



DETERMINATION OF PEANUT SEED QUALITY FROM
STANDARD GERMINATION TEST

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CHAPTER I

INTRODUCTION

In the United States, the peanut (Arachis hypogaea L.) crop is usually planted in spring as climatic conditions will allow. In Oklahoma, dates vary between May 15 to July 1. These dates are desirable from the standpoint of lessening the risk of injury to the crop through early frost in the fall.

However, even though peanuts are seeded at the recommended time under favorable temperature and moisture conditions, planting may be followed by a few days of relatively cool weather, or a combination of cool weather and rain. Such weather ordinarily delays the germination and/or emergence of peanut seeds and in many cases results in a marked decrease in total field stand.

It also has been evident that all seed lots are not influenced in the same way by unfavorable field weather conditions. Some appear to germinate well after exposure to cold, wet soil, while others having the same initial viability exhibit strongly reduced emergence, even subsequent to seed fungicide treatment measures.

Recent research has shown, however, that certain differences between seed lots can not be detected under favorable conditions. Germination tests utilizing the rolled paper towel method and carried out according to the International Rules for Seed Testing (16) reveal only the percentage of seed that are viable under near-ideal conditions. A

considerable discrepancy may exist between laboratory test and field emergence.

The objective of the present study was to determine whether the actual quality or vigor of peanut seed lots could be predicted from some measurement taken while conducting the standard rolled paper towel germination test.

The information gained may contribute significantly to the economic welfare of both peanut producers and seedsmen by identifying those seed lots that can be expected to give good performance even under adverse field conditions. These benefits may be obtained without significant additional expense in the standard laboratory test procedures.

CHAPTER II

LITERATURE REVIEW

Seed Size

Although the amount of certified peanut seed is more than adequate to plant the present acreage in Oklahoma, it is estimated that 20-25 percent of the acreage is planted with uncertified seed (2).

Seed lots, as harvested, contain seed of widely varying size and quality. Present methods of grading and processing aim to remove the skinned and broken seed, and to ensure that the seed sold are uniform in shape and size for easier and more precise seeding (24).

The wide range of seed size found within a sample will be partly due to variation from plant to plant which results from genetic differences, interplant competition for light, water, nutrients, and/or the effects of pests and diseases (24).

Seed size also varies due to location in the inflorescence which is likely to reflect differences in flowering time or nutrition of developing seeds which may compete with different success for limited supplies of minerals, nutrients, and carbohydrates (24).

Peanut (Arachis hypogaea L.) seeds require a warm-moist light loamy or sandy soil at planting time. The planting of uniformly sized seeds contributes significantly to the development of a uniform plant population (12,19).

Many seedling failures have occurred when unfavorable conditions have developed subsequent to planting. Hot drying winds, unexpectedly low temperatures, or rains that briefly wet the soil surface and cause the soil to crust, are a few conditions. The length of the hypocotyl in the field is related to depth of planting, as is the emergence of the cotyledon above the soil level. When planted too deep the entire food supply from the cotyledons may be exhausted, and by the time the cotyledons reach the soil surface, the young epicotyl emerges pallid and yellow (13,14).

Much research has attended firstly to determine the origin of seed of different sizes on plant within the crop, and secondly the value of different size fractions for subsequent crop production (1,3,6,7,8, 10,12,15,19,21,24).

Increased seed size within a peanut cultivar has been associated with higher total seed protein and amino acid content (19). Rate of emergence, seedling vigor, and young plant size have consistently favored the large seed (1,3,12,15,18,19).

Some of the inferior performance of smaller seed, particularly slower emergence, weaker seedlings, and lower yield has been attributed to immaturity of small seed (1,3,12,15,18,19). The indeterminate fruiting habit of the peanut plant makes it difficult to time harvest properly. During the normal harvest period, the stage of maturity of individual seed varies from very immature and underdeveloped to large, well developed seed (15).

Immature seeds, although capable of germinating, are not as vigorous as mature seeds nor do they maintain viability in storage as well (23). Gelmond (13) also demonstrated that inclusion of such useless

seed will not only lower the percentage of germination but will also tend to produce unproductive abnormal seedlings which will eventually lead to inadequate crop stand, depletion of soil moisture and nutrients, and lower crop yields.

Baskin and Delouche (4) have shown that enzyme activity and respiration increases as the seed size decreases. They also found that the respiratory quotient (RQ) of large seed was indicative of lipid metabolism, whereas the RQ of small seed more nearly approached that of carbohydrate metabolism.

Coffelt, et al.(10) indicated that commercial grade (seed size) affected the proximate components and amino acid content of peanut meal more than variety.. Smaller seed size of some peanut germplasm has been associated with detrimental characters such as albinism. Coffelt and Hammons (9) in one genetic study found that more albinos occurred from the smaller seed classes while fewer albinos were obtained from the large size seed.

Germination Test

Total germination value as determined by the standard germination test may fail to predict field stand with sufficient accuracy. This is usually due to the failure to detect weaknesses which may be present in the seed. Consequently, such tests overestimate the performance that can be expected from a given seed lot, especially when field conditions are less than optimum (11,13,17, 18,20,22).

Even though several tests have been developed, it has been questioned if one test will ever be available that will measure both viability and vigor. For that reason various combinations of the standard

germination test with one or more vigor tests have been proposed and used as indices of relative seed vigor (5,18,20,21,22,25).

Vigor is defined as: the sum total of all attributes which favor stand establishment under unfavorable conditions (11).

The germination of peanut seeds involves imbibition of water, activation of enzymes and cellular processes including digestion of stored food, respiration, production of ethylene and other hormones, synthesis of new cellular products, transport of food and nutrients from cotyledon to the embryonic axis, and expansion of existing cells in the embryo as well as in the newly formed cells of the root and shoot (14).

Woodstock (26) has categorized vigor tests into two types: (1) physiological tests in which some aspect of germination or seedling growth is measured and (2) biochemical tests which measure a chemical reaction or process such as enzymatic activity or respiration which is presumed to be related to the seed germinative capacity.

Physiological tests may be divided into those tests wherein germination occurs under favorable conditions and tests wherein conditions are unfavorable. Tests under favorable conditions involve speed of germination or rate of seedling growth as important factors. The other area of physiological tests for vigor includes those in which seed are germination under unfavorable conditions where one or more aspects of the environment are distinctly unfavorable, i.e., stress test (26).

Biochemical tests may be grouped into four general classes: (1) vital-staining reactions, (2) enzyme activity not measured by staining reactions, (3) coordinated activity at the level of subcellular fractions such as respiratory and biosynthesis processes, and (4) measures of membrane integrity either by leaching or soaking in toxic solutions (26).

CHAPTER III

MATERIALS AND METHODS

The 24 peanut accessions used in this study were taken from cold storage (4°C) at the Agronomy Research Station, Stillwater, Oklahoma. Seed of these peanut accessions were sized into large, medium, and small sizes by passing them successively over perforated screens. Slot widths were $19/64$, $17/64$, and $15/64$ of an inch, while all slots were $3/4$ of an inch in length. The 24 peanut accessions are listed in Table I.

Laboratory evaluation of the 24 peanut accessions was conducted at the Seed Laboratory of the Oklahoma Crop Improvement Association, Stillwater, Oklahoma. A split-plot design with four replications of 50 intact seeds per accession per size were used. The seeds were kept at alternating conditions of 16 hours dark at 20°C and 8 hours light at 30°C for 10 days in a germinator. Standard rolled paper towel test procedures were utilized.

Two counts were made in the rolled towel test. On the first count (5-day), all seedlings which had complete morphological parts without breaks or lesions were noted as strong. Seedlings were classified as weak if the epicotyl was darkened, or if necrosis was observed in the inner cotyledonary tissue. Decayed seeds and abnormal seedlings were removed. Strong and weak seedlings, and ungerminated seeds were allowed to remain.

TABLE I
PEANUT ACCESSIONS USED IN THIS STUDY

Okla. P-No.	Variety or P.I.	100-Seed Weight (GMS)		
		L	M	S
1258	Tifspan (NVT)	44.00	39.60	30.20
3787	EM-12	50.23	41.70	30.70
1259	Spanscross	43.93	37.05	26.93
1746	Starr Sel.	47.70	41.28	30.70
3145	New Mex. Val. A	51.00	45.70	34.60
3772	G-169	47.53	39.95	29.18
2398	Chico	46.50	39.60	30.90
2379	268689 Sel.	52.70	41.70	34.50
1446	234416 Sel.	50.20	41.00	30.40
3778	EM-3	53.60	43.00	32.00
0006	Starr	44.40	38.50	33.00
1765	268689	48.30	38.50	30.90
3776	EM-1	54.50	43.90	34.20
3782	EM-7	48.40	41.30	34.20
0425	268759	43.10	38.80	31.40
3770	Starr Colch.	50.40	38.50	34.50
0112	Spanhoma	47.20	38.90	30.30
1779	331317	44.50	39.60	31.60
3775	Argentine Sel.	51.00	42.80	31.20
3774	Spanhoma Sel.	43.30	38.60	28.90
3773	O/L Sel. 72-201	66.00	40.30	32.30
1258	Tifspan (LSS)	43.05	37.05	26.93
0559	240555	41.60	37.70	29.90
3771	White Krinkle	46.00	38.90	29.00

On the final count (10-day), all remaining seedlings were classified as normal or abnormal as specified in the International Rules for Seed Testing (16). The normal seedlings were further classified into strong or weak based on the following criteria for weak seedlings:

Root - primary root cracked or split with a set of secondary roots or adventitious roots sufficient to anchor the seedling when grown in soil.

Hypocotyl - minor breaks, lesions, necrosis, twisting or curling which might interfere with conducting tissues, not due to test conditions.

Cotyledon - one cotyledon missing, not caused by test conditions.

Epicotyl - partial decay, or primary leaf missing.

Six different peanut accessions with three seed sizes each were evaluated during each laboratory germination run.

Peanut cold tests were conducted at the Controlled Environment Research Laboratory (CERL), Stillwater. Two Sherer Model W-200 chest-type growth chambers were used for this study. Air circulation was provided by four fans in each chamber. Each chamber contained primarily incandescent light which produced approximately 17,000 luxes at the bottom of the chambers. Both chambers were kept at alternating conditions of 16 hours dark and 8 hours light.

One chamber was set at 10°C for five days to give the seeds severe cold stress and then set at 25°C for nine days. The other chamber was set at a constant temperature of 25°C for 14 days. This served as a check for the seed quality of the specific seed lots being used for the peanut accessions.

Three different peanut accessions with three seed sizes each were evaluated in the same growth chamber at the same time constituting one run. Each growth chamber had the capacity for nine plastic flats, which were 5.50 cm deep and 1417.75 cm². Each flat was planted with four equally-spaced rows in a mixture of three parts sandy soil:one part peat moss. Each row received 25 Granox-treated seeds per accession per seed size. A randomized complete block design was used. The flats were watered when the medium appeared to be dry during each run. At the end of the 14 days, the seedlings were removed and classified into the same categories as in the laboratory germination test.

The analyses of the data obtained in this research were made by using the Statistical Analysis System (SAS) at the Oklahoma State University Computer Center.

CHAPTER IV

RESULTS AND DISCUSSION

Laboratory Germination Tests

First Laboratory Germination Run

The numbers of strong seedlings from three seed sizes each of six peanut accessions counted at 5- and 10-days in the first laboratory germination run are given in Table II. Large, medium, and small seed sizes germinated differently at the 5-day count. P-1746 had the lowest number of strong seedlings in each of the three seed sizes (8.50, 8.50, and 10.50), while P-3145 had the highest numbers (44.75, 46.75, and 41.25). At the 10-day count there was an increase in strong seedlings for the three seed sizes in all peanut accessions except for P-1746 which had a decrease for the large and small seed sizes, P-1258 which had a decrease for the medium seed size, and P-3787 which had a decrease in all three seed sizes. The medium seed size had the highest numbers of strong seedlings in each of the six peanut accessions at the 10-day count except for P-1258 and P-3772 where the largest numbers were obtained from the large seed size. The analysis of variance (Table III) shows a highly significant mean square for the A x SS x D interaction.

Statistical analysis for weak seedlings is also shown in Table III. The A x SS x D interaction was again significant at the 0.01 level of probability. Deterioration is manifested most clearly in the number of weak seedlings as shown in Table II. The numbers of weak seedlings for each of the three seed sizes in all six peanut accessions were higher

TABLE II

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
SIX PEANUT ACCESSIONS COUNTED AT
5- AND 10-DAYS IN THE FIRST
LABORATORY GERMINATION RUN

Okla. P-No.	Seed Size ^{1/}	Seedling Counts					
		Strong		Weak		Tot. Normal	
		5-Day	10-Day	5-Day	10-Day	5-Day	10-Day
1258(NVT)	L	21.75 ^{2/}	30.75	16.25	4.50	38.00	35.25
	M	30.75	30.25	14.25	6.25	45.00	36.50
	S	22.00	23.75	11.00	3.25	33.00	27.00
1259	L	31.50	35.75	16.75	3.75	48.25	39.50
	M	36.75	38.75	11.00	3.75	47.75	42.50
	S	26.25	32.75	18.00	5.50	44.25	38.25
1746	L	8.50	7.25	17.50	8.75	26.00	16.00
	M	8.50	10.00	27.50	5.75	36.00	15.75
	S	10.50	9.00	19.75	7.50	30.25	16.50
3145	L	44.75	47.25	5.25	1.50	50.00	48.75
	M	46.75	49.50	3.50	0.25	50.00	49.75
	S	41.25	45.50	8.75	3.00	50.00	48.50
3772	L	22.00	27.75	24.50	5.75	46.50	33.50
	M	27.75	25.75	21.25	7.25	44.00	33.00
	S	15.50	19.75	22.50	6.00	38.00	25.75
3787	L	15.75	10.00	5.00	1.50	20.75	11.50
	M	24.00	19.00	11.25	3.00	35.25	22.00
	S	15.00	14.50	14.25	5.50	29.25	20.00
1258(NVT)		24.83 ^{3/}	28.25	13.83	4.66	38.66	32.91
1259		31.50	35.75	15.25	4.33	46.75	40.08
1746		9.16	8.75	21.58	7.33	30.75	16.08
3145		44.16	47.41	5.83	1.58	50.00	49.00
3772		20.08	24.41	22.75	6.33	42.83	30.75
3787		18.25	14.50	10.66	3.33	28.41	17.83
	L	24.08 ^{4/}	26.45	14.20	4.29	38.25	30.75
	M	28.20	28.87	14.79	4.37	43.00	33.25
	S	21.75	24.20	15.70	5.12	37.45	29.33
Grand Means		24.66 ^{5/}	26.51	14.90	4.59	39.56	31.11

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 4 observations.

^{3/} Each value is the mean of 12 observations.

^{4/} Each value is the mean of 24 observations.

^{5/} Each value is the mean of 72 observations.

