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Potential Peanut Performance in Double-Cropping Systems[1]

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ABSTRACT

The potential for utilizing selected peanut cultivars in multiple-cropping sequences was studied on a Bonifay sand and Tifton loamy sand soil in cropping sequences with grain sorghum, tomato transplants, and cucumbers. The peanut cultivars Pronto, Comet, and Florunner always produced more pods under a 114-day growing period than for a 99-day growing period. In a 99-day growing period, Pronto and Comet produced significantly more peanuts than Florunner. Total sound mature kernels (TSMK) percentages were always greater for a 114-day growing period. Seeding rate did not affect TSMK or OK characteristics. On restricted growth periods (99 days), early-maturing peanut cultivars resulted in higher percentages of TSMK than the late-maturing cultivars. Under small production scale research units, Pronto peanut was planted early - April, or late June - under both clean and conservation type tillage. The moldboard land preparation portion of a tillage experiment resulted in greater yields when peanut was planted early or late in 4-row seeding, but not statistically more than 2-row seeding. Grain sorghum grown at a population of approximately 200,000 plants/ha produced greater yields when planted in July than in August planting. Greater grain yields of sorghum were produced using moldboard land preparation.

Key Words: Multi-cropping, peanut row spacing, peanut tillage, short season peanut production.

Historically peanut has been grown as a full season, annual summer crop, largely because it was marketed as a high value edible cash crop. In 1982, the governmental support and quota program were altered so that only a portion of the production could be sold under a governmental poundage price support program, but additional poundage may be marketed as non-domestic edible or for oil. This additional peanut poundage may be grown under contract with peanut processors, usually at prices much below the restricted poundage support program. Growers may wish to consider producing a portion of their non-quota peanut crop in early or late sequence with other crops.

Research has shown that peanuts grown in rotation with other crops and mono- or multiple-cropping sequences do not present a major pest management problem (6,7,10). Some economic studies have shown peanuts can be an integral part of pest management and irrigated multiple-crop production systems (11,12). Peanut cultivars with a short season, upright growth habit are available that may be suitable for a two-crop-per-year cropping sequence. Several workers have shown that cultivars with upright growth habit grown in row patterns closer than the standard 91 cm row width may produce higher yields of peanut pods (2,3,4,8,9). Also, recent studies (5) showed that the widely grown Florunner peanut with a prostrate growth habit yielded 14% more in 20 cm row widths as compared to 81 cm row widths.

The objectives of these experiments were to: (a) determine the yield, market grade, and value of peanuts grown in short growing periods for use in multiple-cropping sequences with other crops, (b) measure the production potential of short-season peanuts grown in combination with grain sorghum or vegetables, (c) measure

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the influence of row spacing and selected conservation tillage practices on production of short-season peanut (d) measure the influence of row spacing and population on a second crop of grain sorghum following short-season peanut.

Materials and Methods

Four separate experiments were conducted, using two upright cultivars (Comet and Pronto) requiring short growth periods and one prostrate cultivar (Florunner) requiring a longer growth period for maximum peanut production, to study the influence of cultivars and seeding rates on pod yield and market grade when grown in a close-row arrangement with restricted growth periods. Three experiments were conducted on a Bonifay sand and one on a Tifton loamy sand soil near Tifton, Georgia. Early spring experiments were planted on April 1, 1981 and 1982 on Bonifay sand and on May 4, 1982, on Tifton loamy sand. The peanuts were dug after 99 and 114 days growth periods. These tests were planted in split plot randomized complete block designs with growth periods as main plots replicated four times and the three cultivars seeded at regular and reduced rates in randomized subplots. The respective seeding rates were 84 and 112 kg/ha in 1981, and 100 and 140 kg/ha in 1982. The subplots consisted of four rows (two paired rows spaced 33 cm part and 41 cm between the paired rows) on a bed 1.8 m wide and 6.1 m long. The summer test was planted July 27, 1981, following the spring peanut test on Bonifay sand and dug after a 112-day growth period. This test was planted at two seeding rates (90 and 140 kg/ha) in a completely randomized design using the plot size and row spacing mentioned above.

