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Effects of Intrarow Spacing on Yield and Market Quality of Peanut (*Arachis hypogaea* L.) Genotypes[1]

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ABSTRACT

Pod yields and grading data were analyzed for six peanut (*Arachis hypogaea* L.) genotypes grown in 91 cm rows while using three intrarow distances; 10.2 cm, 15.2 cm and 30.5 cm. Yields were analyzed for a 6-year period from 1975 to 1980 and grading data were analyzed for a 7-year period from 1974 to 1980.

Three genotypes (Dixie Runner, UF714021 and UF439-16-6-3) showed no significant yield differences (all differences reported at the 5% level) among spacings. Florunner and Florigiant produced the same yields at 10.2 cm spacings as they did at 15.2 cm. Both cultivars showed a significant yield reduction at the 30.5 cm spacing. Early Bunch yields were significantly higher at 15.2 cm than at 30.5 cm, while the yield at 10.2 cm was intermediate, but was not significantly different from either 15.2 or 30.5 cm.

Grading data included percentages of extra large kernels (ELK), total sound mature kernels, and Virginia pods. The percentage of ELK for Florigiant at 15.2 cm was significantly greater than the 30.5 cm spacing. Changes in intrarow spacings of the six gentoypes in this study produced no significant differences in any grading data with that exception.

All the currently grown cultivars in these tests had yields with plant spacings at 15.2 cm that were not significantly different from yields at 10.2 cm. With good quality seeds and good production practices a considerable savings could be made with little or no yield reduction by planting at spacings near 15 cm.

Key Words: Groundnut, planting patterns, intrarow competition, genotypic interactions.

Extension Agronomists in the southeastern United States had noticed an apparent difference among peanut genotypes in their ability to compensate for poor stands. If, in fact, such differences occur, they will have an important bearing on production practices such as replanting after poor seed germination, or after poor seedling establishment caused by disease, insects or drought.

The majority of intrarow plant spacing studies in peanuts have used the older Spanish cultivars (2,4,5,6,9,12) and often have examined different intrarow spacings for a single cultivar. In these and other studies (6,11) where 91 cm rows were used, highest yields were obtained at the closest intrarow spacings tested, even with spacings as close as 8 cm.

The data on yields of the larger bunch and runner-type plants generally indicate that in 91 cm rows, maximum yields may be obtained with seeds more widely spaced than for Spanish cultivars. Most of these studies (1,3,10,12) again do not examine differences between genotypes. One study by Wynne et al. (13), using two Virginia-type cultivars, in an experiment designed to study the effects of plant spacing and growth regulator use, showed no significant difference in yields between 13 and 25 cm intrarow spacings for either cultivar in 91 cm rows without growth regulator application.

This study (13) did, however, show significant effects of intrarow spacing on the market grade of the fruit. In studying fancy size pods, extra large kernels (ELK), and sound mature kernels (SMK) it was found that for NC-17 there was a significant increase in the percentage of ELK and SMK at the closer intrarow spacings. For NC-5 the only significant effect on grading characteristics was a decrease in the percentage of fancy pods at the closer spacing. In three of five years Cox and Reid (3) also found an increase in the percentage of ELK for NC-2 as spacing was decreased. In one of five years of their study SMK also increased at closer spacings, but in no case did the closer spacing cause a decrease in grade. Mixon (8), studying both Virginia and runner market types found no significant difference in market grade factors at intrarow spacings of 8, 11, and 15 cm when studied over several row widths.

The purpose of this study was to determine whether genotypic differences exist in the ability of peanuts to compensate for poor stand. While yield was the primary concern, the spacing effect on peanut grade was also examined.

Materials and Methods

Four cultivars and two experimental lines were used in this study. Three were runner (Dixie Runner, Florigiant and Florunner), and three were bunch (Early Bunch, UF439-16-6-3 and UF714021) in botanical classification.

The six lines also differed in commercial pod types. Florunner, Dixie Runner and UF439-16-6-3 are commercial runner-types, while Florigiant, Early Bunch and UF714021 are commercial Virginia-types.

The peanuts were grown on the Agronomy Farm of the University of Florida on Arredondo fine sand for 7 years, from 1974 to 1980. Production practices followed standard University of Florida Cooperative Extension Service recommendations and included irrigation.

Plots were 6.1 m long and included 2 rows 91.4 cm apart. To insure a stand as close as possible to the desired intrarow distances, the 15.2 cm and 30.5 cm spacings were double planted by hand. The 10.2 cm spacing was also planted by hand, with every other seed double planted. Two to three weeks after planting the plots were thinned to the proper spacing. At harvest taproots were counted. Any plot having less than 90% or greater than 110% of the desired stand was treated statistically as a missing plot.