TABLE III
 ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
 NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
 OF SIX PEANUT ACCESSIONS COUNTED AT
 5- AND 10-DAYS IN THE FIRST
 LABORATORY GERMINATION RUN

Source	d. f.	Seedling Mean Square		
		Strong	Weak	Tot. Normal
Total	143	161.83	58.74	187.81
Rep	3	18.54	38.85	15.49
Accession(A)	5	4062.04**	436.23**	2665.22**
Seed Size(SS)	2	375.46**	17.33	293.80**
A x SS	10	44.36**	40.27**	99.35**
Error a	51	13.45	10.21	16.28
Day(D)	1	122.84**	3823.36**	2575.56**
A x D	5	63.41**	123.96**	146.85**
SS x D	2	12.55	1.44	16.19
A x SS x D	10	14.79**	30.19**	14.92*
Error b	54	5.22	7.35	6.13

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

at the 5-day count with a decrease at the 10-day count. The large and small sizes had the largest decrease in all peanut accessions except for P-1746 and P-3787 where the largest decrease was obtained from the medium and small sizes, and P-1258 which had the largest decrease from the large and small seed sizes (Table II).

Statistical analysis for total normal seedlings is also shown in Table III. The A x SS x D interaction was significant at the 0.05 level of probability. There was a decrease in total normal seedlings in all peanut accessions for each of the three seed sizes when counted at 10-days, however, P-3145 had only slightly less than initial for all three seed sizes. The major decreases were observed in peanut accessions which had the higher numbers of weak seedlings at the 5-day count (Table II).

Second Laboratory Germination Run

Table IV shows the mean numbers of strong, weak, and total normal seedlings from three seed sizes each of six peanut accessions in the second laboratory germination run. The analysis of variance for strong seedlings indicates that the A x SS interaction was significant at the 0.01 level of probability (Table V). The average of strong seedlings over the 5- and 10-day counts was slightly higher for the medium seed size in three of the accessions, however, P-0006 and P-1765 had the largest number of strong seedlings from the large seed size while P-3778 had slightly more from the small seed size (Table VI, Figure 1).

The A x D interaction was also significant at the 0.01 level of probability (Table V). There was an increase in the numbers of strong seedlings from the 5- to the 10-day count for all six peanut accessions

TABLE IV
 MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
 SEEDLINGS FROM THREE SEED SIZES EACH OF
 SIX PEANUT ACCESSIONS COUNTED AT
 5- AND 10-DAYS IN THE SECOND
 LABORATORY GERMINATION RUN

Okla. P-No.	Seed Size ^{1/}	Seedling Counts					
		Strong		Weak		Tot. Normal	
		5-Day	10-Day	5-Day	10-Day	5-Day	10-Day
0006	L	22.50 ^{2/}	30.00	19.75	5.00	42.25	35.00
	M	21.00	29.50	21.00	4.25	42.00	33.75
	S	12.25	24.25	22.25	1.50	34.50	25.75
1446	L	39.75	38.75	6.25	2.00	46.00	40.75
	M	44.25	45.50	5.00	2.00	49.25	47.50
	S	40.50	44.25	7.75	3.50	48.25	47.75
1765	L	16.25	21.00	21.75	6.25	38.00	27.25
	M	13.25	19.25	22.75	6.00	36.00	25.25
	S	11.50	16.25	18.75	3.75	30.25	20.00
2379	L	15.75	19.75	20.75	7.25	36.50	27.00
	M	18.00	24.00	22.50	7.50	40.50	31.50
	S	14.50	20.25	19.00	3.00	33.50	23.25
2398	L	44.00	45.50	3.25	1.50	47.25	47.00
	M	47.25	49.25	2.75	0.50	50.00	49.75
	S	48.25	45.50	1.75	1.75	50.00	47.25
3778	L	34.75	37.75	13.00	2.75	47.75	40.50
	M	33.75	39.25	13.50	3.00	47.25	42.25
	S	34.75	38.50	12.25	5.25	47.00	43.75
0006		18.58 ^{3/}	27.92	21.00	3.58	39.58	31.50
1446		41.50	42.82	6.33	2.50	47.83	45.33
1765		13.67	18.83	21.08	5.33	34.75	24.16
2379		16.08	21.33	20.75	5.92	36.83	27.25
2398		46.50	46.75	2.58	1.25	49.08	48.00
3778		34.42	38.50	12.92	3.67	47.34	42.17
	L	28.83 ^{4/}	32.13	14.13	4.13	42.96	36.26
	M	29.58	34.46	14.58	3.88	44.16	38.34
	S	26.96	31.50	13.63	3.13	40.59	34.63
Grand Means		28.46 ^{5/}	32.69	14.11	3.71	42.57	36.40

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 4 observations.

^{3/} Each value is the mean of 12 observations.

^{4/} Each value is the mean of 24 observations.

^{5/} Each value is the mean of 72 observations.

TABLE V

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
OF SIX PEANUT ACCESSIONS COUNTED AT
5- AND 10-DAYS IN THE SECOND
LABORATORY GERMINATION RUN

Source	d. f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	143	163.50	63.38	86.18
Rep	3	81.41	15.10	50.23
Accession(A)	5	3966.07**	570.99**	1591.76**
Seed Size(SS)	2	93.86*	10.42	160.01**
A x SS	10	44.75**	12.22	69.99**
Error a	51	21.63	0.10	21.19
Day(D)	1	646.05**	2895.84**	1369.00**
A x D	5	62.67**	269.99**	90.17**
SS x D	2	8.36*	1.59	2.69
A x SS x D	10	6.89	6.65	4.75
Error b	54	7.03	9.78	5.02

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE VI

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
SIX PEANUT ACCESSIONS IN THE SECOND
LABORATORY GERMINATION RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
0006	L	26.25 ^{2/}	12.38	38.63
	M	25.25	12.63	37.88
	S	18.25	11.88	30.13
1446	L	39.25	4.13	43.38
	M	44.88	3.50	48.38
	S	42.38	5.63	48.00
1765	L	18.63	14.00	32.63
	M	16.25	14.38	30.63
	S	13.88	11.25	25.13
2379	L	17.75	14.00	31.75
	M	21.00	15.00	36.00
	S	17.38	11.00	28.38
2398	L	44.75	2.38	47.13
	M	48.25	1.63	49.88
	S	46.88	1.75	48.63
3778	L	36.25	7.88	44.13
	M	36.50	8.25	44.75
	S	36.63	8.75	45.38
0006		23.25 ^{3/}	12.29	35.54
1446		42.17	4.42	46.59
1765		16.25	13.21	29.46
2379		18.71	13.33	32.04
2398		46.63	1.92	48.55
3778		36.46	8.29	44.75
	L	30.48 ^{4/}	9.13	39.61
	M	32.02	9.23	41.25
	S	29.23	8.38	37.61
Grand Means		30.58 ^{5/}	8.91	39.49

^{1/} L=large - ride 19/64-inch screen.
M=medium - pass through 19/64 and ride 17/64-
inch screen.
S=small - pass through 17/64 and ride 15/64-
inch screen.

All screens were 3/4-inch slotted screens.

Dimensions shown above are slot widths.

^{2/} Each value is the mean of 8 observations.
^{3/} Each value is the mean of 24 observations.
^{4/} Each value is the mean of 48 observations.
^{5/} Each value is the mean of 144 observations.

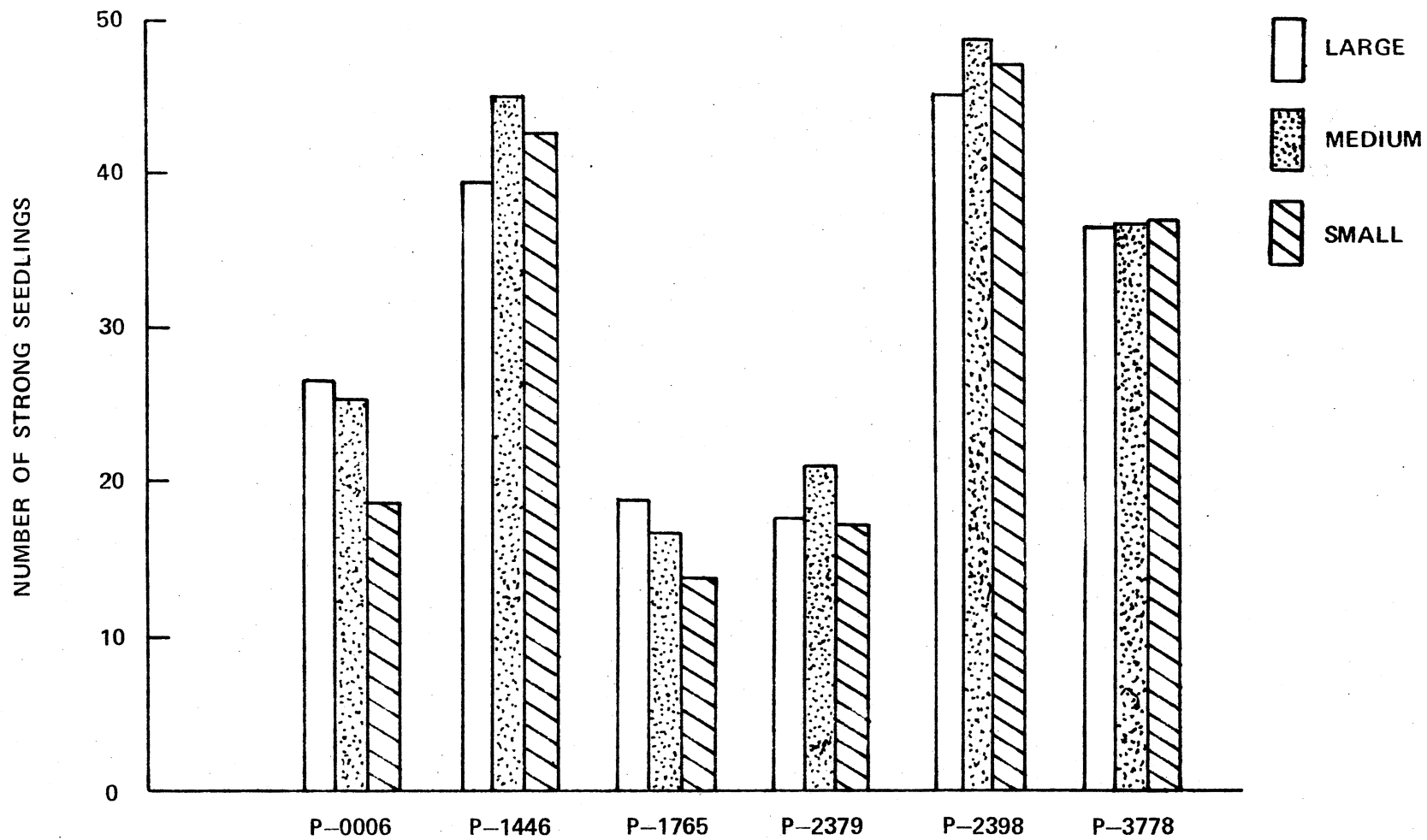


Figure 1. Number of Strong Seedlings from Three Seed Sizes Each of Six Peanut Accessions in the Second Laboratory Germination Run.

when averaged over seed size. This increase was higher for P-0006 and P-2379 (9.34 and 5.25, respectively). The lowest increase was obtained from P-2398 and P-1446 (0.25 and 1.32, respectively), which had the highest numbers of strong seedlings at the 5-day count (Table IV, Figure 2).

The SS x D interaction was significant at the 0.05 level of probability as shown in Table V. The numbers of strong seedlings were higher at the 10-day count for each of the three seed sizes when averaged over the six accessions (Table IV, Figure 3). The highest numbers of strong seedlings resulted from the medium seed size.

Statistical analysis for weak seedlings indicates highly significant mean squares for accessions, days, and the A x D interaction, as shown in Table V. There was a decrease in the number of weak seedlings from the 5- to 10-day count. This was more evident in the peanut accessions that had the highest numbers of weak seedlings at the 5-day count (Table IV, Figure 4).

Statistical analysis of total normal seedlings was also given in Table V. The A x SS interaction was highly significant. The medium seed size germinated better than the large and small seed sizes except for P-0006 and P-1765, where the large seed size had the largest number of total normal seedlings, and P-3778 where the largest number of normal seedlings was produced from the small seed (Table VI, Figure 5).

The A x D interaction was also highly significant as shown in Table V. The numbers of total normal seedlings of each of the six peanut accessions averaged over the three seed sizes decreased at the

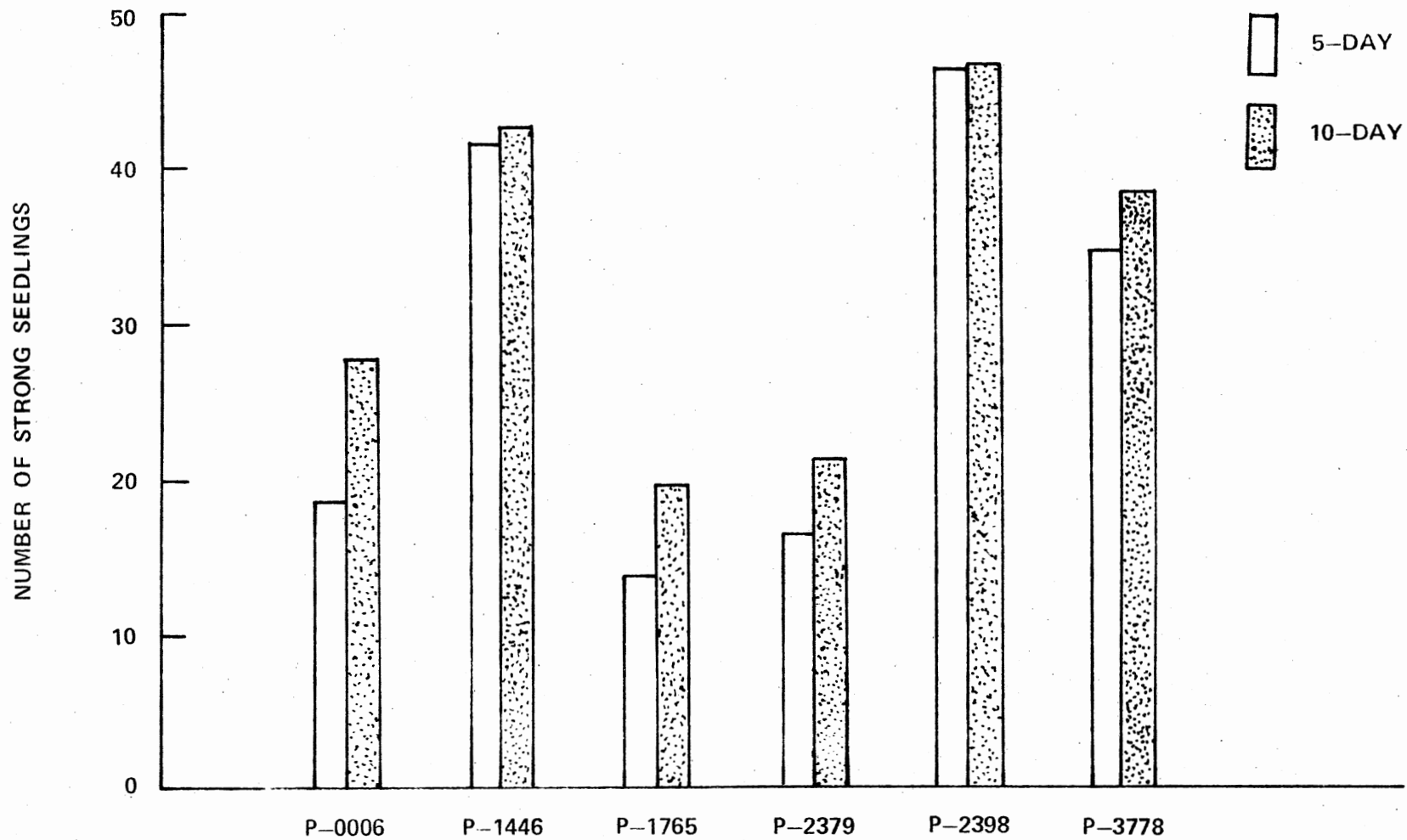


Figure 2. Number of Strong Seedlings from Six Peanut Accessions Counted at 5- and 10-Days in the Second Laboratory Germination Run.

