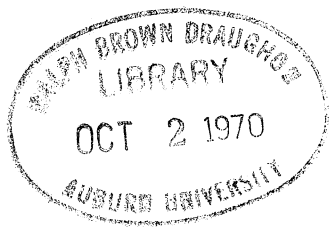


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*Effect of*  
**SEED SIZE on VIGOR and  
YIELD of RUNNER PEANUTS**



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**CROPS RESEARCH DIVISION, USDA AGRICULTURAL RESEARCH SERVICE**

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## *Effect of*

# SEED SIZE on VIGOR and YIELD of RUNNER PEANUTS

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NINETY per cent of Alabama's peanut acreage is in 12 southeastern counties. In 1961, Alabama farmers harvested from 193,000 acres approximately 210,370,000 pounds of peanuts with an estimated value of \$22,000,000. Peanuts rank third in value among field crops in the State.

Each year some Alabama farmers use small seed known as "pegs" to plant their peanut acreage. These "pegs" are peanuts that pass through standard grading screens used by the seed processors to obtain No. 1 seed. Most "peg" seed, which are frequently referred to as "shrivels," are immature, as indicated by longitudinal wrinkles in their coats. No. 1 peanut seed are largely fully mature with only a small percentage of immatures.

The greater vigor of seedlings from larger seed has been generally recognized for many years. In 1901 Miller and Pammel (8), working with small and large seed of several legumes, noted that in most instances larger seed produced more vigorous seedlings. Similar conclusions have been drawn from work with both grasses (4,7,10,11) and other legumes (1,2,3). In 1919 Kidd and West (6) indicated that larger seed resulted in more vigorous plants and higher yield.

Higgins and Bailey (5) and Parham (9) have presented evidence that No. 1 peanut seed produce more vigorous seedlings than "peg" seed. Woodroof (12) presented a 3-year summary from a field emergence study, showing that No. 1 machine-shelled peanuts gave 76 per cent emergence as compared with 67 per cent

for medium "pegs" and 57 per cent for small "pegs." Poor emergence of peanut plants grown from "pegs" was also noted by Higgins and Bailey.

Reduced yields of peanuts grown from "peg" seed were noted by Woodroof (13,14) and Higgins and Bailey. In 2 out of 3 years with Virginia Bunch 46-2 in Virginia,<sup>1</sup> yield of pods, shelling percentage, and per cent extra-large kernels increased with increasing seed size.

The experiments reported in this bulletin were conducted to answer questions in regard to yield and vigor of peanut plants grown from seed of various seed size classes.

### EXPERIMENTAL PROCEDURE

Mechanically-shelled peanut seed grown at the Wiregrass Substation, Headland, Alabama, were separated into seed size classes using various peanut-grading screens. The seed classes were selected from single lots of Dixie Runner peanut seed for use in the 1958 greenhouse experiments and for the 1959 and 1960 field experiments. The Early Runner variety was used in the 1961 experiment. After separation into size classes, the seed were hand selected to remove any visibly damaged kernels. Five seed size classes, (small, medium, and large No. 1 seed and small and medium "pegs") were used. The number of seed per pound for each seed class used is given in Table 1. A representative sample of each seed class is shown in Figure 1.

TABLE 1. PEANUT SEED PER POUND OF VARIOUS SEED CLASSES

Seed classes	Seed per pound	
	Seed range	Average
	No.	No.
<b>Classes of No. 1's</b>		
Large.....	800- 880	832
Medium.....	976-1,072	1,024
Small.....	1,200-1,280	1,264
<b>Classes of "Pegs"</b>		
Medium.....	1,744-1,856	1,792
Small.....	2,656-2,704	2,688

<sup>1</sup> Unpublished results of cooperative studies by the Tidewater Research Station, Virginia Agricultural Experiment Station, Holland, Virginia, and the Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture.