The plots were dug with a mechanical peanut inverter-shaker and field dried for approximately one week before mechanical threshing. Data were recorded for pod yields and market grade determinations were made using a 500 gram sample from each plot. Percentage total sound-mature kernels (TSMK) represent the sound seed riding a 5.9 x 19.0 mm slotted grading screen and sound splits, and percentage other kernels (OK) were seed passing the above mentioned screen. The dollar value per hectare ($/ha) was calculated from the overall means of tests using 1982 loan support prices for quota peanuts which reflect the yield and grade. In 1981 and 1982, grain sorghum (Funk's GR-522 or Early Oro) was planted in rows 61 and 91 cm apart at target populations of 148,000 and 222,000 plants per hectare. The same experimental plots were used for the grain sorghum as for the peanut cultivars.

The seedbed was prepared by deep-turning and marking off level beds before crop planting. Fertilizer was applied broadcast and incorporated into the soil at rates determined by soil test analysis. All pesticide applications were at recommended rates. Peanut leafspot fungicide and required insecticides were applied as needed. Metolachlor herbicide was applied preemergence to the spring- and summer-planted peanut cultivar tests and to the summer planted grain sorghum grown on Bonifay sand. Preplanted incorporated benefin and vernolate followed by ground cracking treatments of alachlor and naptalam-dinoseb were applied to the spring planted peanut cultivar tests grown on Tifton loamy sand soil.

Experiments were irrigated with about 1.5 to 2.5 cm of water when plants were observed to show slight wilting. Supplemental overhead irrigation water was applied 7 times in the spring of 1981, 2 times in the spring of 1982 to the Bonifay sand test. No irrigation was applied in the spring of 1982 to the Tifton loamy sand test.

In 1981 and 1982, Pronto peanut was also grown in multiple-cropping sequences under center pivot irrigation on a field scale production system. The cropping sequences in 1981 were Pronto peanut-grain sorghum (area 1), tomato transplants-Pronto peanuts (area 2), and in 1982, the cropping sequence was cucumbers-Pronto peanut (area 1). Each production area was approximately 3 hectares in size. Treatment variables on peanut were tillage (moldboard plow, subsoil plant), and row spacing. Treatment variables on grain sorghum include the above tillage but planted to obtain plant populations of 148,000 and 222,000 plants per hectare. Treatment variables on tomato transplants and cucumbers included tillage practices only. The peanut row spacing was two rows spaced 81 cm apart and paired rows spaced 36 cm apart with the centers of the pairs 81 cm apart on a 1.6 m wide bed. Peanut seeding rate was 100 kg/ha. In the 1981 center-pivot area (area 1), benefin plus alachlor herbicides were applied to the Pronto peanut test, and metolachlor plus atrazine was applied to the grain sorghum test. In the 1982 center-pivot area (area 1), ethalfluralin was applied to the cucumber study, and pendimethalin plus metolachlor was applied to the Pronto peanut study. In the 1982 center-pivot area (area 2), diphenamid was applied to the tomato transplant test, and pendimethalin plus metolachlor herbicides were applied to the peanut test. The center pivot system was used to apply all fertilizer and pest control materials in these production sequences. Center pivot irrigation was applied in reference to moisture blocks and water was added to experiments when soil moisture tension at 15 cm depth reached 25-30 centibars.

Results and Discussion

Cultivar Spring Tests - Figure 1 graphically presents the pod yield, calculated dollar value, percentage sound and mature kernels (seed) and sound splits (TSMK), and percentage other kernels (OK) for the means of the spring tests. Pod yields were greater when the cultivars were grown for a 114-day growth period (3282 kg/ha) than for the 99-day growth period (2250 kg/ha.) Also, the TSMK percentages were greater (65.4% vs. 57.7%), but as expected the OK percentages were less (6.6% vs. 10.0%) for the 114-day growth period. The regular seeding rate produced more peanuts than the reduced seed rate (2966 vs. 2816 kg/ha) for the combined growth periods, but no differences were noted in the percentages of TSMK or OK. In the 99-day growth period, the later maturing Florunner cultivar yielded less (2715 kg/ha) for the combined seeding rates than Comet (2855 kg/ha) and Pronto (2878 kg/ha) cultivars.