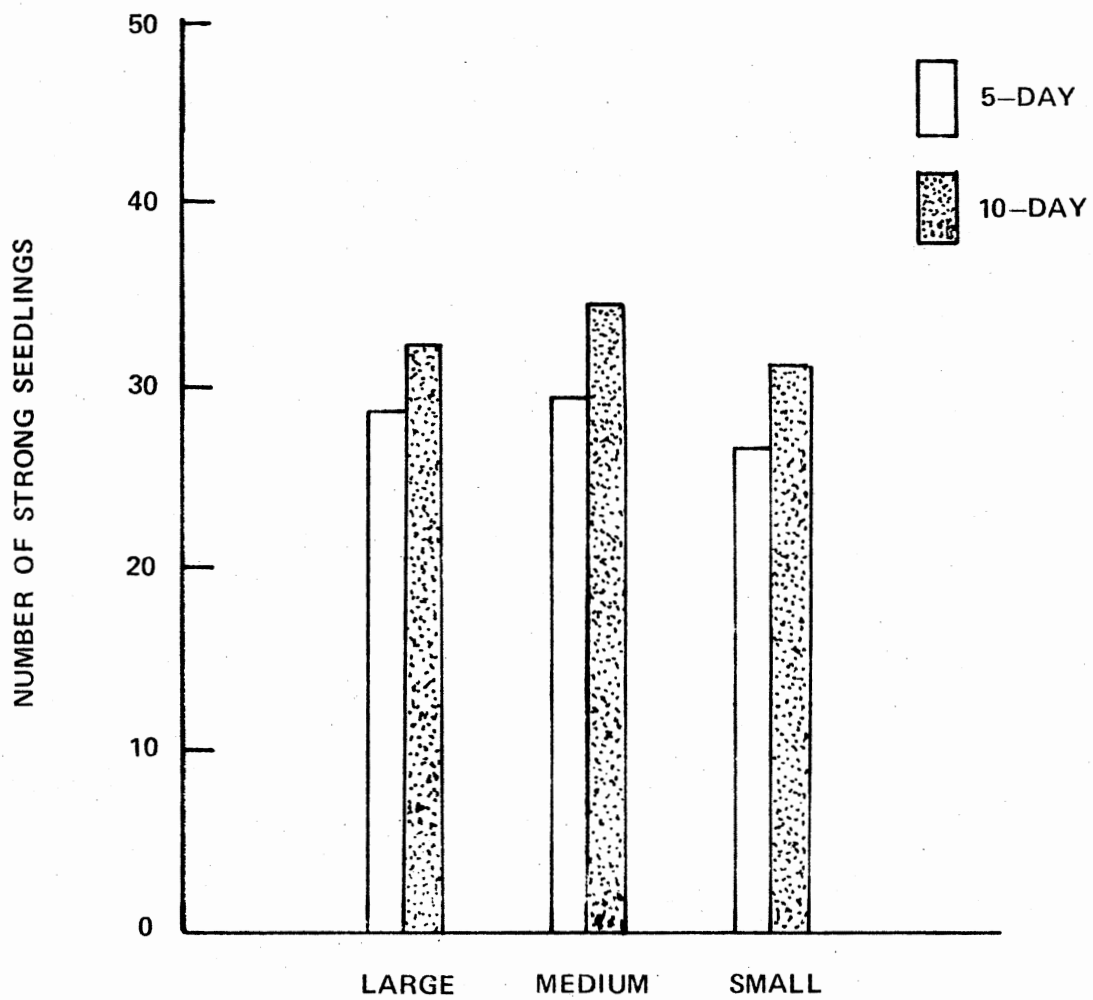


Figure 3. Number of Strong Seedlings from Three Seed Sizes Counted at 5- and 10-Days in the Second Laboratory Germination Run.

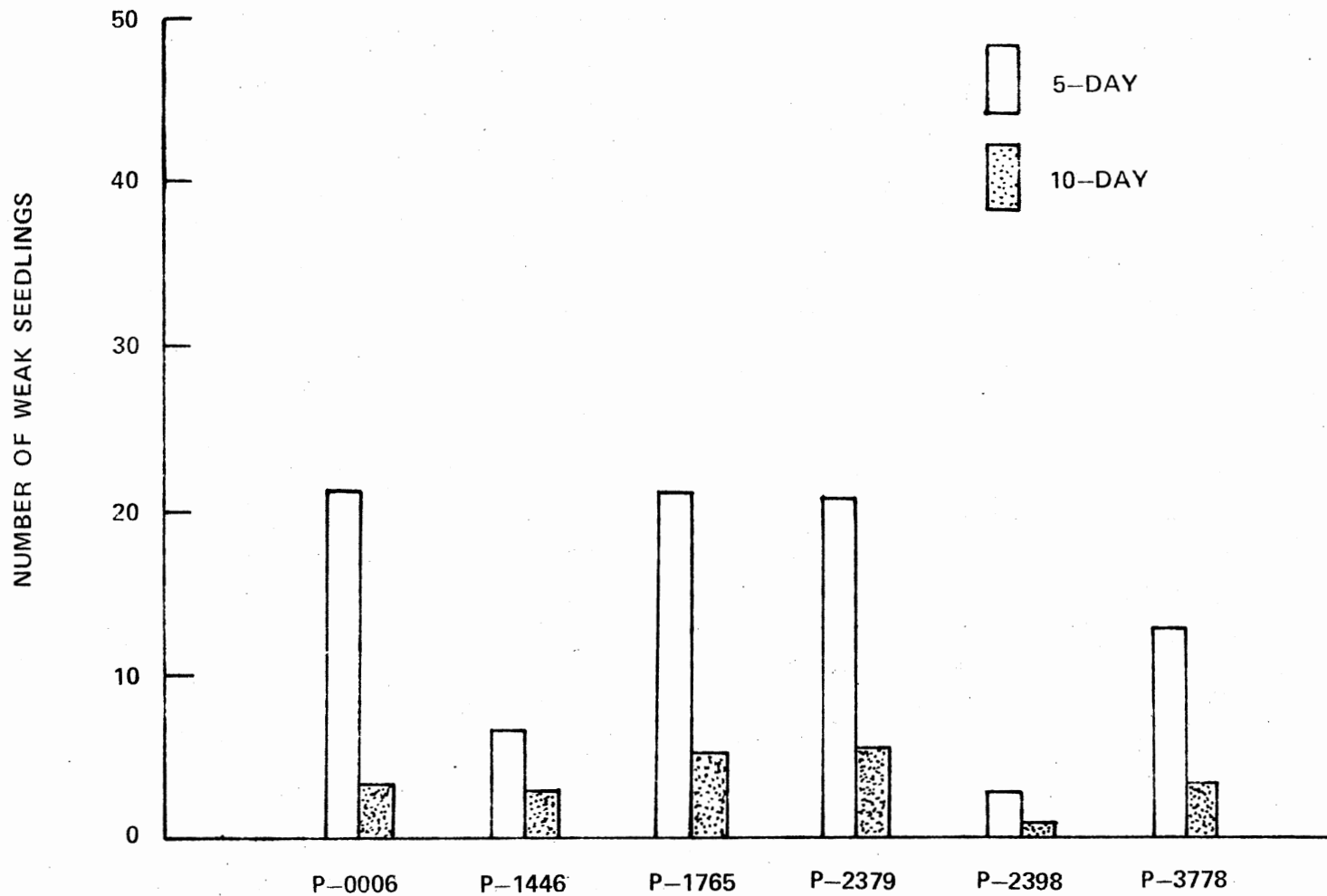


Figure 4. Number of Weak Seedlings from Six Peanut Accessions Counted at 5- and 10-Days in the Second Laboratory Germination Run.

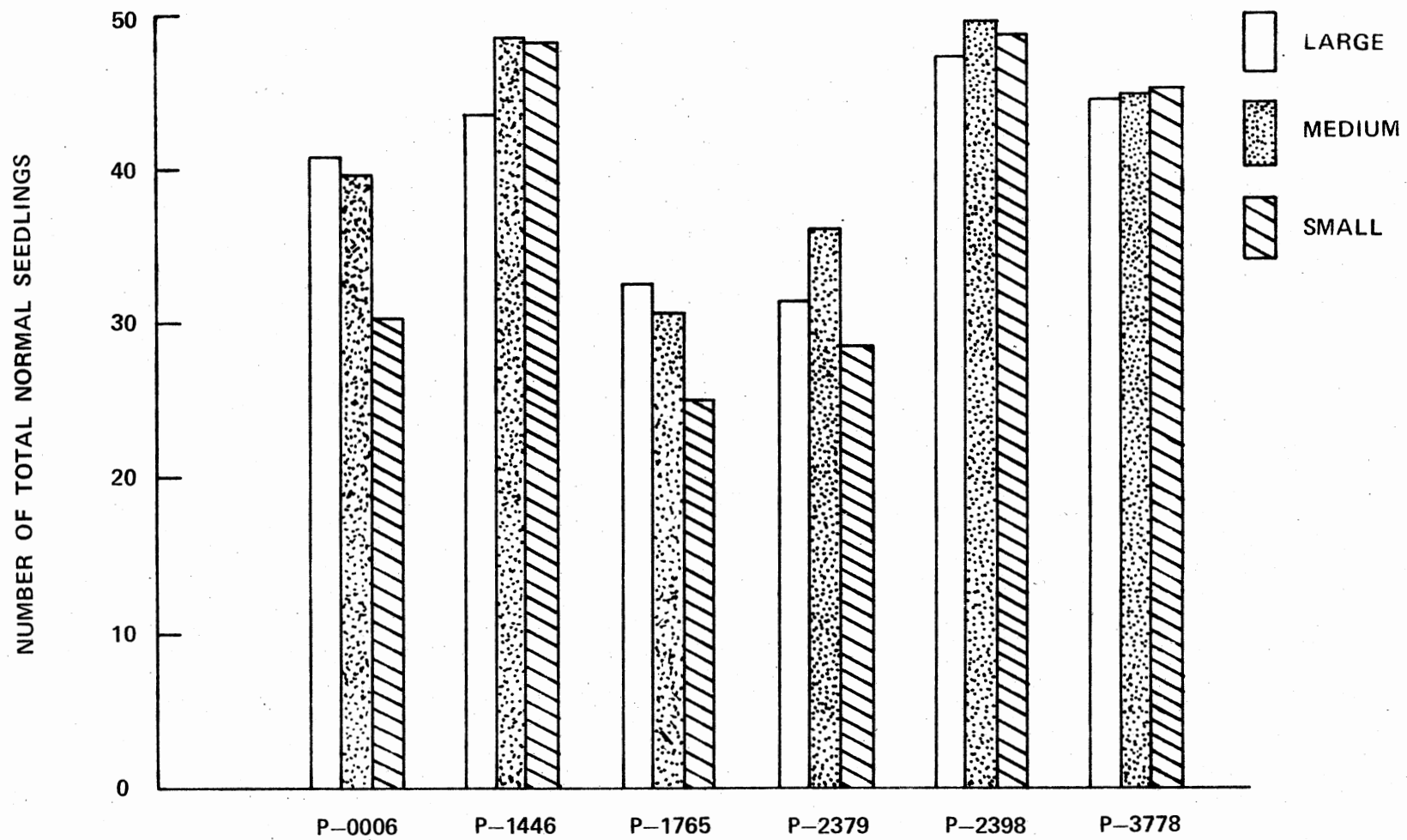


Figure 5. Number of Total Normal Seedlings from Three Seed Sizes Each of Six Peanut Accessions in the Second Laboratory Germination Run.

10-day count. These decreases were higher for the peanut accessions that had the higher numbers of weak seedlings at the 5-day count (Table IV, Figure 6).

Third Laboratory Germination Run

The mean numbers of strong, weak, and total normal seedlings from three seed sizes each of six peanut accessions, counted at 5- and 10-days in the third laboratory germination run, are shown in Table VII. Statistical analyses for seedlings produced in run three are shown in Table VIII. The A x SS interaction in the analysis of strong seedlings was significant at the 0.05 level of probability. Large, medium, and small seed germinated differently in each of the six peanut accessions (Table IX, Figure 7).

The A x D interaction was highly significant as shown in Table VIII. P-3782, which had the highest number of strong seedlings at the 5-day count, also had the highest number of strong seedlings at the 10-day count. P-0425, which had the lowest number of strong seedlings at the 5-day count, also had the lowest number at the 10-day count (Table VII, Figure 8). In fact, all six accessions maintained their relative ranking at the 5- and 10-day counts. However, some accessions increased more than others from the 5- to the 10-day count and P-0112 actually decreased slightly at the second count.