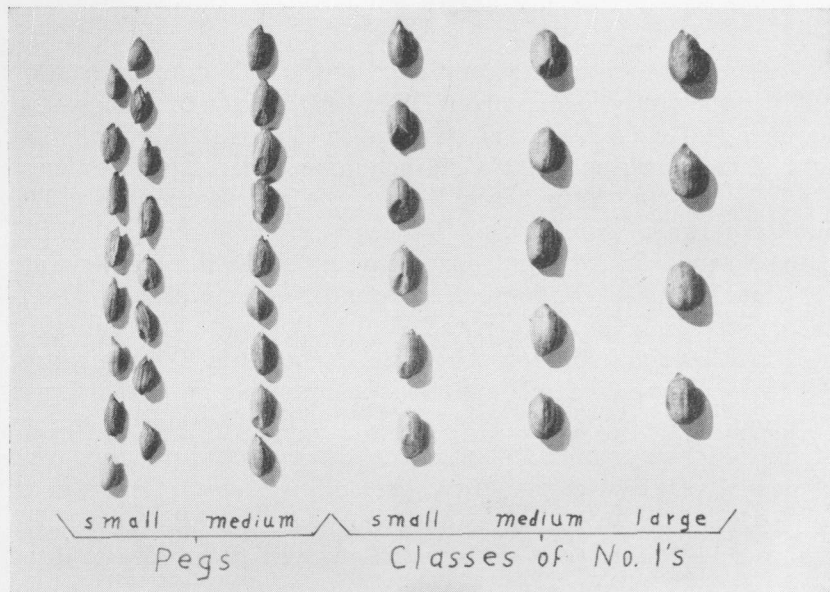


FIGURE 1. Peanut seed shown here are representative of five size classes. Seed weight of seed shown for each class is approximately the same (2 grams).

### GREENHOUSE EXPERIMENTS

Preliminary experiments were conducted in the greenhouse at Auburn. Plantings were made February 12 and 27, 1958, in benches filled with 9 inches of Norfolk sandy loam soil. Soil in the benches was treated with 4-12-12 fertilizer and gypsum at the rate of 500 and 2,000 pounds per acre, respectively. The fertilizer and gypsum were thoroughly mixed in the soil before planting. Heating cables were placed in the soil at the bottom of the benches to maintain soil temperature at approximately 75°F. under conditions where air temperatures within the greenhouse ranged from 34° to 104°F. Seed classes were replicated 7 times in both plantings. Each replicate consisted of three adjacent rows 36 inches long spaced 4 inches apart. Seed were spaced 1 inch apart in the rows. Two weeks after seed were planted, the two outside rows of each plot were removed for dry-weight determinations, and the center rows were thinned to 10 plants. At the end of another 2-week interval (4 weeks after planting), the 10 plants that remained in each seed-class replicate were used to determine dry weight per plant.

## FIELD EXPERIMENTS

Field experiments were conducted at the Wiregrass Substation on Norfolk sandy loam soil in 1959, 1960, and 1961. Each year various seed size classes were planted in randomized experiments with 6-inch drill spacing in 36-inch rows. Planting dates were April 17, 12, and 21 in 1959, 1960, and 1961, respectively. The 1959 experiment consisted of single row plots 38 feet long replicated 8 times. In 1960 and 1961, two-row plots 40 feet long were replicated 6 times. Five hundred pounds per acre of 0-10-20 fertilizer was applied broadcast in 1958 and 600 and 375 pounds per acre in 1960 and 1961, respectively. On the basis of soil analysis, 3,000 pounds per acre of high-calcium lime was applied prior to planting in the test area in 1960. Each year 500 pounds per acre of gypsum was applied broadcast to the potential pegging zone of peanut plants at early-bloom stage.

The large No. 1 class of peanuts was planted at the rate of two seed per hill; other seed classes were planted at the rate of three seed per hill. All plots were thinned to one plant per hill shortly after emergence. In 1960 and 1961, a portion of the seed classes was also planted at the rate of 50 pounds per acre with no thinning of plants. The spaced seed were planted with hand planters and the 50-pound-per-acre rate was dropped by hand in an open furrow and covered.

Each year one plant from both ends of each plot row was removed for dry-weight determination at intervals of 4, 8, and 12 weeks from planting and immediately before harvest. At each sampling time, the two end plants in the space-planted plots were discarded and the third plant was used for dry weight. In the plots drilled at 50 pounds of seed per acre, one-foot at both ends of each row was discarded and the next plant in the row was used for dry weight.

Plant samples used for dry-weight determination were dried at 155°F., and the weights were recorded in grams per plant.

The single-row plots in 1959 and the double-row plots in 1960 and 1961 were adjusted to 30 feet in length before harvesting for yield, which was recorded in pounds of pods per acre. Pod samples of 200 grams per plot were used in determining market grade data.