Field notes were taken on plant appearance, plant growth habit, plant

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uniformity, vegetative plant disease, plant mainstem height, pod type, pod disease, and pod appearance.

After pod yields were calculated (on an 8% moisture basis), samples were bulked from replications 1 and 2 and from replications 3 and 4. These two lots were then graded according to USDA procedures. Grading data analyzed (as percentage of the total sample weight) included: Virginia size pods (pods riding 1.35 cm spaced rollers), other kernels (seeds that pass through a 0.6 x 2.54 cm screen), sound splits (split or broken seeds without damage), visual and concealed damage, meats, sound mature kernels (whole seeds riding a 0.6 x 2.54 cm screen), and extra large kernels (whole seeds riding a 0.85 x 2.54 cm screen). Total sound mature kernels (TSMK) were calculated by adding together the percentage of sound mature kernels and sound splits.

The experimental design was a randomized complete block with four replications. Treatments included three intrarow spacings (10.2 cm, 15.2 cm, and 30.5 cm) for each of the six genotypes.

Yield data averaged over the four replications are reported for the 6-year period from 1975 to 1980, while the grading sample data are reported for the 7 years from 1974 to 1980.

Results and Discussion

Pod yields for each of the 6 years are given in Table 1. Analysis of variance indicated that significant year-to-year variation existed for all genotypes averaged over plant spacings with the exception of Early Bunch. When averaged over years, the different intrarow spacings had no effect on yields of Dixie Runner, UF714021 or UF439-16-6-3, although there were overall trends towards lower yields at greater spacings for the two experimental lines.

Table 1. Pod Yields of six genotypes at three intrarow spacings, 1975 to 1980.

		Year						
Genotype	Spacing	1975	1976	1977	1978	1979	1980	Mean
		kg/ha						
Florunner	10.2 cm	5534	4179	4659	5087	4537	5717	4953a*
	15.2 cm	5420	4448	4916	4923	4456	5575	4956a
	30.5 cm	5229	3866	3777	4965	4484	5097	4566b
Florigiant	10.2 cm	6339	3296	4932	5217	4619	5420	4981a
	15.2 cm	5485	3987	5339	5160	4793	5664	5070a
	30.5 cm	5960	3866	3540	4509	4403	4741	4504b
Dixie Runner	10.2 cm	4212	2027	2921	3073	2340	4549	3186a
	15.2 cm	4089	2067	2604	2841	2352	4436	3064a
	30.5 cm	4403	2189	2678	2978	2287	4334	3146a
UF439-16-6-3	10.2 cm	3915	4354	3825	5066	4029	5460	4444a
	15.2 cm	4252	3723	3967	5160	4061	5677	4472a
	30.5 cm	4232	3328	3662	5270	3784	5217	4249a
Early Bunch	10.2 cm	5372	4484	4566	5453	4314	5241	4903ab
	15.2 cm	5729	5200	4427	4944	4801	5229	5053a
	30.5 cm	5392	4476	4537	4956	4362	4671	4733b
UF714021	10.2 cm	5087	5066	5120	5078	4517	5473	5053a
	15.2 cm	5176	4700	4794	5135	4468	5697	4993a
	30.5 cm	4834	4509	4509	5453	4416	5270	4830a

* For each genotype, means followed by the same letter are not significantly different at the 5% level as determined by Duncan's Multiple Range Test.

For both Florunner and Florigiant, the yields at 10.2 and 15.2 cm intrarow spacings were not significantly different, but yields at 30.5 cm were significantly lower. Early Bunch pod yields were highest at 15.2 cm, significantly greater than yields at the 30.5 cm spacing. The yields at 10.2 cm were not significantly different from either the 15.2 or 30.5 cm spacing.

The significant differences in yields for both Early Bunch and Florunner were consistent over years. However, a significant year by spacing interaction occurred with Florigiant. These interactions are examined in Table 2. Although these interactions exist, in 4 years out of 6 the yields at 30.5 cm were lower than yields at either 10.2 or 15.2 cm. When averaged over the 6 year period, the yields at 30.5 cm were significantly lower than either of the other two spacings.

Table 2. Year x Spacing Interaction of Florigiant for pod yields.

	Spacing		
Year	10.2 cm	15.2 cm	30.5 cm
	kg/ha		
1980	5420ab*	5664a	4741b
1979	4619a	4793a	4403a
1978	5217a	5160ab	4509b
1977	4932a	5339a	3540b
1976	3296a	3987a	3866a
1975	6389a	5485b	5960ab
Mean	4981a	5070a	4504b

* For each year, yields followed by the same letter are not significantly different at the 5% level as determined by Duncan's Multiple Range Test.

