SOME PHYSICAL CHARACTERISTICS OF THE SPANISH PEANUT POD AND KERNEL

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INTRODUCTION

The objective of this study is to determine certain peanut pod and kernel characteristics of the Argentine variety with four irrigation treatments, and six varieties grown in an irrigated and non-irrigated variety test, as well as the relationship between length and width of sized peanut kernels.

Broken kernels, dirty-faced splits, seedcoat breakage and lack of uniform size are some of the factors contributing to shelling losses. Apparently there are different requirements for testa thicknesses among processors. Salters using the whole peanut prefer a thick kernel skin, while those salting blanched peanuts prefer a thin skin. Information concerning the methods of determining the physical characteristics of peanut pod and kernels and the size of sample to use are not available. Information concerning the quantative pod and kernel characteristics of various strains is of value to the breeder in peanut improvement and to the growers in selecting a planter and in planting the seed. Growers need a pod with sufficient thickness for protection of kernels in picking and curing. The terms "thick, medium and thin" are commonly used to express pod thickness. A more definite measure is needed for such information to be useful. Emphasis should also be placed on some of the basic physical components of the peanut pod and kernel in their relation to shelling, moisture, field treatments and methods of measurement.

These studies and evaluations were made in hope that they may benefit the entire peanut industry.

LITERATURE REVIEW

Little progress in evaluation of characteristics of the pod and kernel has been made. In reporting the published works on these characteristics, it has been impossible to unfold a sequence of events or to build a coordinated body of knowledge derived from the results of previous experiments.

According to Gregory, Smith and Yarbrough (4)[/1], the peanut pod varies in size from about 1 x 0.5 to 8 x 2 cm. and may contain from one to six kernels. The kernels are suspended from the inner ventral (upper) surface of the pericarp. The attachment and hence the hilum always lies toward the apex of the seed bearing segment. A limited elongation may take place in the isthmus between two seed-bearing segments of the peanut pod in some varieties of *Arachis hypogaea* L. Gregory, *et al*. stated that the thickness of the pericarp or shell and the ease with which it may be broken open differ greatly among varieties of *A. hypogaea*. The shell may be paper thin or more than 2 mm. thick. There appears to be a positive correlation between size of fruit and thickness of shell but in segregating progenies of thick-large x thin-small strains, the thick-small and thin-large types occasionally appear. In no case, however, did the writers observe thinnest-largest or thickest-smallest combinations.

According to Thompson and Russell (11), the characteristic reticula-

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/1 Figures in parenthesis refer to Literature Cited.

tions underlying the veins are ridges of mechanical tissue arising as outward extensions of the sclerenchymatous mesocarp layer. This layer is continuous except at the sutures. The endocarp consists of a parenchymatous tissue which surrounds the ovules during development. The cells of the endocarp lose their contents and their walls collapse as the pod matures.

In a cross sectional examination of the peanut pod, Richter (9) observed that the mechanical tissue of the mesocarp was interrupted along the sutures. He demonstrated that this was the line of normal dehiscence by cutting the pod into rings and passing them over suitable sized chick peas. The peas were allowed to swell; the rings were always broken along the ventral suture.

The fruit of those varieties which normally produce two seed generally have seven percent of the ovules that fail to be pollinated and an additional ten percent abort during the early growth period, resulting in about 17 percent of the fruit being one-seeded (1). Middleton and Harvey (5) reported that there is a tendency for immature fruit or "pops" (fruit with aborted embryos) to occur on the outermost branches.

Giles (3) reported a need to define "state of maturity" to secure needed quality and a determination of criteria for that quality, both in terms of physical and chemical properties.

Young (12) recognized the need for evaluation of existing shelling machinery and its effects on quality. He suggested a belt-wide laboratory to be used for study and development of new machinery.

Boswell (2) recognized the need for evaluation of strains and products from specific agronomic treatments, and to conduct these studies in an advanced or semi-final stage.

MATERIALS AND METHODS

The peanuts for these studies were obtained from tests at the Perkins Agronomy Station and a farmer cooperator located near Albert, Oklahoma.

A randomized block design was used at both locations with plantings made at recommended rates and depths. The variety Argentine was planted at Perkins while at Albert the six varieties used included Dixie Spanish, Local Spanish, Stratford Spanish, Spantex, Argentine and Spanish 18-38-42.