Pre-emergence herbicide, DNBP (4, 6 dinitro-o-secondary butyphenol), was applied in a 12-inch band on the row at the rate of 3 pounds per acre immediately after planting. This treatment

controlled most annual weeds for 4 to 6 weeks. Conventional cultivation was used throughout the remainder of the season.

Plots were dusted with a DDT-sulfur mixture for leafspot and insect control.

## RESULTS AND DISCUSSION

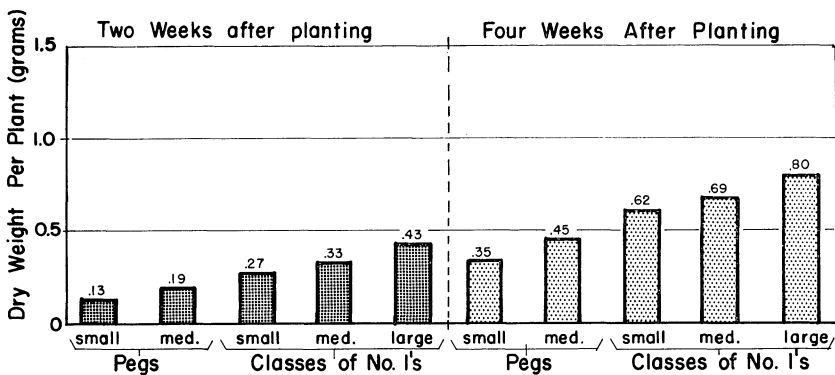
### PLANT VIGOR IN RELATION TO SEED CLASSES

Dry weights of plants were not significantly different between the two greenhouse experiments. Therefore, the results were combined in Figure 3. Since the dry-weight determinations were used as a measure of vigor, these measures are used to express vigor differences. The greater vigor of seedlings grown from each successively larger seed size was evident 2 and 4 weeks after planting. Four weeks were required for plants from small and medium "pegs" to attain size of 2-week-old plants from medium and large No. 1 seed. A representative seedling grown from each of the seed classes is shown in Figure 2.

At the end of 2 weeks, plants from large No. 1 seed were over



FIGURE 2. Peanut seedlings above were selected two weeks after planting five seed size classes; L. to R. Seedlings grown from small and medium "pegs" and from small, medium, and large No. 1.



**FIGURE 3.** Dry weights of peanut seedlings 2 weeks and 4 weeks after planting various seed size classes in greenhouse in 1958 are shown here. Significance at .01 level is .02 for 2 weeks and .07 for 4 weeks.

3 times as heavy as those from small pegs; at 4 weeks this superiority was much less.

Data from the field experiments (1959, 1960, and 1961) on vigor of plants obtained 4, 8, and 12 weeks after planting and at harvest are presented in Figure 4 and Tables 2 and 3.

Averages of the data from spaced plantings for these years show that larger seed resulted in more vigorous plants than smaller seed at every stage of development. When considered on a yearly basis, all classes of No. 1 seed in the spaced plantings produced more vigorous plants throughout the growing season than did small "pegs" (Tables 2 and 3). Similarly, all classes of No. 1 seed produced more vigorous plants each year at 4, 8, and 12 weeks than medium "pegs" and throughout the growing season in 1960 and 1961.

Seedlings from No. 1 seed emerged earlier and grew faster than those from small or medium "pegs." However, as the season progressed, the superiority in vigor of plants from large seed became less pronounced. For example, on the basis of the average for 3 years, plants from large No. 1 seed were about twice the size of those from small "pegs" 4 and 8 weeks after planting. At 12 weeks this superiority was only about 48 per cent, and by harvest only 35 per cent. Vigor relationships among seed classes at different stages of plant development are shown graphically in Figure 4. The extent to which plants from small seed gained in growth on plants from larger seed and the stage of growth during which



