed from Florunner dug at 90 to 140 days equalled or exceeded that of Pronto (Table 3). Conversely, for the smaller size classes of medium and No. 1, the percentages of Florunner seed were equal or less than for Pronto at any of the six growth periods. The interactions noted for the seed-size components as related to year effects is largerly attributed to heat stress in 1980 when a prolonged drought was experienced (Fig. 3).

The results of the seed to hull ratio determinations, which are obtained by dividing the dry weight of the seed by the dry weight of the hulls, are given in Table 4. A calculated seed-hull ratio of 4 is equal to 80% sound-mature kernels and other kernels. The seed-hull

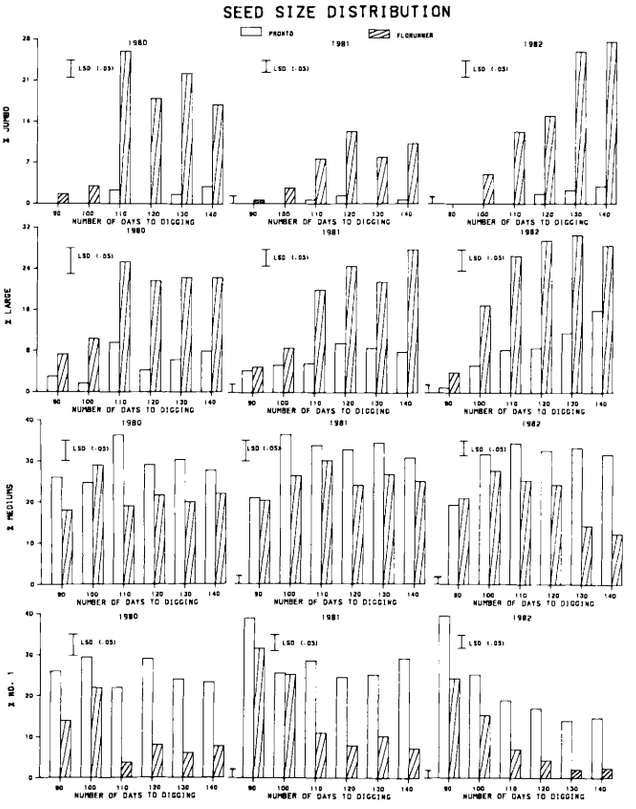

Fig. 3. Screen distribution percentages of jumbo, large, medium and No. 1 seed of Florunner and Pronto cultivars at 90-140 days after planting.

ratio of Florunner is inheritantly higher than for the Pronto cultivar. However, peanuts from the plants of both cultivars dug 90 days after planting had lower maturity indexes than those dug 110 or more days after planting. Even at 100 days after planting the maturity

Table 3. Mean screen distribution percentages of jumbo, large, medium and No. 1 seed for Florunner and Pronto cultivars at 90 to 140 days after planting (1980-1982).

Days after planting	(% Jumbo)		(% Large)		(% Mediums)		(% No. 1)	
	Pronto	Florunner	Pronto	Florunner	Pronto	Florunner	Pronto	Florunner
90	0.0 b[1/]	0.8 d	2.8 c	5.4 c	22.1 bc	19.8 d	34.9 a	23.3 a
100	0.0 b	3.6 c	4.1 b	12.0 b	30.9 bc	27.7 a	26.8 b	20.9 b
110	1.0 a	15.3 b	7.9 a	24.0 a	34.8 a	24.8 b	23.2 cd	7.2 c
120	1.0 a	15.1 b	7.6 a	25.3 a	31.4 bc	23.3 b	23.6 c	6.8 c
130	1.3 a	18.8 a	8.9 a	24.9 a	32.7 ab	20.3 c	21.1 d	6.1 c
140	2.2 a	18.3 a	10.7 a	26.3 a	30.0 c	19.8 d	22.4 cd	5.8 c
Cultivar Mean	0.9	12.0	7.0	19.7	30.3	22.6	25.3	11.7

1/ Means in columns with different letters are significantly different (P = 0.05) according to DMRT.

Interactions -- Year x days, cultivar x year x days, and year x cultivar x days interactions are significant (P = 0.05).

indexes averaged less than for later digging times. Because of the inherent later maturity of the Florunner cultivar, the seed from plants dug prior to 110 days showed a greater reduction in maturity than for Pronto. These lower maturity indexes, as well as the reduced percentages of sound, mature seed, the reduced seed weight and the increased percentages of other kernels (Table 2) indicated the poor seed grade quality for the earlier digging times.

Table 4. Seed-Hull Ratio Maturity Index.

Days After Planting	1980		1981		1982		Ave.	
	P	F	P	F	P	F	P	F
90	2.42c[1/]	1.67e	2.68b	2.32c	2.41b	2.11c	2.50b	2.03c
100	2.62c	3.09d	2.78b	2.55c	2.39b	3.15b	2.06b	2.93b
110	3.68a	4.15a	3.00ab	3.15b	2.50ab	3.24b	3.06a	3.51a
120	3.25b	3.60bc	3.17a	3.35ab	2.59ab	3.82a	3.00a	3.69a
130	3.41ab	3.96ab	3.04ab	3.10b	2.37b	3.70a	2.94a	3.59a
140	3.15b	3.55c	3.26a	3.67a	2.84a	3.97a	3.08a	3.73a
Cultivar Mean	3.09	3.34	2.99	3.02	2.52	3.33	2.86	3.23
Year Mean	3.21		3.01		2.92		3.05	

1/ Means in columns with different letters are significantly different (P = 0.05) according to DMRT.

Interactions -- Year x days, and cultivar x days interactions are significant (P = 0.01). Year x cultivar x days interaction is significant (P = 0.05).

In 1980, both Florunner and Pronto cultivars reached their highest seed-hull ratios at 110 days after planting. This indicates that the Florunner cultivar may produce its highest percentage of mature seed earlier in some years, especially in years with limited rainfall during the time of seed development which happened in 1980 (7). The yield and dollar value (Fig. 1) also were greater at 110 days for Florunner and Pronto. In 1981 and 1982, the maturity as reflected in the seed-hull ratios was increasingly greater at the later diggings, which also resulted in greater yield and value. The peanut cultivars apparently did not reach the degree of maturity in 1981 and 1982 that was evident at 110 days in 1980 because of a wide range of immature to fully mature seed. This may have been attributed to the indeterminate fruiting nature of peanuts which was influenced by the environmental condition, especially rainfall, causing the proportion of immature vs. mature seed to vary among years and digging times. In 1982, for instance, there was a gradual increase in the seed-hull ratios (Table 4), yield and value (Fig. 1). This was a year with good rainfall distribution. Seed with a greater proportion of mature seed as indicated by a high seed-hull ratio are known to be of better edible quality as compared to immature seed.

Results of this study indicate that the full-season Florunner cultivar produced greater pod yield, market value, and percentage of large and jumbo size seed than the short-season Pronto cultivar when grown for a limited growth period of at least 110 days after planting. However, because of the significant yearly interactions involving grade, seed size distribution, and maturity, the impaired quality aspect of digging too early is strongly emphasized. Therefore the economics of using peanuts in a double-cropping system should be carefully evaluated.

The practice of harvesting peanuts before their optimum pod maturity usually results in a greater portion of immature shelled seed. These immatures are largely considered as other kernels in the market grade, but may also be a portion of the No. 1's. Peanut oil extracted from immature seed has already been shown to be of poor quality (6), and products containing imma-

ture seed have a less desirable flavor and product stability (1), and usually germinate poorly (2).

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