The irrigation treatments at Perkins consisted of four soil moisture stress levels; no irrigation (T_1), when soil moisture in the estimated root zone receded to seven percent on an oven dry basis (T_2), when soil moisture in the estimated root zone receded to nine percent on an oven dry basis (T_3), and when soil moisture in the estimated root zone receded to 11 percent on an oven dry basis (T_4). These particular percentages correspond to soil moisture tensions for the latter three treatments of seven, three and one atmosphere, respectively, as determined by the pressure membrane apparatus (8). These tensions were determined by soil and irrigation specialists.

No particular moisture level was approximated at Albert as applications were made at the discretion of the cooperator.

Peanuts were harvested from the two center rows of each six-row plot at Perkins, while the Albert samples were composited by replications for each variety in the irrigated and non-irrigated variety tests.

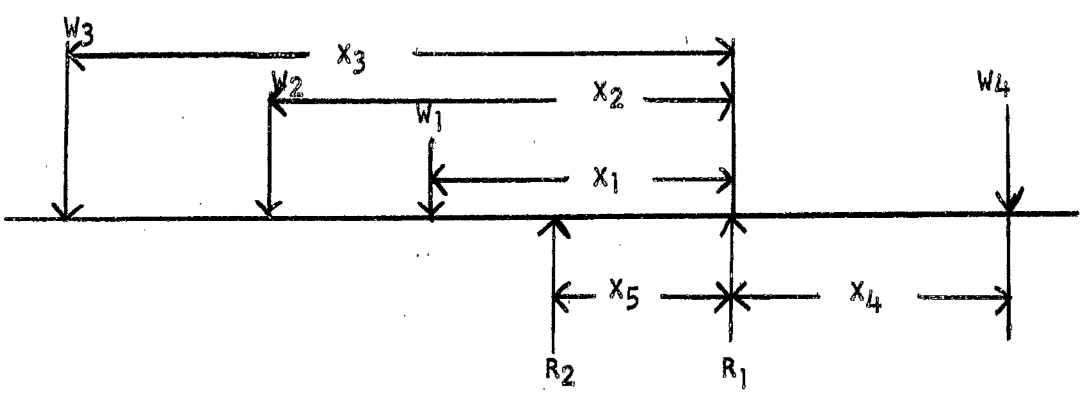
Preliminary measurements of peanuts from the Perkins study were conducted without control of temperature or humidity. Ten peanuts from each plot were measured for the following; pod length, pod diameter, relative weight required to crack the pod, pod thickness at six positions and testa thickness (skin).

The primary data were obtained from the samples in the Perkins test. The peanuts were placed in a room with a constant temperature of 70° F. and humidity of 63 to 66 percent. These samples were allowed to remain for four days, after which measurements were made within the room.

A friction stop micrometer, graduated in thousandths of an inch was used to measure length, diameter and thickness. A torsion balance was employed for the measurement of weight. A device was designed to measure the relative strength of the pod (Figure 1). This machine was constructed by Professor Jay Porterfield of the Agricultural Engineering Department. The following formula was used to convert cracking strength to pounds:

$$R_2X_5 = W_1X_1 + W_2X_2 + W_3X_3 - W_4X_4$$

$$R_2 = \frac{W_1X_1 + W_2X_2 + W_3X_3 - W_4X_4}{X_5}$$



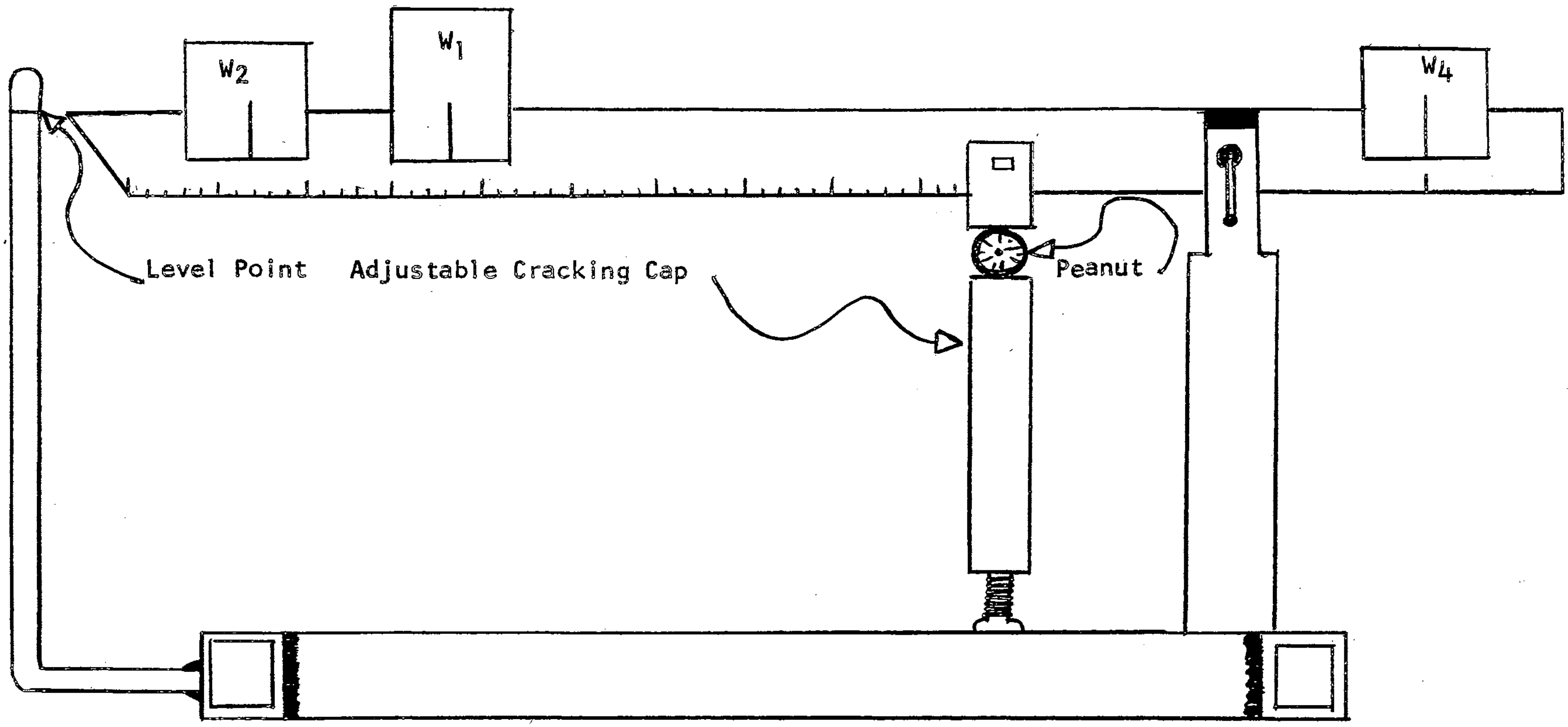


Figure 1. A sketch of the device used to measure the relative cracking strength of peanut pods.

R_1 = Pivot point

W_1 = Beam weight = 1.69 pounds

W_2 =, W_3 =, W_4 = Amount of wts. (1 or 2 lbs.)

R_2 = Cracking point

X_1 = 8.87 Distance from mass center of the beam to pivot point

X_2 =, X_3 =, X_4 = Distance of weight from pivot point

X_5 = 3.87 Distance from pivot point to point of cracking

Example:

$$R_2 = \frac{1.69 \times 8.87 + 2 \times 12 + 1 \times 6 - 1 \times 3.87}{3.87}$$

R_2 = 10.62 lbs. pressure to crack the pod.

The six different positions of pod thickness and the location of these positions are shown in Figure 2.

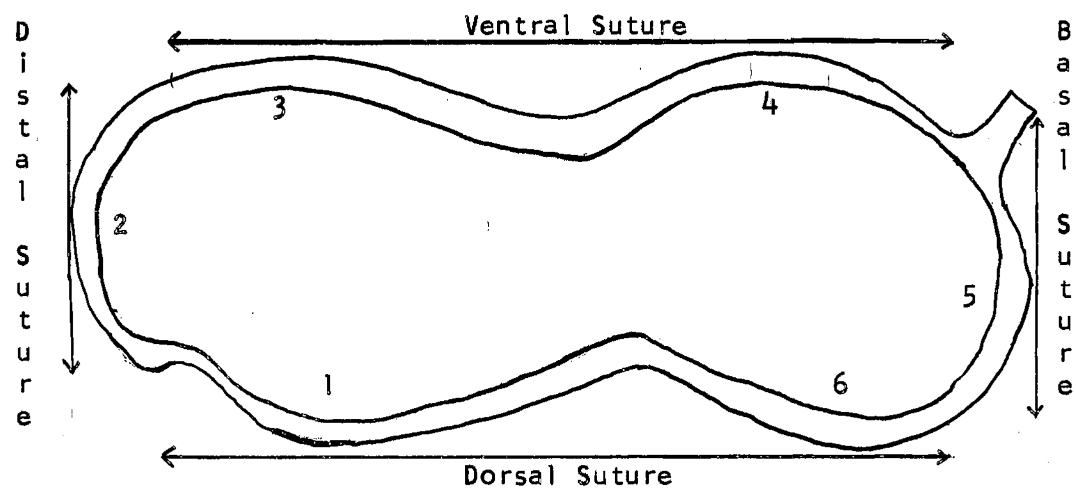


Figure 2. Longitudinal sketch of the peanut pod showing the various positions for shell thickness determinations.