TABLE 2. WEIGHTS OF PEANUT PLANTS TAKEN FROM FIELD PLANTINGS APPROXIMATELY 4 AND 8 WEEKS AFTER PLANTING

Seed class	Four weeks from planting					Eight weeks from planting				
	1959	1960	1961	Av.	Relative wt.	1959	1960	1961	Av.	Relative wt.
	G.	G.	G.	G.	Pct.	G.	G.	G.	G.	Pct.
<b>6-inch drill spacing</b>										
Number 1's										
Large.....	.93	1.32	.97	1.07	218	22.7	18.2	26.6	22.5	199
Medium.....	.72	1.09	.97	.92	188	15.1	13.2	26.6	18.3	162
Small.....	.49	1.08	.65	.75	153	12.9	12.8	21.4	15.7	139
Pegs										
Medium.....	.46	.65	.47	.53	108	8.9	10.5	18.1	12.5	111
Small.....	.28	.88	.27	.49	100	9.3	9.3	15.4	11.3	100
<b>50 pounds per acre in drill</b>										
Number 1's										
Large.....	---	1.24	.74	.99	319	---	14.8	21.3	18.1	223
Small-Medium.....	---	1.05	.52	.79	255	---	10.3	16.9	13.6	168
Pegs										
Small.....	---	.37	.26	.31	100	---	5.2	11.8	8.1	100
L.S.D. at .05	.17	.33	.11	[.15] <sup>1</sup> (.17) <sup>2</sup>		4.8	2.0	5.3	[2.8] (3.1)	
L.S.D. at .01	.24	.44	.15	[.21] (.23)		6.5	3.6	7.0	[3.7] (4.1)	

<sup>1</sup> L.S.D. for first five classes in brackets.<sup>2</sup> L.S.D. for 2-year averages in parentheses.

TABLE 3. WEIGHTS OF PEANUT PLANTS TAKEN APPROXIMATELY 12 WEEKS AFTER PLANTING AND AT HARVEST

Seed class	Twelve weeks from planting					Immediately before harvest				
	1959	1960	1961	Av.	Relative wt.	1959	1960	1961	Av.	Relative wt.
	G.	G.	G.	G.	Pct.	G.	G.	G.	G.	Pct.
<b>6-inch drill spacing</b>										
Number 1's										
Large.....	54.9	77.2	88.6	73.6	148	94.3	205.4	106.7	135.5	133
Medium.....	39.2	88.5	90.0	72.6	146	103.1	186.9	103.7	131.2	129
Small.....	44.6	55.0	81.1	60.2	121	83.7	155.9	90.9	110.2	108
Pegs										
Medium.....	35.9	50.6	67.5	51.3	103	97.0	43.4	78.4	106.2	104
Small.....	35.2	67.0	47.1	49.8	100	95.5	143.0	86.7	101.7	100
<b>50 pounds per acre in drill</b>										
Number 1's										
Large.....	---	69.9	67.7	68.8	232	---	194.9	91.1	143.0	259
Small-Medium.....	---	49.6	53.3	51.3	173	---	92.3	70.7	81.5	148
Pegs										
Small.....	---	22.9	36.3	29.6	100	---	54.9	55.5	55.2	100
L.S.D. at .05	16.2	22.4	8.0	[9.8] <sup>1</sup> (11.7) <sup>2</sup>		N.S.	43.7	26.3	[20.9] (25.1)	
L.S.D. at .01	N.S.	30.1	10.7	[13.0] (15.5)		N.S.	58.6	35.3	[27.8] (33.3)	

<sup>1</sup> L.S.D. for first five classes in brackets.<sup>2</sup> L.S.D. for 2-year averages in parentheses.

major changes in vigor relationships among seed classes occurred varied from season to season.

Changes in plant vigor of Early Runner (1961) as the season progressed showed that differences in vigor associated with seed size were still evident 12 weeks after planting. Changes in plant