The average mainstem heights for 5 years are listed in Table 3. For all genotypes the increased distance between plants decreased the height of the mainstems.

Table 3. Effect of intrarow spacing on mainstem heights of six genotypes.

Average of 5 years

	Spacing		
Genotype	10.2 cm	15.2 cm	30.5 cm
Florunner	42.2a*	39.5ab	34.9b
Florigiant	44.0a	42.8a	36.4b
Dixie Runner	39.6a	37.3ab	34.2b
UF439-16-6-3	47.4a	41.8b	41.2b
Early Bunch	40.3a	37.2a	33.5b
UF714021	54.5a	50.7ab	47.1b

* For each genotype, heights followed by the same letter are not significantly different at the 5% level as determined by Duncan's Multiple Range Test.

The different distances between plants had no effect on any genotype for plant growth habit, vegetative plant disease incidence, or pod disease incidence, nor did they affect the ratings given for plant appearance, plant uniformity or pod appearance.

Grading data for percentage of Virginia size pods and total sound mature kernels (TSMK) are listed in Tables 4 and 5, respectively. No genotype showed any significant difference between spacing for either Virginia size pods or TSMK. In Table 6 the percentage of extra large kernels for Florigiant at 15.2 cm was significantly greater than the ELK mean at 30.5 cm. No other genotypes showed differences between spacings for ELK percentage.

Although not listed in tables, this study measured other kernels, percentage of meats, and visual and concealed damage. No genotype showed differences between spacings for any of these grading categories.

Table 4. Effect of intrarow spacing on percentage of Virginia pods for six genotypes, 1974 to 1980.

Genotype	Spacing	Year 1974	1975	1976	1977	1978	1979	1980	Mean
		% Virginia pods							
Florunner	10.2 cm	14.9	8.8	9.0	22.0	5.1	12.5	11.3	12.0*
	15.2 cm	17.5	2.3	7.1	17.5	5.9	14.0	10.1	10.6
	30.5 cm	21.0	6.5	5.6	12.4	12.7	14.8	13.0	12.3
Florigiant	10.2 cm	87.4	84.4	87.3	89.7	83.1	87.3	83.5	86.6
	15.2 cm	86.9	81.7	90.3	87.9	87.9	91.3	91.6	88.2
	30.5 cm	84.3	84.6	91.7	89.9	94.4	86.4	86.6	88.3
Dixie Runner	10.2 cm	0.8	0.0	1.2	4.5	1.1	2.7	1.7	1.7
	15.2 cm	0.3	0.0	1.1	1.1	0.7	2.8	0.9	1.0
	30.5 cm	0.0	0.8	0.4	2.4	1.1	2.0	4.0	1.5
UF439-16-6-3	10.2 cm	10.8	1.4	3.4	12.9	4.2	11.0	5.0	7.0
	15.2 cm	8.8	6.2	3.2	16.9	3.5	9.7	6.5	7.8
	30.5 cm	10.9	3.9	3.6	16.9	3.0	9.2	4.5	5.1
Early Bunch	10.2 cm	81.9	78.7	84.4	89.9	90.6	82.9	86.8	85.0
	15.2 cm	81.5	78.2	80.1	93.2	86.1	90.5	87.1	85.2
	30.5 cm	79.6	75.2	75.6	85.6	86.1	91.0	89.4	83.2
UF714021	10.2 cm	54.6	66.1	61.3	74.9	65.2	80.5	67.5	67.2
	15.2 cm	55.6	68.3	59.1	75.8	72.0	77.4	67.4	68.0
	30.5 cm	57.1	70.2	59.4	72.8	75.8	73.0	69.5	68.3

* Means for each genotype are not significantly different at the 5% level.

Table 5. Effect of intrarow spacing on percentage of total sound mature kernels, 1974 to 1980.