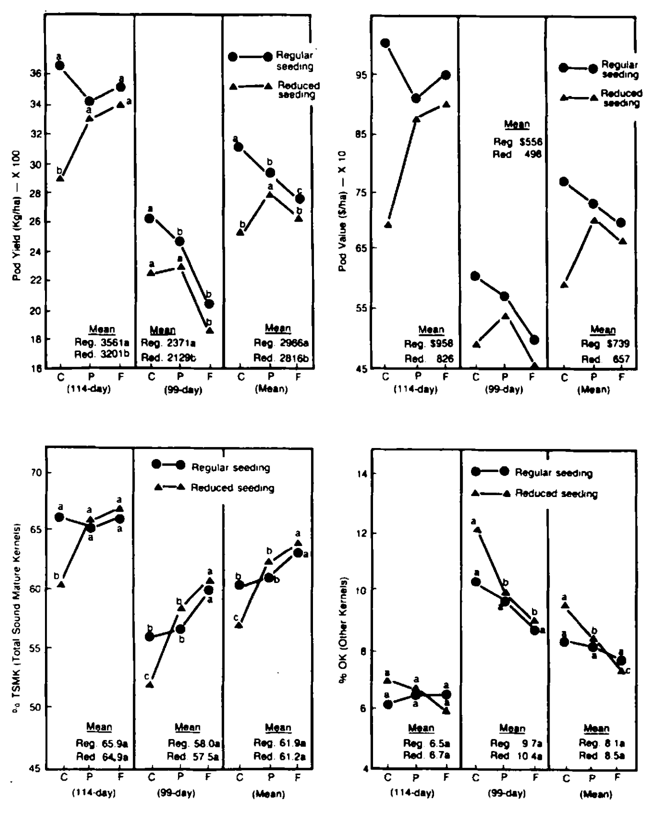

Fig. 1. The effect of spring planting and two growth periods on pod yield, pod value, percentage sound-mature and other kernels using early-maturing Comet (C) and Pronto (P), and late-maturing Florunner (F) peanut cultivars.

Table 1 gives the statistical significance and interaction levels of probability. There were highly significant

Table 1. Statistical significance and interactions of early spring planted peanuts.

	Three Spring Tests 1981-1982			Summer Test. 1981		
	Yield (kg/ha)	TSMK (%)	OK (%)	Yield (kg/ha)	TSMK (%)	OK (%)
Seeding rate (S)	**	NS	NS	*	NS	NS
Growth period (G)	**	**	**	--	--	--
Cultivar (C)	*	**	**	NS	**	**
S X G	NS	NS	NS	--	--	--
S X C	**	**	*	*	NS	NS
G X C	**	NS	*			
S X G X C	*	NS	NS			
Test (T)	**	**	**			
T X S	NS	NS	NS			
T X G	**	**	NS			
T X C	**	**	**			
T X G X C	**	NS	NS			
T X G X S X C	NS	NS	NS			

*,** Statistically significant at the .05 or .01 level of probability, respectively.

seeding rate and cultivar interactions for yields among the three cultivars grown at two seeding rates. Pronto yielded more than Comet or Florunner at the reduced seeding rate. There were yield interactions between tests and growth periods, tests and cultivars, and between tests, growth period and cultivars at the 0.01 level of statistical probability. Interactions between various parameters for TSMK and OK are presented in Table 1.

In the spring tests, it was obvious that the early-maturing cultivars (Comet and Pronto) and the late-maturing Florunner cultivar produced greater pod yield and pod value when grown for a 114-day period rather than a 99-day period. Furthermore, the regular seeding rate resulted in yields greater than the reduced seeding rate in the 4-row planting pattern. When the cultivars were grown for the 114-day growth period, there were no great yield or value differences between the three cultivars at the regular seeding rate. However, the Comet and Pronto cultivars had a yield and value advantage over Florunner for the 99-day growth period at the regular seeding rate.