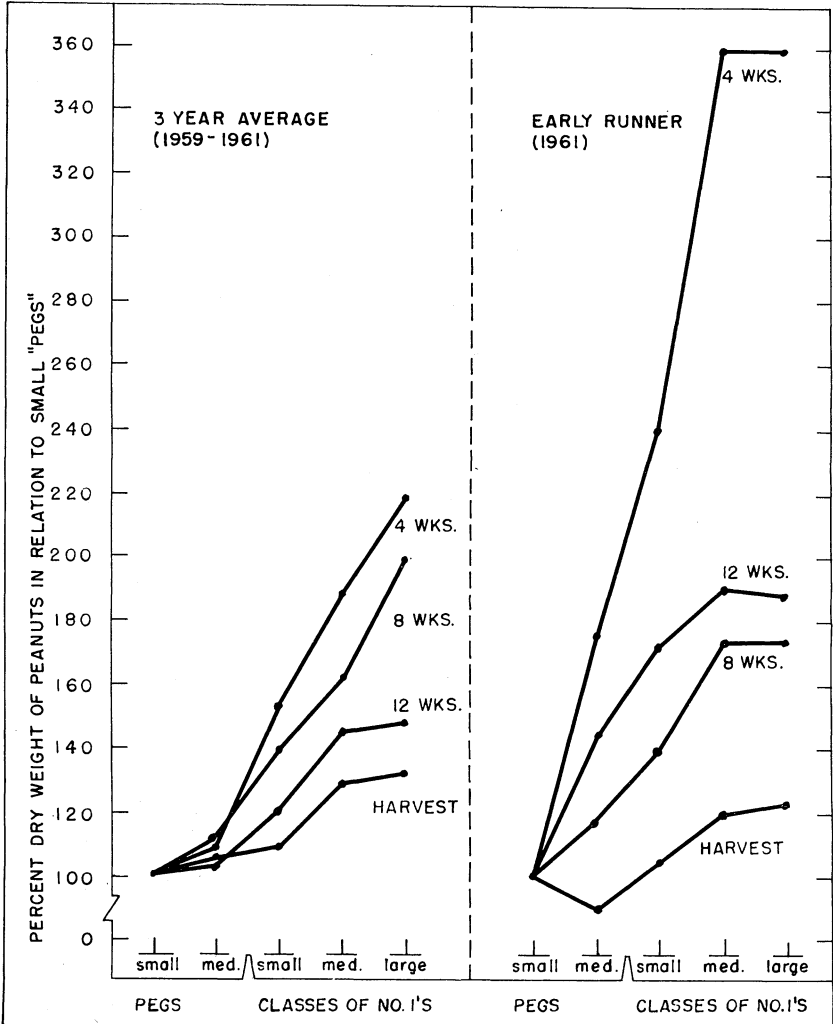


FIGURE 4. Percentage relations of dry weight of peanut plants grown in 6-inch drill spacing and sampled approximately 4, 8, and 12 weeks after planting and immediately before harvest are shown above.

vigor associated with seed size of Dixie Runner (1959-1960) were much less evident 12 weeks after planting.

When plants were seeded at the rate of 50 pounds per acre, plants from larger seed were more vigorous throughout the season in 1960 and 1961 than those from smaller seed. The tendency of plants from small seed to catch up with those from larger seed as the season progressed was much less evident in drill plantings when no thinning was done. On the basis of the 2-year average, plants from large No. 1 seed, which were about 3 times the size of those from small pegs 4 weeks from planting, were still about  $2\frac{1}{2}$  times as large as plants from small pegs at harvest. This result is not surprising because in the unthinned plots the plants from large No. 1 seed had nearly 3 times as much space in the row in which to develop; whereas, plants from small "pegs" were much thicker in the row because of their smaller size.

The greater vigor of seedlings produced from No. 1 seed was evident in both the spaced and the drilled plantings. This greater vigor should favor rapid emergence and establishment of healthy plants. The rapid ground cover produced by the more vigorous plants makes early cultivation and weed control easier.

#### YIELD IN RELATION TO SEED CLASSES

The effects of seed size on pod yield are shown in Figure 5 and Table 4. The 3-year average for pod yield gave the same general pattern as that for plant vigor. The larger the seed planted, the higher the pod yield in the spaced plantings with one exception. Because of nearly 20 per cent fewer plants at harvest, pod yield from large No. 1 seed averaged slightly less than that from other No. 1 seed. Small "pegs" were exceeded in yield by medium "pegs" by about 150 pounds per acre (8%) and by small and medium No. 1's by over 200 pounds per acre (11 to 12%).

When planted at the rate of 50 pounds of seed per acre in 1960 and 1961, No. 1 seed outyielded small "pegs" by about 175 pounds per acre (8%).

Differences in pod yield associated with size of seed were small in 1959 and 1960, but were greater in 1961. Differences were in favor of No. 1 seed all years. In 1961 with Early Runner, small and medium No. 1 seed outyielded medium "pegs" by 163 to 211 pounds per acre (8 and 10%), respectively, and small "pegs" by 363 and 411 pounds per acre (18 and 20%).