Genotype	Spacing	Year 1974	1975	1976	1977	1978	1979	1980	Mean
		% TSMK							
Florunner	10.2 cm	74.0	75.8	71.8	75.4	78.9	77.0	78.3	75.9*
	15.2 cm	76.2	78.4	74.5	77.9	79.7	75.5	77.6	77.1
	30.5 cm	74.3	75.5	73.9	75.5	79.8	78.8	78.7	76.7
Florigiant	10.2 cm	65.8	76.2	66.5	74.3	74.4	73.3	74.3	72.1
	15.2 cm	67.2	75.5	66.6	73.9	73.8	73.3	73.7	72.0
	30.5 cm	65.3	72.0	67.5	66.0	75.3	73.1	71.1	70.1
Dixie Runner	10.2 cm	66.4	63.7	52.3	62.9	58.8	64.1	66.1	62.0
	15.2 cm	60.9	63.2	51.1	65.9	58.1	62.8	67.1	61.3
	30.5 cm	62.0	65.0	48.6	66.8	63.4	58.0	63.9	61.1
UF439-16-6-3	10.2 cm	68.3	76.3	71.1	72.1	75.4	74.4	77.2	73.6
	15.2 cm	68.4	72.7	69.9	72.8	76.7	74.8	78.7	73.4
	30.5 cm	69.1	76.7	70.5	74.0	78.6	76.2	77.2	74.6
Early Bunch	10.2 cm	66.4	72.2	52.7	69.7	76.9	76.1	74.3	69.8
	15.2 cm	66.1	69.9	60.5	73.9	77.3	75.7	75.6	71.3
	30.5 cm	66.0	71.3	59.1	69.3	77.4	75.9	74.0	70.4
UF714021	10.2 cm	71.9	70.1	70.1	66.3	72.4	68.4	66.7	69.4
	15.2 cm	70.7	71.1	70.1	65.2	73.1	69.3	69.8	69.9
	30.5 cm	67.5	67.9	70.2	68.8	73.1	64.8	68.9	68.7

* Means for each genotype are not significantly different at the 5% level.

Table 6. Effect of intrarow spacing on percentage of extra large kernels, 1974 to 1980.

Genotype	Spacing	Year 1974	1975	1976	1977	1978	1979	1980	Mean
		% ELK							
Florunner	10.2 cm	32.7	31.0	17.5	26.3	29.2	28.7	29.2	27.8a*
	15.2 cm	33.5	25.6	18.0	27.3	30.8	26.0	30.5	27.4a
	30.5 cm	31.2	21.6	16.2	23.3	33.1	23.1	25.0	24.8a
Florigiant	10.2 cm	37.2	58.1	33.1	60.9	46.3	45.3	42.3	46.2ab
	15.2 cm	40.4	57.6	36.5	61.5	47.1	45.2	55.2	49.1a
	30.5 cm	35.8	54.8	32.6	52.1	49.5	39.1	44.9	44.1b
Dixie Runner	10.2 cm	2.1	3.0	1.8	6.1	2.4	2.9	5.8	3.5a
	15.2 cm	2.3	3.4	1.1	8.1	1.0	4.0	3.6	3.4a
	30.5 cm	1.1	3.1	1.0	7.6	1.9	2.8	4.5	2.8a
UF439-16-6-3	10.2 cm	27.6	27.7	14.0	35.1	24.6	20.6	28.1	21.5a
	15.2 cm	28.1	28.5	14.6	35.5	23.7	19.8	27.2	21.4a
	30.5 cm	27.1	27.7	12.4	31.5	25.9	19.3	20.5	23.5a
Early Bunch	10.2 cm	37.7	51.2	46.3	66.2	58.6	55.2	46.3	51.7a
	15.2 cm	36.4	49.2	42.7	65.9	58.0	52.0	41.9	49.4a
	30.5 cm	36.6	50.5	41.9	63.4	60.8	52.5	47.8	50.5a
UF714021	10.2 cm	42.0	56.5	47.0	51.6	48.5	45.4	50.6	48.8a
	15.2 cm	31.5	58.9	43.3	53.3	47.9	46.6	48.4	47.1a
	30.5 cm	38.1	52.4	42.2	57.9	47.7	44.8	54.3	48.2a

* For each genotype, means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Summary and Conclusion

Six genotypes were grown for six years at three different intrarow spacings to determine whether genotypic differences for stand compensation existed. Three genotypes (Dixie Runner, UF439-16-6-3 and UF714021) showed an ability to compensate for poor stand by yielding the same at between-plant distances of 10.2 cm, 15.2 cm, and 30.5 cm in 91 cm rows. Florunner, and Florigiant showed less ability to compensate as indicated by significant yield reductions when planted 30.5 cm apart within the row as compared to 10.2 and 15.2 cm. Early Bunch showed the same pattern as Florunner and Florigiant in that it had significantly lower yields at 30.5 cm when compared with 15.2 cm. However, Early Bunch yields at 10.2 cm were not significantly different from either spacing.

None of the six genotypes in these tests showed differences in grading data due to differences in intrarow plant spacings, excluding the one exception listed above. Thus the six genotypes are all able to produce the same size pods and kernels regardless of the level of competition between plants (within the limits of this study).

Although not an original intent of this study, the data show that current extension recommendations for intrarow seed spacings of 7.6 to 10.2 cm may be closer than necessary for good yields.

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