Statistical analysis for weak seedlings indicated that the A x D interaction was again highly significant (Table VIII). There was a drastic reduction in the number of weak seedlings for each of the six peanut accessions at the 10-day count, except for P-0112 and P-3782

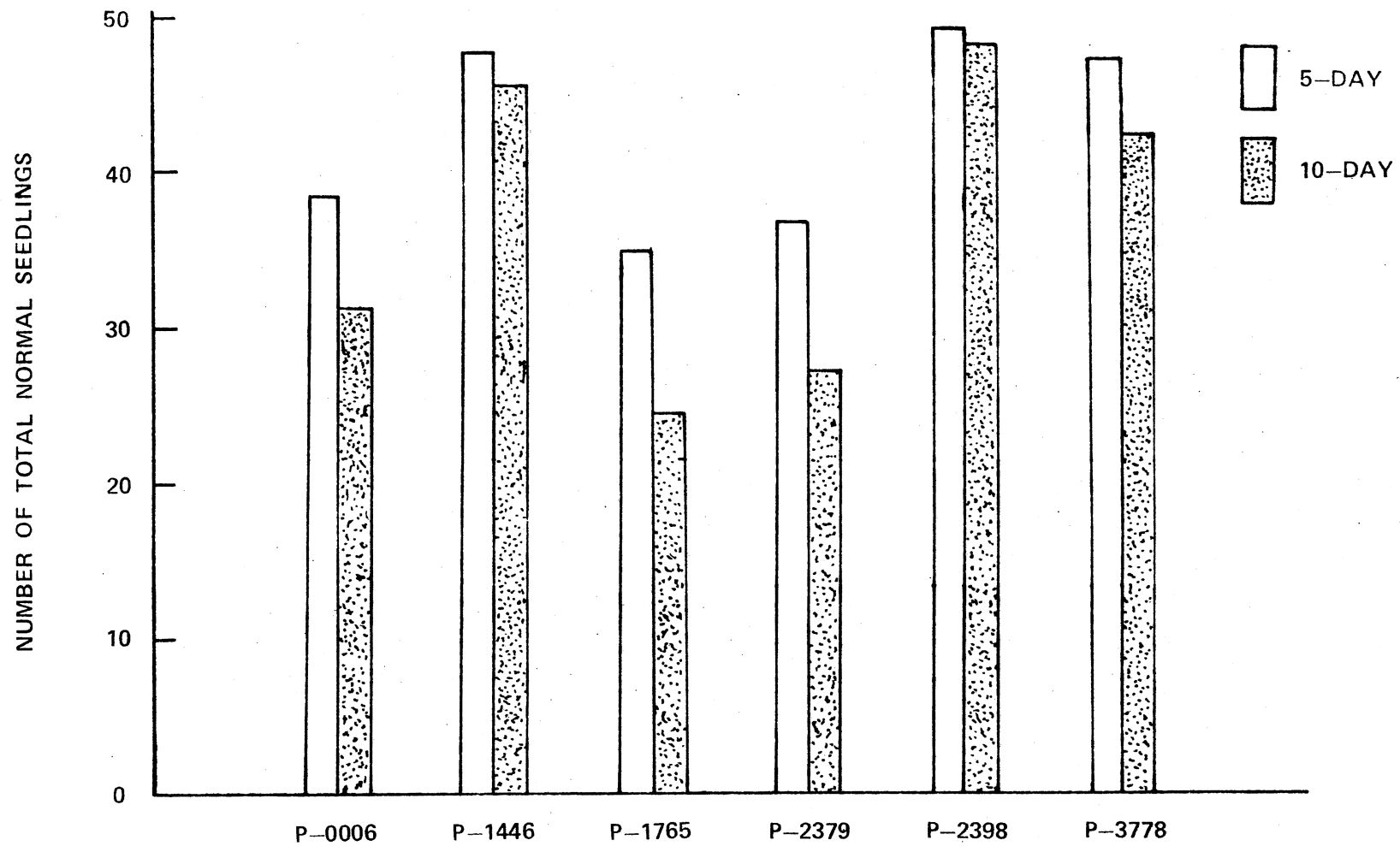


Figure 6. Number of Total Normal Seedlings from Six Peanut Accessions Counted at 5- and 10-Days in the Second Laboratory Germination Run.

TABLE VII

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
SIX PEANUT ACCESSIONS COUNTED AT
5- AND 10-DAYS IN THE THIRD
LABORATORY GERMINATION RUN

Okla. P-No.	Seed ₁ / Size	Seedling Counts					
		Strong		Weak		Tot. Normal	
		5-Day	10-Day	5-Day	10-Day	5-Day	10-Day
0112	L	43.00 ^{2/}	40.75	5.75	5.25	48.75	46.00
	M	44.25	42.50	5.00	4.25	49.25	46.75
	S	42.00	44.25	4.25	1.75	46.25	46.00
0425	L	10.50	10.25	12.25	4.00	22.75	14.25
	M	15.25	15.75	24.25	5.75	39.50	21.50
	S	14.50	18.50	18.50	4.75	33.00	23.00
1779	L	30.00	31.25	11.75	2.50	41.75	33.75
	M	27.25	27.50	16.75	6.25	44.00	33.75
	S	23.75	26.50	18.75	2.50	42.50	29.00
3770	L	18.50	21.75	25.75	5.00	44.25	26.75
	M	16.00	21.50	25.75	8.00	41.75	29.50
	S	17.00	22.00	20.25	4.50	37.25	26.50
3776	L	22.25	22.50	20.75	4.25	43.00	26.75
	M	27.00	31.00	19.50	3.75	46.50	34.75
	S	21.75	25.00	17.75	5.00	39.50	30.00
3782	L	44.75	45.00	3.25	2.75	48.00	47.75
	M	47.00	47.25	3.00	2.75	50.00	50.00
	S	47.25	48.50	2.75	1.50	50.00	50.00
0112		43.08 ^{3/}	42.50	5.00	3.75	48.08	46.25
0425		13.42	14.75	18.33	4.83	31.75	19.58
1779		27.00	28.42	15.75	3.75	42.75	32.17
3770		17.17	21.75	23.92	5.83	41.09	27.58
3776		23.67	26.17	19.33	4.33	43.00	30.50
3782		46.33	46.92	3.00	2.33	49.33	49.25
	L	28.17 ^{4/}	28.58	13.25	3.96	41.42	32.54
	M	29.46	30.92	15.71	5.13	45.17	36.05
	S	27.71	30.75	13.71	3.33	41.42	34.08
Grand Means		28.44 ^{5/}	30.08	14.22	4.14	42.66	34.22

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown
above are slot widths.

^{2/} Each value is the mean of 4 observations.

^{3/} Each value is the mean of 12 observations.

^{4/} Each value is the mean of 24 observations.

^{5/} Each value is the mean of 72 observations.

TABLE VIII

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
OF SIX PEANUT ACCESSIONS COUNTED AT
5- AND 10-DAYS IN THE THIRD
LABORATORY GERMINATION RUN

Source	d.f.	Seedling Mean Square		
		Strong	Weak	Tot. Normal
Total	143	159.83	69.93	110.53
Rep	3	55.68	5.94	28.09
Accession(A)	5	3995.16**	533.21**	1813.23**
Seed Sizes(SS)	2	38.27*	55.09*	175.05**
A x SS	10	47.25*	28.37	62.28*
Error a	51	29.50	15.48	24.59
Day(D)	1	96.69**	3660.25**	2567.11**
A x D	5	18.73**	324.27**	208.86**
SS x D	2	20.97	5.77	11.30
A x SS x D	10	2.95	19.64	21.75*
Error b	54	7.32	11.90	10.68

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE IX

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
SIX PEANUT ACCESSIONS IN THE THIRD
LABORATORY GERMINATION RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
0112	L	41.86 ^{2/}	5.50	47.38
	M	43.38	4.63	48.01
	S	43.13	3.00	46.13
0425	L	10.38	8.13	18.51
	M	15.50	15.50	30.00
	S	16.38	11.63	28.01
1779	L	30.63	7.13	37.76
	M	27.38	11.50	38.88
	S	25.13	10.63	35.76
3770	L	20.13	15.38	35.51
	M	18.75	16.38	35.63
	S	19.50	12.38	31.88
3776	L	22.38	12.50	34.88
	M	29.00	11.63	40.63
	S	23.38	11.38	34.76
3782	L	44.88	3.00	47.88
	M	47.12	2.88	50.00
	S	47.88	2.12	50.00
0112		42.79 ^{3/}	4.38	47.17
0425		14.08	11.58	25.66
1779		27.71	9.75	37.46
3770		19.46	14.88	34.34
3776		24.92	11.83	36.75
3782		46.63	2.67	49.30
	L	28.38 ^{4/}	8.60	36.98
	M	30.19	10.41	40.60
	S	29.23	8.52	37.75
Grand Means		29.26 ^{5/}	9.18	38.44

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens.

Dimensions shown above are slot widths.

^{2/} Each value is the mean of 8 observations.

^{3/} Each value is the mean of 24 observations.

^{4/} Each value is the mean of 48 observations.

^{5/} Each value is the mean of 144 observations.

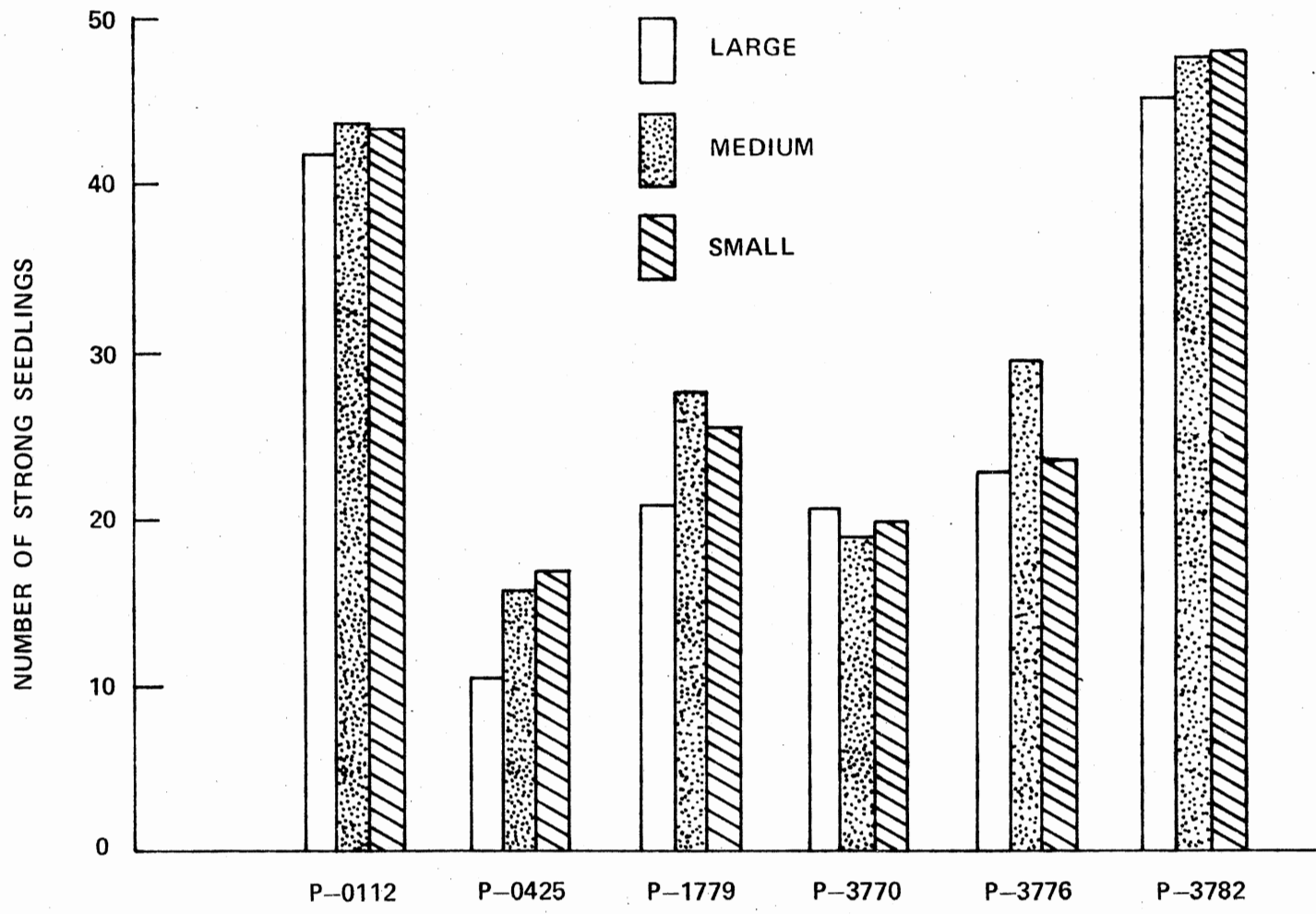


Figure 7. Number of Strong Seedlings from Three Seed Sizes Each of Six Peanut Accessions in the Third Laboratory Germination Run.

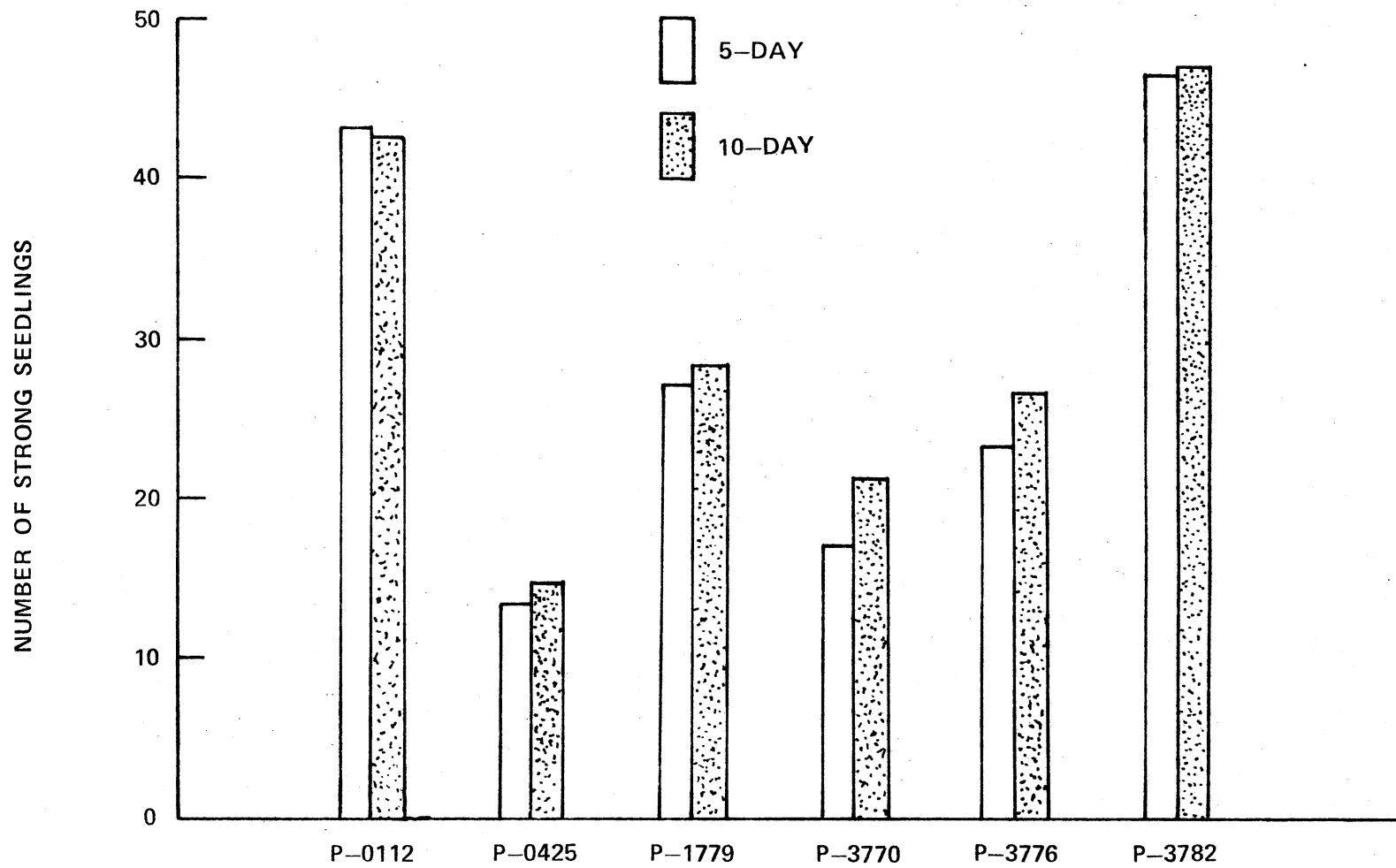


Figure 8. Number of Strong Seedlings from Six Peanut Accessions Counted at 5- and 10-Days in the Third Laboratory Germination Run.

which had considerably fewer weak seedlings at the 5-day count than did the other four accessions (Table VII, Figure 9).