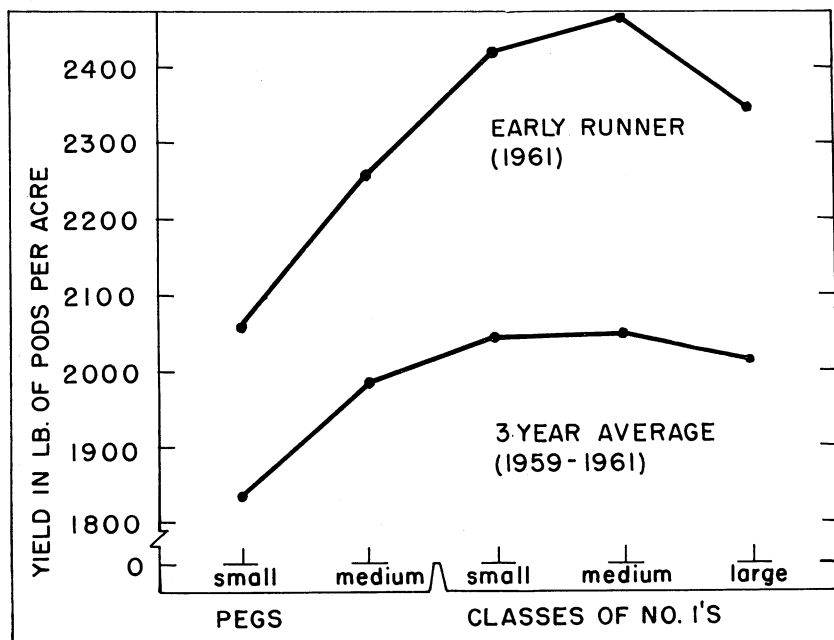


FIGURE 5. Above are yields of peanuts grown from various seed size classes.

TABLE 4. POD YIELD OF PEANUTS GROWN FROM VARIOUS SEED SIZE CLASSES

Seed class	Yield per acre				Relative yield
	1959	1960	1961	Av.	
	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Pct.</i>
<b>6-inch drill spacing</b>					
Number 1's					
Large.....	1,113	2,577	2,347	2,012	110
Medium.....	1,162	2,517	2,468	2,049	112
Small.....	1,210	2,493	2,420	2,041	111
Pegs					
Medium.....	1,113	2,565	2,257	1,978	108
Small.....	1,065	2,372	2,057	1,831	100
<b>50 pounds per acre in drill</b>					
Number 1's					
Large.....	---	2,517	2,372	2,444	107
Small-Medium.....	---	2,638	2,323	2,481	109
Pegs					
Small.....	---	2,468	2,105	2,287	100
L.S.D. at .05	N.S.	N.S.	195	[162] <sup>1</sup> (N.S.) <sup>2</sup>	
L.S.D. at .01	N.S.	N.S.	261	[N.S.] <sup>1</sup> (N.S.)	

<sup>1</sup> L.S.D. for first five classes in brackets.

<sup>2</sup> L.S.D. for 2-year averages in parentheses.

When seed were planted at the rate of 50 pounds per acre, the plants grown from small-medium and large No. 1 seed of Early Runner outyielded those from small "pegs" by 218 and 267 pounds per acre (10 and 13%), respectively.

In years when striking vigor differentials persist until late in the season, pod yields tend to be positively correlated with size of seed. In other years when plants from small seed tend to catch up with the larger plants from large seed early in the season, yields from "peg" seed may closely approach those from No. 1 seed. Results of these seed size studies are in general agreement with similar studies with runner and Spanish peanuts in Georgia (5) and Virginia (unpublished).

#### CHARACTERISTICS OF PEANUT KERNELS IN RELATION TO SIZE OF SEED PLANTED

Results of data on pod samples taken from the field experiments in 1959, 1960, and 1961 are presented in Tables 5 and 6.

No shelling percentage differences were evident between peanuts produced from any of the seed size classes (Table 5).

TABLE 5. PER CENT PLANT STAND AT HARVEST AND SHELLING PERCENTAGE OF 200 GRAM SAMPLES OF PODS TAKEN FROM PEANUT SEED SIZE TESTS, 1959-1961