In the spring tests, the percentage TSMK for Florunner equalled or exceeded Comet or Pronto cultivars regardless of the growth period or seeding rate. The percentages of OK were not significantly different for cultivars for the 114-day growth period, but Florunner had less OK's than Comet or Pronto at the reduced seeding rate when grown for 99 days.

Grain sorghum planted in late July or early August following peanuts produced 1090 to 2223 kg/ha grain in 1981 and 1982 (Table 2). There was no significantly yield difference due to planting date, row spacing, or population in 1981. In 1982, there was no difference due to row spacing or population with the July-planted grain sorghum. The grain sorghum planted in August, 1982, produced significantly less grain than that planted in July, 1982. In addition, the thicker population resulted in significantly better yields than the thinner population at both row spacings. In 1981, an earlier maturing hybrid

Table 2. Late-planted grain sorghum response following peanuts in Bonifay sand soil.

Planting Date	Row Spacing (cm)	Plant Count 1000 Plants/ha 1981	1982	Yield[1] kg/ha 1981	1982
July 21	61	136.5[2]	108.2[2]	1440 a	1838 a
July 21	61	222.9	188.9	2129 a	1858 a
July 21	91	139.5	117.5	1504 a	1945 a
July 21	91	166.2	171.7	1748 a	2223 a
August 5	61	128.8[3]	104.3[3]	1424 a	1227 b
August 5	61	224.2	194.5	1766 a	1607 a
August 5	91	120.0	122.7	1312 a	1090 b
August 5	91	224.5	178.0	1796 a	1597 a

[1] Yields followed by the same letter are not significantly different at the 0.05 probability level as determined by DMRT.

[2] Sorghum cultivar Funk's 522-DR.

[3] Sorghum cultivar Early Oro.

was planted in August (Early Oro). Funk's G-522DR was planted on the remaining test plots for 1981 and 1982. These data suggest that a very early-maturing grain sorghum hybrid may produce satisfactory yield in Georgia in a short growing period after August 1.

Sorghum plantings did not consistently give the desired populations of 148,000 or 222,000 plants per hectare. Observations indicated we had some stand loss from fall armyworm soon after grain sorghum emerged. However, a separation between high and low populations in grain sorghum was obtained. In all cases, the higher population resulted in higher yield over the corresponding lower population in the same row spacing. Row spacing did not appear to affect grain sorghum yield at same planting dates.

No pest management problems were encountered in the double cropping sequence of peanut-grain sorghum over the 2-year period on Bonifay sand soil. These results would indicate this could be a very desirable double-cropping sequence in which peanuts are grown in rotation with a grass crop on an annual basis.

Summer Tests - An experiment conducted in the summer of 1981 on a Bonifay sand immediately following the spring peanut test was dug 112 days after planting. Pod yields were slightly lower (1700 kg/ha) than for the spring test (1977 kg/ha), Figure 2. The Comet and Pronto cultivars yielded more and had a higher value than Florunner when seeded at the regular rate, but there was no difference in yield when cultivars were seeded at a reduced rate. The average yield and market value of cultivars were greater when seeded at the regular rate. TSMK percentages were greater and the percentage of OK was less for the early-maturing cultivars

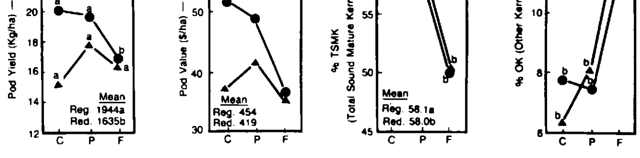

Fig. 2. The effect of summer planting on pod yield, pod value, percentage sound-mature and other kernels using early maturing Comet (C) and Pronto (P), and late maturing Florunner (F) peanut cultivars.

(Comet and Pronto) than for the later-maturing Florunner cultivar at both seeding rates.