The analysis of variance for total normal seedlings indicated that the A x SS x D interaction was significant at the 0.05 level of probability (Table VIII). The total normal seedlings decreased for each of the three seed sizes of each of the six peanut accessions at the 10-day count. This decrease was more pronounced for the four accessions with more weak seedlings at the 5-day count for each of the three seed sizes (Table VII).

Fourth Laboratory Germination Run

Table X shows the mean numbers of strong, weak, and total normal seedlings from three seed sizes each of six peanut accessions counted at 5- and 10-days in the fourth laboratory germination run.

The analysis of variance for strong seedlings indicated that the A x SS x D interaction was significant at the 0.05 level of probability (Table XI). Large, medium, and small seed germinated differently at the 5-day count in each of the six peanut accessions, with the medium seed size having the largest number of strong seedlings for all accessions (Table X).

Seed size differences were also evident at the 10-day count, however, for P-0559, P-3771, and P-3774, the highest numbers of strong seedlings were obtained from the small seed size rather than from the medium size.

Statistical analysis for weak seedlings indicated that the A x D interaction was highly significant (Table XI). There was a decrease in the number of weak seedlings at the 10-day count for all peanut

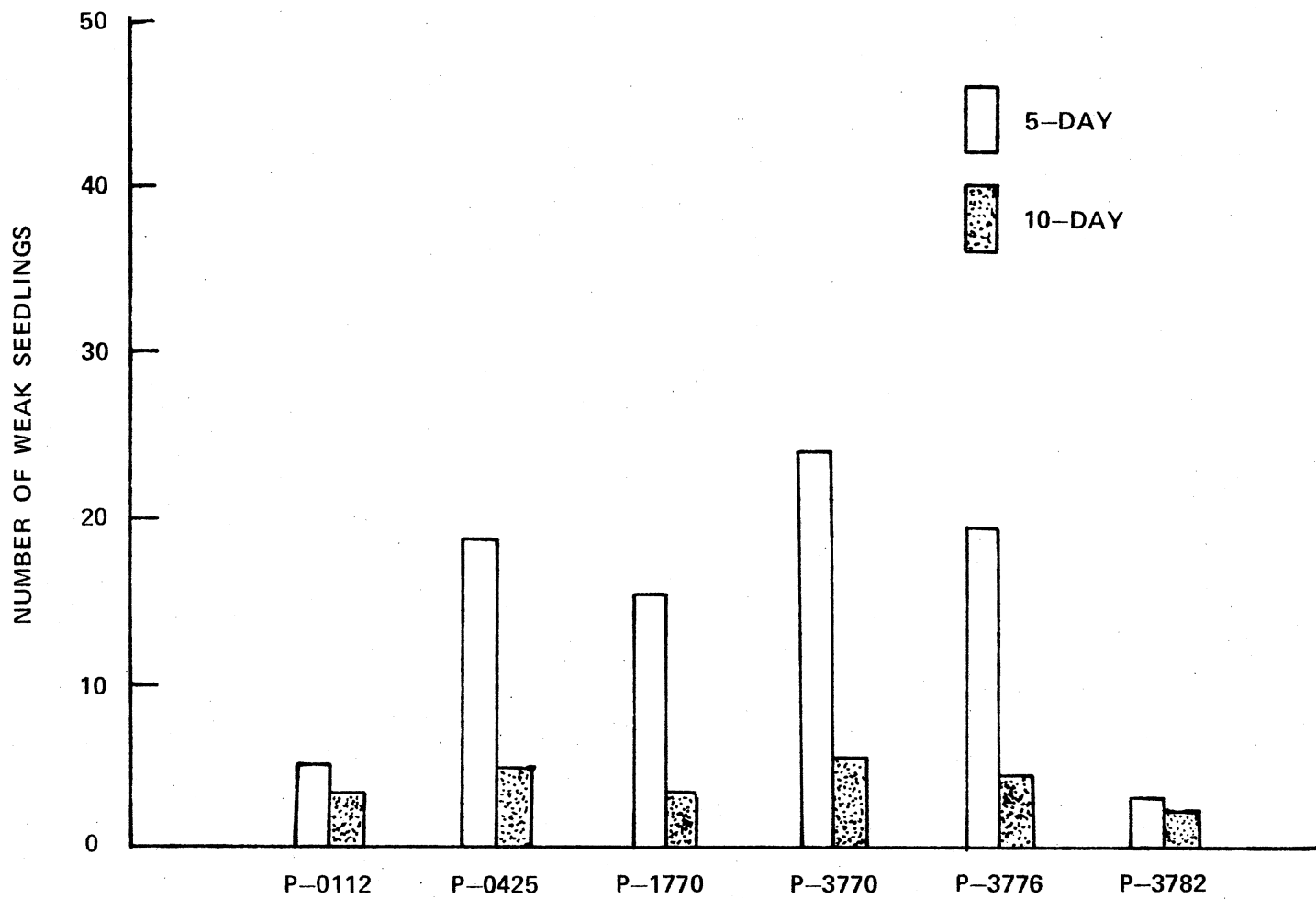


Figure 9. Number of Weak Seedlings from Six Peanut Accessions Counted at 5- and 10-Days in the Third Laboratory Germination Run.

TABLE X
 MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
 SEEDLINGS FROM THREE SEED SIZES EACH OF
 SIX PEANUT ACCESSIONS COUNTED AT
 5- AND 10-DAYS IN THE FOURTH
 LABORATORY GERMINATION RUN

Okla. P-No.	Seed Size ^{1/}	Seedling Counts					
		Strong		Weak		Tot. Normal	
		5-Day	10-Day	5-Day	10-Day	5-Day	10-Day
0559	L	16.25 ^{2/}	22.75	15.50	4.75	31.75	27.50
	M	18.00	23.75	13.75	5.25	31.75	29.00
	S	14.75	25.25	16.50	3.25	31.25	28.50
1258(LSS)	L	22.50	25.00	13.25	6.50	35.75	31.50
	M	28.75	29.50	14.25	8.00	43.00	37.50
	S	21.00	24.50	15.00	5.75	36.00	30.25
3771	L	43.00	42.00	6.00	3.75	49.00	45.75
	M	44.25	42.75	4.00	3.50	48.25	46.25
	S	41.00	43.75	6.75	2.50	47.75	46.25
3773	L	40.75	43.00	7.50	3.50	48.25	46.50
	M	43.75	45.25	4.25	2.50	48.00	47.75
	S	42.50	42.00	4.75	4.50	47.25	46.50
3774	L	26.00	25.00	11.50	4.00	37.50	29.00
	M	29.75	32.25	9.75	4.00	39.50	36.25
	S	29.25	33.75	10.00	2.00	39.25	35.75
3775	L	10.00	12.50	9.25	1.75	19.25	14.25
	M	16.25	20.75	14.50	4.00	30.75	24.75
	S	12.50	13.25	14.50	7.75	27.00	21.00
0559		16.33 ^{3/}	23.92	15.25	4.42	31.58	28.34
1258(LSS)		24.08	26.33	14.17	6.75	38.25	33.08
3771		42.75	42.83	5.83	3.25	48.33	46.08
3773		42.33	43.42	5.50	3.50	47.83	46.92
3774		28.33	30.33	10.42	3.33	38.75	33.66
3775		12.92	15.50	12.75	4.50	25.66	20.00
	L	26.42 ^{4/}	28.38	10.50	4.04	36.92	32.42
	M	30.13	32.28	10.08	4.54	40.21	36.92
	S	26.83	30.42	11.25	4.29	38.08	34.71
Grand Means		27.79 ^{5/}	30.39	10.61	4.29	38.40	34.68

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/}Each value is the mean of 4 observations.

^{3/}Each value is the mean of 12 observations.

^{4/}Each value is the mean of 24 observations.

^{5/}Each value is the mean of 72 observations.

TABLE XI

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
OF SIX PEANUT ACCESSIONS COUNTED AT
5- AND 10-DAYS IN THE FOURTH
LABORATORY GERMINATION RUN

Source	d.f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	143	135.03	25.55	97.59
Rep	3	22.03	15.21	4.64
Accession(A)	5	3334.67**	164.87**	2223.72**
Seed Size(SS)	2	186.05**	3.69	189.90**
A x SS	10	27.10*	16.79	50.01**
Error a	51	22.62	9.37	21.17
Day(D)	1	242.84**	1437.67**	498.78**
A x D	5	40.74**	75.52**	21.58*
SS x D	2	9.01	6.19	5.47
A x SS x D	10	9.06*	7.02	3.67
Error b	54	4.04	4.59	3.57

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

accessions. This decrease was again largest for the four peanut accessions with the largest number of weak seedlings at the 5-day count (Table X, Figure 10).

Table XI also presents the analysis of variance for total normal seedlings. The A x SS interaction was statistically significant at the 0.01 level of probability. Each peanut accession responded differently at each seed size, however, in each of the six accessions the large and small seed size produced similar numbers of total normal seedlings except for P-3774 and P-3775. The major differences occurred within the medium seed size except for P-3771 and P-3773 (Table XII, Figure 11). The number of total normal seedlings for the medium seed size ranged from 27.75 to 47.75, while the large and small seed sizes ranged from 16.75 to 47.38 and from 24.01 to 47.01, respectively.

The A x D interaction was significant at the 0.05 level of probability as shown in Table XI. At the 5-day count the number of total normal seedlings varied from 25.66 for P-3775 to 48.33 for P-3771. At the 10-day count there was again a decrease in the number of total normal seedlings for each of the peanut accessions. As in the previous runs, this decrease was most evident in the four accessions that had higher numbers of weak seedlings at the 5-day count, while the two peanut accessions with fewer weak seedlings at the 5-day count had the lowest decrease (Table X, Figure 12).

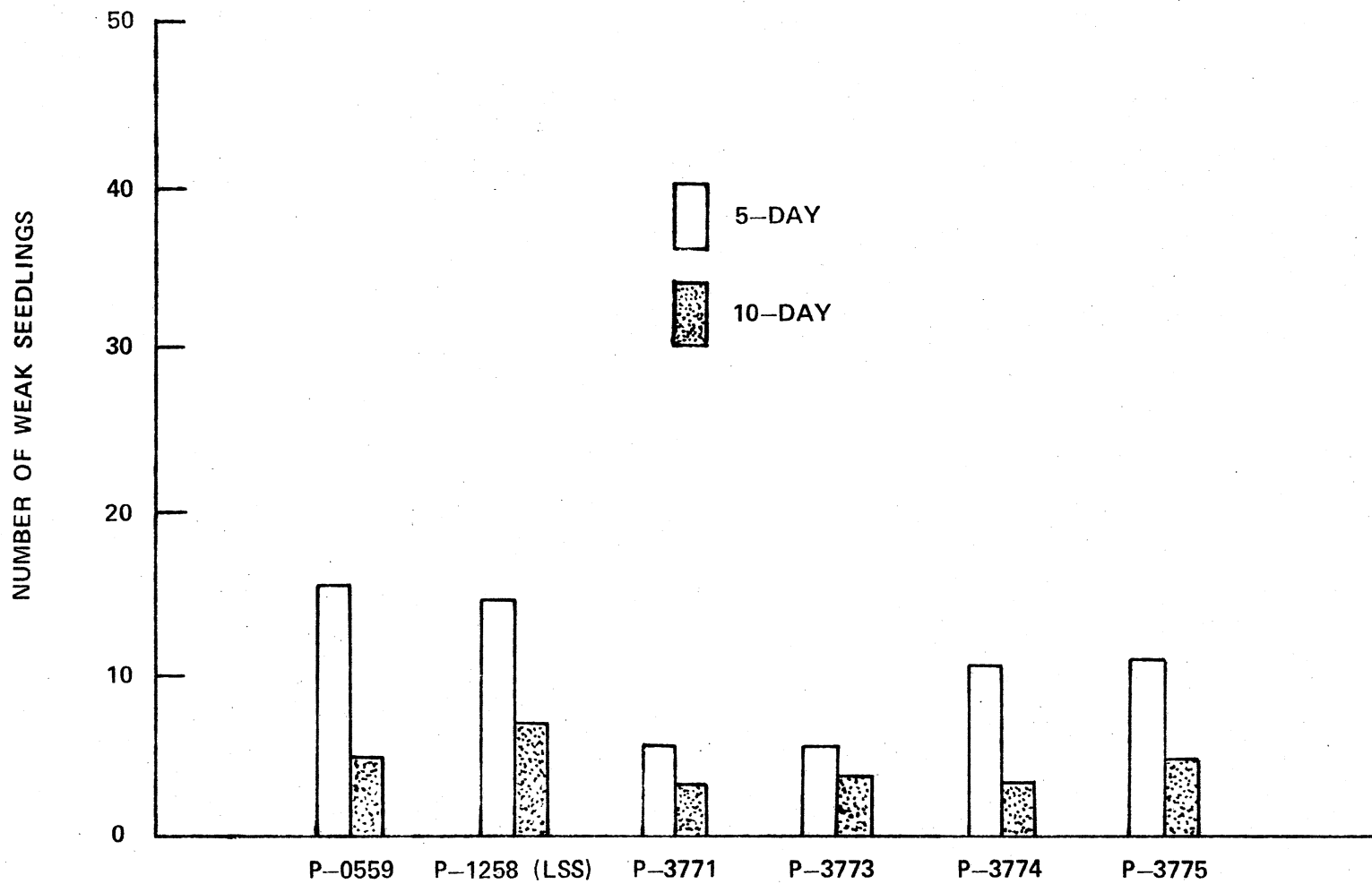


Figure 10. Number of Weak Seedlings from Six Peanut Accessions Counted at 5- and 10-Days in the Fourth Laboratory Germination Run.

TABLE XII

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
SIX PEANUT ACCESSIONS IN THE FOURTH
LABORATORY GERMINATION RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
0559	L	19.50 ^{2/}	10.13	29.63
	M	20.88	9.50	30.38
	S	20.00	9.88	29.88
1258(LSS)	L	23.75	9.88	33.63
	M	29.13	11.13	40.26
	S	22.75	10.38	33.13
3771	L	42.50	4.88	47.38
	M	43.50	3.75	47.25
	S	42.38	4.63	47.01
3773	L	41.88	5.50	47.38
	M	44.50	3.38	47.88
	S	42.25	4.63	46.88
3774	L	25.50	7.75	33.25
	M	31.00	6.88	37.88
	S	31.50	6.00	37.50
3775	L	11.25	5.50	16.75
	M	18.50	9.25	27.75
	S	12.88	11.13	24.01
0559		20.13 ^{3/}	9.83	19.96
1258(LSS)		25.21	10.46	35.67
3771		42.79	4.42	47.21
3773		42.86	4.50	47.36
3774		29.33	6.88	36.21
3775		14.21	8.63	22.84
	L	27.40 ^{4/}	7.27	34.67
	M	31.25	7.31	38.56
	S	28.63	7.77	36.40
Grand Means		29.09 ^{5/}	7.45	30.54

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens.

Dimensions shown above are slot widths.

^{2/}Each value is the mean of 8 observations.

^{3/}Each value is the mean of 24 observations.

^{4/}Each value is the mean of 48 observations.

^{5/}Each value is the mean of 144 observations.