Seed class	Per cent plant stand at harvest				Shelling percentage			
	1959	1960	1961	Av.	1959	1960	1961	Av.
	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>
<b>6-inch drill spacing</b>								
Number 1's								
Large.....	81.0	80.9	84.7	82.2	74.3	71.2	76.0	73.8
Medium.....	98.3	97.9	92.2	96.1	74.1	70.9	75.9	73.6
Small.....	97.9	98.9	99.3	98.7	74.8	70.1	76.1	73.7
Pegs								
Medium.....	96.2	95.5	98.5	96.7	73.6	70.4	75.4	73.1
Small.....	94.1	82.7	97.7	91.5	74.3	70.5	75.3	73.4
<b>50 pounds per acre in drill</b>								
Number 1's								
Large.....	--	--	--	--	--	71.2	75.7	73.4
Small-Medium	--	--	--	--	--	72.2	75.7	73.9
Pegs								
Small.....	--	--	--	--	--	71.1	74.9	73.0
L.S.D. at .05	4.7	4.4	4.3	2.6	1.3	1.1	1.3	0.8 (0.8) <sup>1</sup>
L.S.D. at .01	6.4	6.1	5.8	3.5	1.8	1.5	1.7	1.0 (1.1)

<sup>1</sup> L.S.D. for 2-year averages within parentheses.

TABLE 6. PROPORTION SOUND MATURE KERNELS AND SEED COUNT PER OUNCE FROM SHELL POD SAMPLES TAKEN FROM PEANUT SEED SIZE TESTS, 1959-1961

Seed class	Proportion sound mature kernels <sup>1</sup>				Seed count per ounce			
	1959	1960	1961	Av.	1959	1960	1961	Av.
	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>No.</i>	<i>No.</i>	<i>No.</i>	<i>No.</i>
<b>6-inch drill spacing</b>								
Number 1's								
Large.....	93.1	88.5	86.8	89.9	62	63	53	59
Medium.....	92.4	86.8	87.4	89.2	62	66	53	60
Small.....	92.7	86.8	87.9	89.2	61	66	53	61
Pegs								
Medium.....	91.6	86.5	84.7	88.0	63	65	54	61
Small.....	92.7	86.4	86.6	89.0	64	65	54	61
<b>50 pounds per acre</b>								
Number 1's								
Large.....	---	86.3	87.7	87.0	---	65	53	59
Small-Medium	---	89.5	88.7	89.1	---	64	52	58
Pegs								
Small.....	---	87.3	85.6	86.5	---	63	53	58
L.S.D. at .05	1.8	2.2	1.7	0.9 (1.4) <sup>2</sup>	2.5	3.0	1.7	1.4 (1.8)
L.S.D. at .01	2.5	2.9	2.2	1.2 (1.9)	3.4	4.0	2.3	1.8 (2.3)

<sup>1</sup> Proportion of seed riding 15/64-inch screen in 1959; 16/64-inch screen in 1960 and 1961.

<sup>2</sup> L.S.D. for 2-year averages within parentheses.

Three-year averages of the proportion of sound, mature kernels from field plantings produced by the No. 1 seed size classes in the 6-inch drill spacing were greater than those from medium "pegs." Only the large No. 1 seed class produced a significantly greater proportion of sound, mature kernels than small "pegs."

Data on seed count per ounce indicate that mature shelled peanuts produced from large No. 1 seed were slightly larger than those produced from small No. 1 or medium "pegs." As indicated, these larger seed were from one of the larger seed size treatments that produced vigorous plants. The larger seed probably resulted from greater food storage in the cotyledons when produced on more vigorous plants. If seed stock used consisted of a mixture of genetic seed sizes, continued selection of the larger seed for several generations would likely screen out genetically larger peanut seed that would breed true for large seed size.

## SUMMARY

Experiments in the greenhouse at the Auburn Agricultural Experiment Station in 1958 and in the field at the Wiregrass Substation in 1959, 1960, and 1961 were conducted to determine vigor and yield differences between peanut plants grown from various seed size classes. The results are summarized as follows:

1. Peanut seedlings grown from No. 1 seed emerged earlier and grew off faster than seedlings from small or medium "peg" seed. This greater vigor was evident throughout the season.

2. No. 1 seed resulted in higher pod yields than small "peg" seed in both 6-inch drilled plantings and in 50 pounds per acre plantings. Small and medium No. 1 seed produced 214 pounds per acre more than small "pegs" in spaced plantings and 194 pounds per acre more in drilled plantings. Two hundred fourteen pounds of pods at 11 cents per pound would be \$23. In 1961, the average increase of 387 pounds per acre of pods from small and medium No. 1 seed over small "pegs" would be valued at \$42.

3. Only well-developed No. 1 peanut seed are recommended for planting in Alabama. Such seed favor rapid emergence, vigorous early growth, less difficulty in controlling weeds, and usually result in appreciably higher yields than smaller seed.



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