Center Pivot Production Systems - Tifton Loamy Sand Soil - Pronto peanut planted in a 4-row pattern resulted in a higher yield and greater income than when planted in a 2-row pattern (Table 3). There was no statistical difference between the seedbed preparation techniques for Pronto peanut in 1981. The treatment with a high population of grain sorghum within each seedbed variable produced in the highest grain sorghum yield. The subsoil-plant (conservation) tillage reduced grain sorghum yield when compared to moldboard-plant tillage. The growing period for the Pronto peanuts was 106 days. Grain sorghum planting was delayed 13 days because of wet weather. Although yield levels were lower than the average state yield produced by farmers growing full season cultivars, Pronto peanut followed by grain sorghum can produce acceptable yields in a double cropping sequence, and would be economically feasible (Table 3).

Table 3. Influence of tillage on a double-cropping sequence of peanut-grain sorghum in a small scale irrigated production system.[1]

Area 1 - RDC Center Pivot - 1981

Pronto Peanuts

Tillage	Row Pattern	$/ha	Yield kg/ha
moldboard plow	2	1099	2713 b
moldboard plow	4	1419	3341 a
subsoil plant	2	1045	2652 b
subsoil plant	4	1152	3034 a

[1]Planted 4-9-81. Dug 7-24-81.

Grain Sorghum

Tillage	Plant Count 1,000/ha	Yield (kg/ha)	
moldboard	118.7	4293 b	
moldboard	203.9	4885 a	
			4590 a
subsoil plant	97.6	3224 b	
subsoil plant	171.3	4181 a	
			3703 b

[1]Planted 8-7-81.

Pronto peanut planted after harvesting tomato transplants under the center pivot resulted in yields of 2681 to 3358 kg/ha and income of $1099 to $1381/ha (Table 4). A subsoil-plant (conservation) tillage reduced peanut yield when compared to moldboard plow seedbed. However, row spacing for Pronto peanut planted June 1 following tomato transplants did not affect yields in either seedbed. The growing season for Pronto peanut following tomato transplants was 102 days.

In 1982, Pronto peanut was planted following a crop of cucumbers under the center pivot production unit. Pronto peanut grown in a 2-row pattern in subsoil plant (conservation) tillage resulted in significantly lower yields when compared to moldboard plow or 4-row pattern (Table 5). The average peanut yield was approximately 50% of expected yield. Vegetative growth of the peanut was normal, but pegging and pod set were reduced.

Table 4. Effect of tillage on Pronto peanuts planted after tomato transplant production.[1]

Area 2 - RDC Center Pivot - 1981

Pronto Peanuts

Tillage	Row Pattern	$/ha	Yield (kg/ha)	
moldboard plow	2	1314	3033 a	
moldboard plow	4	1381	3358 a	
				3195 a
subsoil plant	2	1099	2681 a	
subsoil plant	4	1186	2803 a	
				2742 b

[1]Planted 6-1-81. Dug 9-10-81.

Table 5. Effect of tillage on Pronto peanuts planted after cucumbers.[1]

Area 1 - RDC Center Pivot - 1982

Pronto Peanuts

Tillage	Row Pattern	$/ha	Yield kg/ha
moldboard plow	2	757 a	1709 a
moldboard plow	4	758 a	1692 a
subsoil plant	2	573 b	1279 b
subsoil plant	4	827 a	1793 a

[1]Planted 6-25-82. Dug 9-27-82.

The crop of cucumbers was abandoned because of a poor stand related to herbicide injury. We also suspect herbicide injury on Pronto peanut which reduced pegging and pod set. A dinitroaniline herbicide was applied at 1.12 kg/ha to the cucumbers. Pendimethalin, a related dinitroaniline herbicide, was applied to the peanut tillage-row spacing test. Research has shown that this herbicide family can cause reduced pegging and pod set (1). We suspect that the concentration of the herbicide in the peanut pegging zone was great enough to reduce peanut yields as indicated in Table 5. No other herbicide injury in the cropping sequence was noted.

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