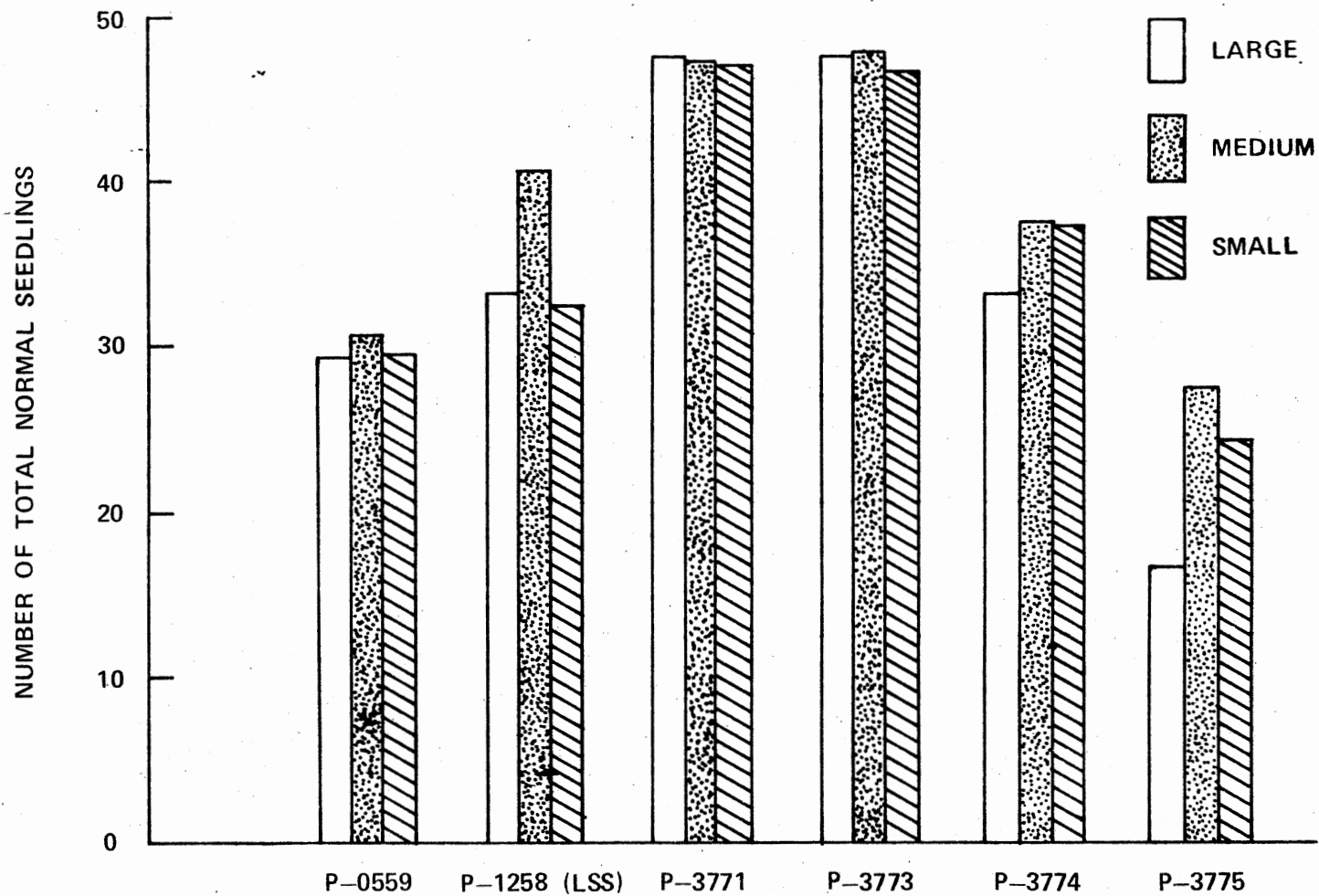


Figure 11. Number of Total Normal Seedlings from Three Seed Sizes Each of Six Peanut Accessions in the Fourth Laboratory Germination Run.

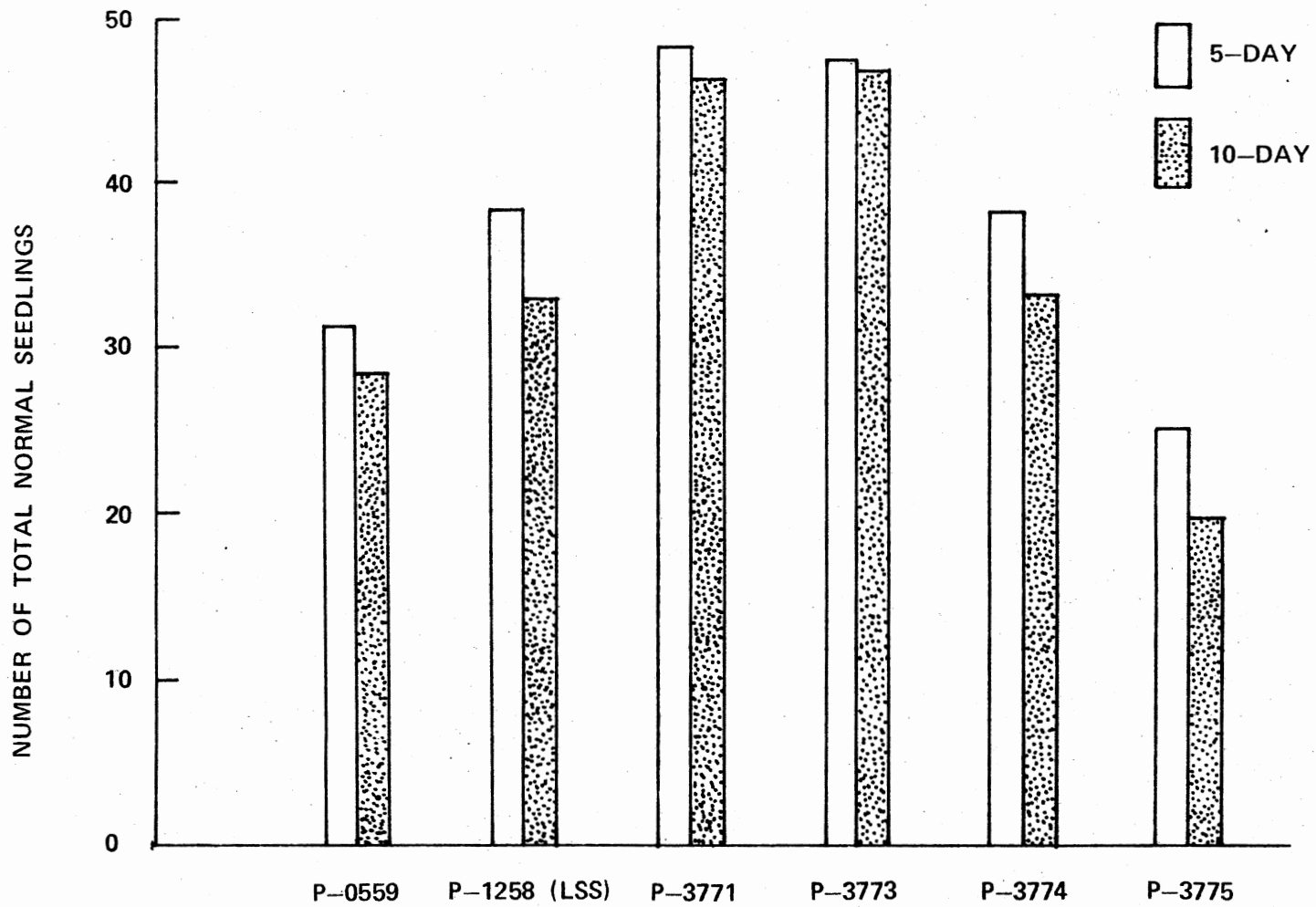


Figure 12. Number of Total Normal Seedlings from Six Peanut Accessions Counted at 5- and 10-Days in the Fourth Laboratory Germination Run.

Cold Tests

Run Number 1

The analysis of variance for strong seedlings in Table XIII indicates highly significant mean squares for temperatures, seed sizes, and accessions, and for the SS x A interaction. The numbers of strong seedlings averaged over the three peanut accessions and all seed sizes for 25 and 10°C were 12.08 and 9.36, respectively, as shown in Table XIV.

Table XIV shows the number of strong seedlings for each of the three peanut accessions for each of the two temperatures. The 25°C resulted in higher numbers of strong seedlings than did the 10°C treatment. Table XV shows the results of large, medium, and small seed sizes for each of the three peanut accessions. There were more strong seedlings produced from the large seed size in two of the peanut accessions, while the medium seed size produced slightly more strong seedlings for P-1746. However, the overall germination of P-1746 was quite low.

Statistical analysis for weak seedlings (Table XIII) indicates a significant mean square for the SS x A interaction indicating that the number of weak seedlings produced was determined by the particular combination of seed size and accession involved.

Statistical analysis for total normal seedlings (Table XIII) indicates highly significant mean squares for temperatures, seed sizes, and accessions, and for the SS x A interaction. The overall means for 25 and 10°C were 13.31 and 10.31, respectively. Table XV presents the data for the SS x A interaction. P-1258 and P-3787 produced higher numbers of total normal seedlings from the larger seed sizes while P-1746 produced opposite results. However, it should be again pointed out that

TABLE XIII

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
OF THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE FIRST
COLD TEST RUN

Source	d.f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	71	34.01	1.18	32.89
Temperature(T)	1	133.38**	1.38*	162.00**
Seed Size(SS)	2	116.68**	4.63*	76.85**
T x SS	2	2.43	0.51	1.63
Accession(A)	2	819.68**	1.04	765.09**
T x A	2	0.26	0.43	0.13
SS x A	4	34.06**	3.10*	48.10**
T x SS x A	4	2.06	0.37	0.88
Error	54	4.79	1.02	5.41

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE XIV

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE FIRST
COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Strong		Weak		Tot. Normal	
		25°C	10°C	25°C	10°C	25°C	10°C
1258 (NVT)	L	20.00 ^{2/}	18.50	0.75	0.25	20.75	18.75
	M	15.50	13.75	1.25	0.00	16.75	13.75
	S	14.00	9.75	1.50	1.50	15.50	11.25
1746	L	5.25	2.25	0.50	0.75	5.75	3.00
	M	6.00	3.75	1.25	0.75	7.25	4.50
	S	5.25	2.25	2.25	2.25	7.50	4.50
3787	L	16.25	14.25	1.00	0.50	17.25	14.75
	M	15.50	11.75	1.75	1.75	17.25	13.50
	S	11.00	8.00	0.75	0.75	11.75	8.75
1258 (NVT)		16.50 ^{3/}	14.00	1.17	0.58	17.67	14.59
1746		5.50	2.75	1.33	1.25	6.38	4.00
3787		14.25	11.33	1.17	1.00	15.42	12.33
	L	13.83 ^{4/}	11.67	0.75	0.50	14.58	12.17
	M	12.33	9.75	1.42	0.83	13.75	10.58
	S	10.08	6.67	1.50	1.50	11.58	8.17
Grand Means		12.08 ^{5/}	9.36	1.22	0.94	13.31	10.31

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/74 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 4 observations.

^{3/} Each value is the mean of 12 observations.

^{4/} Each value is the mean of 12 observations.

^{5/} Each value is the mean of 36 observations.

TABLE XV

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS IN THE
FIRST COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
1258(NVT)	L	19.25 ^{2/}	0.50	19.75
	M	14.63	0.63	15.26
	S	11.88	1.50	13.38
1746	L	3.75	0.63	4.38
	M	4.88	1.00	5.88
	S	3.75	2.25	6.00
3787	L	15.26	0.75	16.00
	M	13.63	1.75	15.38
	S	9.50	0.75	10.25
1258(NVT)		15.25 ^{3/}	0.88	16.13
1746		4.13	1.29	5.42
3787		12.79	1.08	13.87
	L	12.75 ^{4/}	0.63	13.38
	M	11.04	1.13	12.17
	S	8.38	1.50	9.88
Grand Means		10.72 ^{5/}	1.08	11.81

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/}Each value is the mean of 8 observations.

^{3/}Each value is the mean of 24 observations.

^{4/}Each value is the mean of 24 observations.

^{5/}Each value is the mean of 72 observations.

the overall germination of P-1746 was unacceptably low even in the optimum temperature control chamber.

Run Number 2

The analysis of variance for strong seedlings indicates highly significant differences between temperatures and among seed sizes and accessions, as shown in Table XVI.

The overall means of strong seedlings at 25 and 10°C were 19.39 and 16.63, respectively, indicating that the cold treatment tended to reduce the number of strong seedlings (Table XVII). The numbers of strong seedlings for large, medium, and small seed sizes averaged over the three accessions and the two temperatures were 20.21, 18.21, and 15.46, respectively. P-3145 produced the highest number of strong seedlings with 23.08, followed by P-1259 with 17.96 and P-3772 with 12.83 (Table XVIII).

The T x SS interaction was significant for the weak seedling evaluation (Table XVI). As indicated by the means in Table XVII, the medium size seed produced most of the weak seedlings at 10°C while at 25°C the medium size seed produced fewer weak seedlings than either of the other two sizes.

The analysis of variance for total normal seedlings (Table XVII) indicates highly significant mean squares for temperatures, seed sizes, and accessions, and for the T x A interaction. The number of total normal seedlings decreased in all accessions at 10°C when averaged over the three seed sizes. The major decrease was obtained from P-3772, while P-1259 and P-3145 had only slight decreases, as shown in Table XVII.

TABLE XVI

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
 NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
 OF THREE PEANUT ACCESSIONS EXPOSED TO
 25°C AND 10°C IN THE SECOND
 COLD TEST RUN

Source	d.f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	71	30.18	1.81	28.37
Temperature(T)	1	147.35**	0.05	130.68**
Seed Size(SS)	2	136.50**	1.01	137.26**
T x SS	2	6.22	7.13*	12.35
Accession(A)	2	630.38**	4.02	547.26**
T x A	2	18.01	3.79	33.52**
SS x A	4	14.19	0.45	11.04
T x SS x A	4	7.33	1.98	4.87
Error	54	6.06	1.60	6.65

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE XVII

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE SECOND
COLD TEST RUN

Okla P-No.	Seed Size ^{1/}	Strong		Weak		Tot. Normal	
		25°C	10°C	25°C	10°C	25°C	10°C
1259	L	21.50 ^{2/}	19.50	1.50	0.75	23.00	20.25
	M	17.25	17.75	1.50	2.25	18.75	20.00
	S	17.50	14.25	1.00	1.25	18.50	15.50
3145	L	24.50	23.50	0.00	1.25	24.50	24.75
	M	25.00	22.25	0.00	1.75	25.00	24.00
	S	23.00	20.25	0.50	0.50	23.50	20.75
3772	L	17.25	15.00	2.00	0.50	19.25	15.50
	M	17.00	10.00	0.50	2.25	17.50	12.25
	S	11.50	6.25	2.50	0.50	14.00	6.75
1259		18.75 ^{3/}	17.17	1.33	1.42	20.08	18.59
3145		23.17	22.00	0.16	1.17	24.33	23.17
3772		15.25	10.42	1.67	1.08	16.92	11.50
	L	21.08 ^{4/}	19.33	1.17	0.83	22.25	20.16
	M	19.75	16.67	0.67	2.08	20.42	18.75
	S	17.33	13.58	1.33	0.75	18.66	14.33
Grand Means		19.39 ^{5/}	16.53	1.06	1.22	20.44	17.75

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 4 observations.

^{3/} Each value is the mean of 12 observations.

^{4/} Each value is the mean of 12 observations.

^{5/} Each value is the mean of 36 observations.

TABLE XVIII

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS IN THE
SECOND COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
1259	L	20.50 ^{2/}	1.13	21.63
	M	17.50	1.88	19.38
	S	15.88	1.13	17.01
3145	L	24.00	0.63	24.63
	M	23.63	0.88	24.51
	S	21.63	0.50	22.13
3772	L	16.13	1.25	17.38
	M	13.50	1.38	14.88
	S	8.88	1.50	10.38
1259		17.96 ^{3/}	1.38	19.34
3145		23.08	0.67	23.75
3772		12.83	1.38	14.21
	L	20.21 ^{4/}	1.00	21.21
	M	18.21	1.38	19.59
	S	15.46	1.04	16.50
Grand Means		17.96 ^{5/}	1.14	19.10

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/}Each value is the mean of 8 observations.

^{3/}Each value is the mean of 24 observations.

^{4/}Each value is the mean of 24 observations.

^{5/}Each value is the mean of 72 observations.

It should also be pointed out that P-3772 had the poorest germination at the 25°C or optimum temperature.

Run Number 3

The analysis of variance for strong seedlings in Table XIX indicates highly significant mean squares for temperatures and accessions, and for the T x A and SS x A interactions. The numbers of strong seedlings averaged over the three peanut accessions and the three seed sizes for 25 and 10°C were 13.97 and 10.72, respectively, as shown in Table XX. The numbers of strong seedlings averaged over the two temperatures ranged from 23.17 for P-2398 to 5.33 for P-1765, as shown in Table XXI.

The analysis of variance for weak seedlings in Table XIX indicates highly significant differences among peanut accessions. The analysis of variance for total normal seedlings indicates highly significant mean squares for temperatures and accessions and for the T x A and SS x A interactions while seed size was significant at the 0.05 level of probability (Table XIX). There was a decrease in the number of total normal seedlings for each of the three peanut accessions at 10°C (Table XX).

Run Number 4

The analysis of variance for strong seedlings (Table XXII) indicates highly significant mean squares for temperatures, seed sizes, and accessions and for the SS x A interaction. The numbers of strong seedlings averaged over seed sizes and temperatures were 8.25 for P-0425, 9.46 for P-3770, and 10.79 for P-3776 (Table XXIII). The average numbers of strong seedlings for 25 and 10°C were 11.61 and 7.39, respectively (Table XXIV). The numbers of strong seedlings for large, medium, and

TABLE XIX

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
OF THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE THIRD
COLD TEST RUN

Source	d. f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	71	68.31	1.46	61.50
Temperature(T)	1	190.13**	1.13	162.00**
Seed Size(SS)	2	9.56	0.93	16.43*
T x SS	2	5.17	0.04	4.88
Accession(A)	2	2168.85**	12.06**	1876.76**
T x A	2	19.27**	0.50	25.04**
SS x A	4	13.79**	1.95	22.76**
T x SS x A	4	6.15	0.61	7.04
Error	54	3.24	1.21	4.43

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE XX

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE THIRD
COLD TEST RUN

Okla P-No.	Seed Size ^{1/}	Strong		Weak		Tot. Normal	
		25°C	10°C	25°C	10°C	25°C	10°C
1765	L	8.75 ^{2/}	5.25	2.00	2.25	10.75	7.50
	M	7.25	4.50	1.75	1.75	9.00	6.25
	S	4.75	1.50	1.25	1.25	6.00	2.75
2379	L	10.75	4.75	1.50	2.00	12.25	6.75
	M	10.50	8.25	2.50	2.75	13.00	11.00
	S	12.00	5.00	1.75	1.25	13.75	6.25
2398	L	23.00	23.25	0.50	0.75	23.50	24.00
	M	24.25	22.00	0.25	0.50	24.50	22.00
	S	24.50	22.00	0.25	1.50	24.75	23.50
1765		6.92 ^{3/}	3.75	1.67	1.75	8.59	5.50
2379		11.08	6.00	1.92	2.00	13.00	8.00
2398		23.92	22.42	0.33	0.92	24.25	23.34
	L	14.17 ^{4/}	11.08	1.33	1.67	15.50	12.75
	M	14.00	11.58	1.50	1.67	15.50	13.25
	S	13.75	9.50	1.08	1.33	14.83	10.83
Grand Means		13.97 ^{5/}	10.72	1.30	1.55	15.28	12.28

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/}Each value is the mean of 4 observations.

^{3/}Each value is the mean of 12 observations.

^{4/}Each value is the mean of 12 observations.

^{5/}Each value is the mean of 36 observations.

TABLE XXI

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS IN THE
THIRD COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
1765	L	7.00 ^{2/}	2.13	9.13
	M	5.88	1.75	7.63
	S	3.13	1.25	4.38
2379	L	7.75	1.75	9.50
	M	9.38	2.63	12.01
	S	8.50	1.50	10.00
2398	L	23.13	0.63	23.76
	M	23.13	0.38	23.51
	S	23.25	0.88	24.13
1765		5.33 ^{3/}	1.71	7.04
2379		8.54	1.96	10.50
2398		23.17	0.63	23.80
	L	12.63 ^{4/}	1.50	14.13
	M	12.79	1.58	14.37
	S	11.63	1.21	12.84
Grand Means		12.35 ^{5/}	1.43	13.78

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15.64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 8 observations.

^{3/} Each value is the mean of 24 observations.

^{4/} Each value is the mean of 24 observations.

^{5/} Each value is the mean of 72 observations.

TABLE XXII

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
OF THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE FOURTH
COLD TEST RUN

Source	d.f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	71	53.97	2.06	13.08
Temperature(T)	1	320.88**	6.72	420.50**
Seed Size(SS)	2	45.13**	2.35	67.39**
T x SS	2	0.85	1.10	1.50
Accession(A)	2	38.79**	0.93	31.06**
T x A	2	1.27	2.68	7.17
SS x A	4	10.36**	3.29	8.39
T x SS x A	4	2.54	0.24	2.29
Error	54	5.32	2.06	4.65

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE XXIII

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS IN THE
FOURTH COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
0425	L	9.88 ^{2/}	3.50	13.38
	M	8.75	2.25	11.00
	S	6.13	3.25	9.38
3770	L	9.88	3.00	12.88
	M	9.13	3.13	12.26
	S	9.38	1.75	11.13
3776	L	12.00	2.75	14.75
	M	12.00	3.00	15.00
	S	8.38	2.38	10.76
0425		8.25 ^{3/}	3.00	11.25
3770		9.46	2.63	12.08
3776		10.79	2.71	13.50
	L	10.58 ^{4/}	3.08	13.67
	M	9.96	2.79	12.75
	S	7.96	2.46	10.41
Grand Means		9.50 ^{5/}	2.78	12.28

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/}Each value is the mean of 8 observations.

^{3/}Each value is the mean of 24 observations.

^{4/}Each value is the mean of 24 observations.

^{5/}Each value is the mean of 72 observations.

TABLE XXIV

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE FOURTH
COLD TEST RUN

P-No.	Size ^{1/}	Strong		Weak		Tot. Normal	
		25°C	10°C	25°C	10°C	25°C	10°C
0425	L	11.50 ^{2/}	8.25	3.75	3.25	15.25	11.50
	M	11.00	6.50	2.75	1.75	13.75	8.25
	S	8.25	4.00	3.50	3.00	11.75	7.00
3770	L	1.75	8.00	3.75	2.25	15.50	10.25
	M	12.00	6.25	4.00	2.25	16.00	8.50
	S	11.75	7.00	2.00	1.50	13.75	8.50
3776	L	14.25	9.75	2.50	3.00	16.75	12.75
	M	13.25	10.75	3.25	2.75	16.50	13.50
	S	10.75	6.00	2.25	2.50	13.00	8.50
0425		10.25 ^{3/}	6.25	3.33	2.67	13.58	8.92
3770		11.83	7.08	3.25	2.00	15.08	9.08
3776		12.75	8.83	2.67	2.75	15.42	11.58
	L	12.50 ^{4/}	8.67	3.33	2.83	15.83	11.50
	M	12.08	7.83	3.33	2.25	15.41	10.08
	S	10.25	5.67	2.58	2.33	12.83	8.00
Grand Means		11.61 ^{5/}	7.39	3.08	2.47	14.69	9.86

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/}Each value is the mean of 4 observations.

^{3/}Each value is the mean of 12 observations.

^{4/}Each value is the mean of 12 observations.

^{5/}Each value is the mean of 36 observations.

small seed sizes averaged over accessions and temperatures were 10.58, 9.96, and 7.96, respectively (Table XXIII).

The analysis of variance for weak seedlings indicates that no statistical significance was obtained for any of the three factors studied (Table XXII).

The analysis of variance for total normal seedlings (Table XXII) indicates highly significant differences for temperatures, seed sizes, and accessions. The average numbers of total normal seedlings at 25 and 10°C were 14.69 and 9.86, respectively (Table XXIV). The numbers of total normal seedlings for large, medium, and small seed sizes averaged over accessions and temperatures were 13.67, 12.75, and 10.41, respectively (Table XXIII). The numbers of total normal seedlings for each of the three accessions averaged over seed sizes and temperatures were 11.25 for P-0425, 12.08 for P-3770, and 13.50 for P-3776 (Table XXIII).

Run Number 5

Statistical significance was obtained for temperatures, seed sizes, and accessions, and for the T x SS x A interaction, in the analysis of strong seedlings as shown in Table XXV. The number of strong seedlings was reduced at 10°C when compared with 25°C for each seed size of each accession (Table XXVI). The numbers of strong seedlings averaged over seed sizes and temperatures were 6.92, 17.13, and 14.04 for P-0006, P-1446, and P-3778, respectively (Table XXVII).

The seed size means averaged over accessions indicated a trend of more strong seedlings produced from larger seed, however, this pattern

TABLE XXV

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
OF THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE FIFTH
COLD TEST RUN

Source	d.f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	71	34.38	2.54	29.02
Temperature(T)	1	747.56**	36.13**	455.35**
Seed Size (SS)	2	38.22**	0.34	41.35**
T x SS	2	9.39	7.63*	2.93
Accession(A)	2	657.93**	1.06	618.93**
T x A	2	4.51	6.50*	2.43
SS x A	4	7.56	1.79	8.22
T x SS x A	4	16.47**	4.81*	9.22
Error	54	3.29	1.61	3.82

*Indicates significance at the 0.05 level of probability.
**Indicates significance at the 0.01 level of probability.

TABLE XXVI

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE FIFTH
COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Strong		Weak		Tot. Normal	
		25°C	10°C	25°C	10°C	25°C	10°C
0006	L	13.25 ^{2/}	3.50	2.25	3.75	15.50	7.25
	M	10.75	4.50	2.75	3.25	13.50	7.75
	S	6.00	3.50	2.75	2.50	8.75	6.00
1446	L	19.75	14.25	2.00	2.75	21.75	17.00
	M	22.75	12.25	0.50	6.00	23.25	18.25
	S	20.00	13.75	1.50	3.00	21.50	16.75
3778	L	18.50	12.25	1.50	3.25	20.00	15.50
	M	17.00	12.25	1.25	3.00	18.25	15.25
	S	15.25	9.00	3.00	2.75	18.25	11.75
0006		10.00 ^{3/}	3.83	2.58	3.17	12.58	7.00
1446		20.83	13.42	1.33	3.92	22.16	17.34
3778		16.92	11.17	1.92	3.00	18.84	14.17
	L	17.14 ^{4/}	10.00	1.92	3.25	19.09	13.25
	M	16.83	9.67	1.50	4.08	18.33	13.75
	S	13.75	8.75	2.42	2.75	16.17	11.50
Grand Means		15.92 ^{5/}	9.47	1.94	3.36	17.86	12.83

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 4 observations.

^{3/} Each value is the mean of 12 observations.

^{4/} Each value is the mean of 12 observations.

^{5/} Each value is the mean of 36 observations.

TABLE XXVII

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS IN THE
FIFTH COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
0006	L	8.38 ^{2/}	3.00	11.38
	M	7.63	3.00	10.63
	S	4.75	2.63	7.38
1446	L	17.00	2.38	19.38
	M	17.50	3.25	20.75
	S	16.88	2.25	19.13
3778	L	15.38	2.38	17.76
	M	14.63	2.13	16.76
	S	12.13	2.88	15.01
0006		6.92 ^{3/}	2.88	9.79
1446		17.13	2.63	19.75
3778		14.04	2.46	16.50
	L	13.58 ^{4/}	2.58	16.17
	M	13.25	2.79	16.04
	S	11.25	2.58	13.83
Grand Means		12.70 ^{5/}	2.66	15.35

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 8 observations.

^{3/} Each value is the mean of 24 observations.

^{4/} Each value is the mean of 24 observations.

^{5/} Each value is the mean of 72 observations.

was not consistent when viewed within accessions and temperatures giving rise to the T x SS x A interaction (Table XXVI).

A highly significant difference between temperatures was obtained in the analysis of weak seedlings (Table XXV). The analysis of variance also indicated the T x SS, T x A, and T x SS x A interactions to be significant at the 0.05 level of probability.

Differences occurred between temperatures and among seed sizes and accessions according to the analysis of total normal seedlings (Table XXV). The numbers of total normal seedlings at 25 and 10°C were 17.86 and 12.83, respectively (Table XXVI). The numbers of total normal seedlings averaged over seed sizes and temperatures for P-0006, P-1446, and P-3778 were 9.79, 19.75, and 16.50, respectively (Table XXVII). The numbers of total normal seedlings for large, medium, and small seed averaged over accessions and temperatures were 16.17, 16.04, and 13.83, respectively (Table XXVII).

Run Number 6

Highly significant mean squares were obtained for temperatures, seed sizes, and accessions, and for the SS x A and T x SS x A interactions (Table XXVIII). The number of strong seedlings for each seed size and each accession was higher at 25°C than at 10°C (Table XXIX). The numbers of strong seedlings averaged over seed sizes and temperatures were 17.45 for P-0112, 13.75 for P-1779, and 20.17 for P-3782 (Table XXX). Although trends were noticed for the main effects as indicated above, the actual number of strong seedlings obtained was dependent upon the accession, the seed size, and the temperature, thus giving rise to the significant interactions.

TABLE XXVIII

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
OF THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE SIXTH
COLD TEST RUN

Source	d.f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	71	23.27	2.84	15.53
Temperature(T)	1	561.13**	20.06**	369.01**
Seed Size(SS)	2	49.63**	4.39*	25.10**
T x SS	2	10.13	3.39	14.27*
Accession(A)	2	249.04**	12.77**	149.35**
T x A	2	1.29	1.85	1.43
SS x A	4	35.11**	7.24**	16.47**
T x SS x A	4	26.48**	8.49**	12.06*
Error	54	4.15	1.37	4.43

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE XXIX

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE SIXTH
COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Strong		Weak		Tot. Normal	
		25°C	10°C	25°C	10°C	25°C	10°C
0112	L	19.75 ^{2/}	16.26	1.75	3.00	21.50	19.25
	M	20.00	11.75	1.00	4.00	21.00	15.75
	S	20.25	16.75	2.00	0.50	22.25	17.25
1779	L	20.50	13.00	1.75	1.75	22.25	14.75
	M	15.25	13.00	2.50	3.75	17.75	16.75
	S	14.00	6.75	3.25	3.75	17.25	10.50
3782	L	22.75	19.25	0.75	0.50	23.50	19.75
	M	23.25	19.25	0.25	1.50	23.50	20.75
	S	23.50	13.00	0.50	4.50	24.00	17.50
0112		20.00 ^{3/}	14.92	1.58	2.50	21.58	17.42
1779		16.58	10.92	2.50	3.08	19.08	14.00
3782		23.17	17.17	0.60	2.17	23.67	19.34
	L	21.00 ^{4/}	16.17	1.42	1.75	22.42	17.92
	M	19.50	14.67	1.25	3.08	20.75	17.75
	S	19.25	12.17	1.92	2.92	21.17	15.09
Grand Means		19.92 ^{5/}	14.33	1.53	2.58	21.45	16.92

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/}Each value is the mean of 4 observations.

^{3/}Each value is the mean of 12 observations.

^{4/}Each value is the mean of 12 observations.

^{5/}Each value is the mean of 36 observations.

TABLE XXX

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS IN THE
SIXTH COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
0112	L	18.00 ^{2/}	2.38	20.38
	M	15.88	2.50	18.38
	S	18.50	1.25	19.75
1779	L	16.75	1.75	18.50
	M	14.13	3.13	17.26
	S	10.38	3.50	13.88
3782	L	21.00	0.63	21.63
	M	21.25	0.88	22.13
	S	18.25	2.50	20.75
0112		17.45 ^{3/}	2.04	19.49
1779		13.75	2.79	16.54
3782		20.17	1.33	21.50
	L	18.48 ^{4/}	1.58	20.16
	M	17.08	2.17	19.25
	S	15.71	2.42	18.13
Grand Means		17.12 ^{5/}	2.05	19.18

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 8 observations.

^{3/} Each value is the mean of 24 observations.

^{4/} Each value is the mean of 24 observations.

^{5/} Each value is the mean of 72 observations.

In the analysis of weak seedlings, highly significant mean squares were obtained for temperatures and accessions, and for the SS x A and T x SS x A interactions, while seed size differences were significant at the 0.05 level of probability.

The analysis of variance for total normal seedlings (Table XXVIII) indicates highly significant mean squares for temperatures, seed sizes, and accessions, and for the SS x A interaction, while the T x SS and T x SS x A interactions were significant at the 0.05 level of probability.

Run Number 7

The analysis of variance for strong seedlings (Table XXXI) indicates highly significant mean squares for temperatures, seed sizes, and accessions, and for the T x A and T x SS x A interactions while the T x SS interaction was significant at the 0.05 level of probability.

The average numbers of strong seedlings for 25 and 10°C were 14.28 and 9.17, respectively (Table XXXII). The numbers of strong seedlings for large, medium, and small seed sizes averaged over temperatures and accessions were 11.63, 13.33, and 10.21, respectively (Table XXXIII). The numbers of strong seedlings for the three peanut accessions averaged over temperatures and seed sizes were 15.96 for P-3771, 14.29 for P-3774, and 4.92 for P-3775 (Table XXXIII).

The number of strong seedlings produced was dependent upon temperature, seed size, and accession giving rise to the significant T x SS x A interaction (Table XXXII).

The analysis of variance for weak seedlings (Table XXXI) indicates highly significant mean squares for seed sizes, and for the T x SS and

TABLE XXXI

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
 NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
 OF THREE PEANUT ACCESSIONS EXPOSED TO
 25°C AND 10°C IN THE SEVENTH
 COLD TEST RUN

Source	d. f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	71	37.16	1.54	35.01
Temperature(T)	1	470.22**	0.00	470.22**
Seed Size(SS)	2	58.77**	6.43**	35.50**
T x SS	2	11.43*	7.63**	30.72**
Accession(A)	2	850.35**	1.85	798.79**
T x A	2	52.18**	7.04**	31.60**
SS x A	4	5.81	2.43*	6.23
T x SS x A	4	11.14**	1.79	11.04**
Error	54	2.87	0.86	2.91

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE XXXII

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE SEVENTH
COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Strong		Weak		Tot. Normal	
		25°C	10°C	25°C	10°C	25°C	10°C
3771	L	21.50 ^{2/}	9.25	2.25	2.75	23.75	12.00
	M	20.75	16.00	2.00	3.75	22.75	19.75
	S	18.25	10.00	2.75	3.75	21.00	13.75
3774	L	16.00	12.75	2.50	3.00	18.50	15.75
	M	17.75	14.50	1.75	3.50	19.50	18.00
	S	13.25	11.50	5.75	3.50	19.00	15.00
3775	L	7.00	3.25	4.00	2.75	11.00	6.00
	M	7.00	4.00	3.25	3.25	10.25	7.25
	S	7.00	1.25	4.50	2.50	11.50	3.75
3771		20.17 ^{3/}	11.75	2.33	3.42	22.50	15.17
3774		15.67	12.92	3.33	3.33	19.00	16.25
3775		7.00	2.83	3.92	2.83	10.92	5.66
	L	14.83 ^{4/}	8.42	2.92	2.83	17.75	11.25
	M	15.17	11.50	2.33	3.50	17.50	15.00
	S	12.83	7.58	4.33	3.25	17.16	10.83
Grand Means		14.28 ^{5/}	9.17	3.19	3.19	17.47	12.36

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 4 observations.

^{3/} Each value is the mean of 12 observations.

^{4/} Each value is the mean of 12 observations.

^{5/} Each value is the mean of 36 observations.

TABLE XXXIII

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS IN THE
SEVENTH COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
3771	L	15.38 ^{2/}	2.50	17.88
	M	18.38	2.88	21.26
	S	14.13	3.25	17.38
3774	L	14.38	2.75	17.13
	M	16.13	2.63	18.76
	S	12.38	4.63	17.01
3775	L	5.13	3.38	8.51
	M	5.50	3.25	8.75
	S	4.13	3.50	7.63
3771		15.96 ^{3/}	2.88	18.84
3774		14.29	3.33	17.62
3775		4.92	3.38	8.30
	L	11.63 ^{4/}	2.88	14.51
	M	13.33	2.92	16.25
	S	10.21	3.79	14.00
Grand Means		11.72 ^{5/}	3.20	14.92

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 8 observations.

^{3/} Each value is the mean of 24 observations.

^{4/} Each value is the mean of 24 observations.

^{5/} Each value is the mean of 72 observations.

T x A interactions while the SS x A interaction was significant at the 0.05 level of probability.

The analysis of variance for total normal seedlings (Table XXXI) indicates highly significant mean squares for temperatures, seed sizes, and accessions and for the T x SS, T x A, and T x SS x A interactions. The numbers of normal seedlings averaged over seed sizes and accessions for the 25 and 10°C were 17.47 and 12.36, respectively (Table XXXII). The mean numbers of normal seedlings for the large, medium, and small seed sizes averaged over temperatures and accessions were 14.51, 16.25, and 14.00, respectively (Table XXXIII). The numbers of normal seedlings for the three peanut accessions averaged over temperatures and seed sizes were 18.84 for P-3771, 17.62 for P-3774, and 8.30 for P-3775 (Table XXXIII). The number of normal seedlings produced was dependent upon temperature, seed size, and accession giving rise to the significant T x SS x A interaction (Table XXXII).

Run Number 8

The analysis of variance for strong seedlings (Table XXXIV) indicates highly significant mean squares for temperatures, seed sizes, and accessions, and for the T x A and SS x A interactions.

The numbers of strong seedlings for 25 and 10°C averaged over seed sizes and accessions were 13.39 and 11.78, respectively (Table XXXV). The numbers of strong seedlings for the three peanut accessions averaged over temperatures and seed sizes were 8.54 for P-0559, 9.04 for P-1258, and 20.17 for P-3773 (Table XXXVI). The results for the T x A interaction are shown in Table XXXVI. The numbers of strong seedlings decreased in all accessions at 10°C when averaged over the three seed

TABLE XXXIV

ANALYSES OF VARIANCE FOR STRONG, WEAK, AND TOTAL
 NORMAL SEEDLINGS FROM THREE SEED SIZES EACH
 OF THREE PEANUT ACCESSIONS EXPOSED TO
 25°C AND 10°C IN THE EIGHTH
 COLD TEST RUN

Source	d.f.	Seedling Mean Squares		
		Strong	Weak	Tot. Normal
Total	71	34.34	2.96	27.41
Temperature(T)	1	46.72**	0.01	45.13**
Seed Size(SS)	2	32.04**	12.18**	22.72**
T x SS	2	0.68	0.85	0.17
Accession(A)	2	1036.63**	26.35**	737.93**
T x A	2	18.02**	3.10	34.04**
SS x A	4	16.48**	4.14	18.66**
T x SS x A	4	4.54	3.56	3.27
Error	54	2.52	1.75	4.14

*Indicates significance at the 0.05 level of probability.

**Indicates significance at the 0.01 level of probability.

TABLE XXXV

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS EXPOSED TO
25°C AND 10°C IN THE EIGHTH
COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Strong		Weak		Tot. Normal	
		25°C	10°C	25°C	10°C	25°	10°C
0559	L	7.25 ^{2/}	7.00	5.50	4.25	12.75	11.25
	M	9.50	8.25	3.00	5.00	12.50	13.25
	S	10.25	9.00	3.50	4.75	13.75	13.75
1258 (LSS)	L	12.00	6.75	4.25	4.50	16.25	11.25
	M	12.25	8.75	4.50	3.75	16.75	12.50
	S	8.25	6.25	4.00	2.25	12.25	8.50
3773	L	18.75	20.00	3.75	3.75	22.50	23.75
	M	23.00	21.75	1.00	1.00	24.00	22.75
	S	19.25	18.25	2.00	2.50	21.25	20.75
0559		9.00 ^{3/}	8.08	4.00	4.67	13.00	12.75
1258(LSS)		10.83	7.25	4.25	3.50	15.08	10.75
3773		20.33	20.00	2.25	2.42	22.58	22.42
	L	12.67 ^{4/}	11.25	4.50	4.17	17.67	15.42
	M	14.92	12.92	2.83	3.25	17.75	16.17
	S	12.58	11.17	3.17	3.17	15.75	14.34
Grand Means		13.39 ^{5/}	11.78	3.50	3.53	16.89	15.31

^{1/} L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/} Each value is the mean of 4 observations.

^{3/} Each value is the mean of 12 observations.

^{4/} Each value is the mean of 12 observations.

^{5/} Each value is the mean of 36 observations.

TABLE XXXVI

MEAN NUMBER OF STRONG, WEAK, AND TOTAL NORMAL
SEEDLINGS FROM THREE SEED SIZES EACH OF
THREE PEANUT ACCESSIONS IN THE
EIGHTH COLD TEST RUN

Okla. P-No.	Seed Size ^{1/}	Seedlings		
		Strong	Weak	Tot. Normal
0559	L	7.13 ^{2/}	4.88	12.01
	M	8.88	4.00	12.88
	S	9.63	4.13	13.76
1258(LSS)	L	9.38	4.38	13.76
	M	10.50	4.13	14.63
	S	7.25	3.13	10.38
3773	L	19.38	3.75	23.13
	M	22.38	1.00	23.38
	S	18.75	2.25	21.00
0559		8.54 ^{3/}	4.33	12.87
1258(LSS)		9.04	3.88	12.92
3773		20.17	2.33	22.50
	L	11.96 ^{4/}	4.33	16.29
	M	13.92	3.04	16.96
	S	11.88	3.17	15.05
Grand Means		12.58 ^{5/}	3.51	16.10

^{1/}L=large - ride 19/64-inch screen.

M=medium - pass through 19/64 and ride 17/64-inch screen.

S=small - pass through 17/64 and ride 15/64-inch screen.

All screens were 3/4-inch slotted screens. Dimensions shown above are slot widths.

^{2/}Each value is the mean of 8 observations.

^{3/}Each value is the mean of 24 observations.

^{4/}Each value is the mean of 24 observations.

^{5/}Each value is the mean of 72 observations.

sizes. The major decrease was obtained from P-1258, while P-0559 and P-3773 had only slight decreases.

Table XXXVI shows the results for the interaction SS x A. The germination of medium size seed resulted in higher numbers of strong seedlings for two peanut accessions when averaged over temperatures, however, for P-0559, the higher number of strong seedlings was obtained from the small seed size.

The analysis of variance for weak seedlings (Table XXXIV) indicates highly significant differences among seed sizes and accessions. The numbers of weak seedlings for large, medium, and small seed sizes averaged over temperatures and accessions were 4.33, 3.04, and 3.17, respectively (Table XXXVI).

The analysis of variance for total normal seedlings (Table XXXIV) gave the same pattern as for strong seedlings. Significance at the 0.01 level of probability was obtained for temperatures, seed sizes, and accessions, and for the T x A and SS x A interactions. The numbers of normal seedlings for the three peanut accessions averaged over temperatures and seed sizes were 12.87 for P-0559, 12.92 for P-1258, and 22.50 for P-3773 (Table XXXVI).

Table XXXV shows the results for T x A interaction along with the means for the temperature treatments. There was a decrease in the number of total normal seedlings for each of the three peanut accessions with the cold treatment, however, for P-0559 and P-3773, these decreases were very slight.

The number of normal seedlings produced was dependent upon seed size as well as accession giving rise to the significant SS x A interaction.

CHAPTER V

SUMMARY AND CONCLUSIONS

A study was conducted to determine whether the actual quality or vigor of peanut seed lots could be predicted from some measurement taken while conducting the standard rolled paper towel germination test.

There were differences among peanut accessions in all studies conducted. The peanut accessions which had greater numbers of strong seedlings at the end of the 5-day counts in the laboratory germination tests also exhibited greater seedling emergence regardless of the soil temperature in the growth chambers. The peanut accessions which had greater numbers of weak seedlings at the end of the 5-day counts in the laboratory germination tests tended to perform poorly when the soil temperature was at 10°C in the growth chamber. A large number of seedlings counted as weak seedlings (and included in the "total normal" counts) at the end of the 5-day counts either decayed or developed into abnormal seedlings by the end of the 10-day counts. This explains why the total normal seedling count was smaller at 10-days than at 5-days in several instances. Results of the tests made with the 24 peanut accessions indicate that seed producing a high proportion of strong seedlings by the 5-day count will also do better under cold temperatures and presumably other stress conditions that might be encountered under field planting conditions. Knowledge of the capacity for a given seed lot to produce strong,

vigorous seedlings rapidly should enable both seedsmen and peanut producers to select only the highest quality lots for seed purposes.

Under the current procedures followed with the official seed germination test for peanuts, the seedlings are counted at 5-days and the data is recorded. However, only the 10-day "total" counts are reported to the company or individual requesting the germination test. The additional cost of reporting the percentage of strong, "early" seedlings to the seedsmen and the extra cost of including this information on the germination tags should be negligible.

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