Looking at the half-shell with the distal suture to the left and the dorsal suture at the bottom, position one is located at the dorsal distal suture, position two at the distal suture, position three at the ventral distal suture, position four at the ventral basal suture, position five at the basal suture, and position six at the dorsal basal suture.

The cracking of the peanut was made with the dorsal suture down and the ventral suture up, in line with the center of the cracking cap and at right angles to the horizontal weight bar. The exertion of pressure was on the dorsal and ventral sutures at all times. Number of pods cracking at various points for each treatment in the Perkins test were noted and the percentage of crackings at different points were calculated.

The maximum diameter of each pod was measured on either the basal or distal end.

The thickness of the testa was measured at the right cheek with the distal end pointed away from the body and the hilum up. The distal kernel testa was measured in all cases.

In the final study, 40 peanuts from each treatment were measured for pod length, pod diameter, relative weight required to crack the pod, thickness of pod at positions one and four, weight of individual kernel and thickness of testa (skin).

All analyses were made using the I.B.M. 650 with sums of squares and correlations calculated by the machine. Multiple range, correlations and analyses of variance of the seven variables were determined on the previously mentioned calculations as outlined by Snedecor (10).

The data obtained from the Albert samples were taken as stated above except temperature and humidity were not controlled. The four variables measured for these data included length of pod, diameter of pod, pod cracking strength and thickness of pod at position one.

Additional information was obtained for mean length, width and correlation coefficients for the sized seed of three peanut varieties harvested in 1955. These varieties included Argentine, Spantex and Local Spanish. Slotted and round screens were used to screen samples, and 25 of the peanuts that remained on each screen were then measured for each size group.

RESULTS AND DISCUSSION

Multiple range tests of ranked means for the Perkins data were calculated for each of the following variables; pod length, pod diameter, pod cracking strength, pod thickness at positions one and four, seed weight and testa thickness (Tables I, II, III, IV, V, VI, VII).

The differences among pod lengths were not statistically significant; however, the mean pod lengths for the low irrigation levels (T_1 and T_2) were longer than those for treatments three and four (Table I).

The differences in pod diameter among the four irrigation treatments are illustrated in Table II. The mean of treatment one was significantly wider than the means of two and four. There were no significant differences between the means of treatments one and three nor the means of treatment two, three and four. In this study, it appears that the no irrigation treatment resulted in peanuts which were wider and slightly longer than those of the irrigated treatments.

The relative cracking strength of treatment one was significantly greater than those of treatments two and four. There were no significant differences among the means of treatments one and three nor the means of treatments two, three and four. The relative cracking strength apparently decreased as the irrigation level was increased.

The results for differences among irrigation treatments for the mean pod thickness at positions one and four were very similar except that position four ranged from .0073 to .0078 inch thicker than position

TABLE I

MULTIPLE RANGE TEST OF RANKED MEAN POD LENGTH (INCH) FOR FOUR IRRIGATION TREATMENTS AT PERKINS, 1957*

Treatment	T_4	T_3	T_1	T_2
Means	.886	.896	.914	.921

TABLE II

MULTIPLE RANGE TEST OF RANKED MEAN POD DIAMETER (INCH) FOR FOUR IRRIGATION TREATMENTS AT PERKINS, 1957*

Treatment	T_4	T_2	T_3	T_1
Means	.438	.444	.447	.455

TABLE III

MULTIPLE RANGE TEST OF RANKED MEAN RELATIVE CRACKING STRENGTH OF PODS FOR FOUR IRRIGATION TREATMENTS AT PERKINS, 1957*

Treatment	T_4	T_2	T_3	T_1
Means	31.44	32.74	35.61	38.04

TABLE IV

MULTIPLE RANGE TEST OF RANKED MEAN POD THICKNESS POSITION ONE (INCH) FOR FOUR IRRIGATION TREATMENTS AT PERKINS, 1957*

Treatment	T_4	T_3	T_2	T_1
Means	.0292	.0308	.0315	.0352

TABLE V

MULTIPLE RANGE TEST OF RANKED MEAN POD THICKNESS POSITION FOUR (INCH) FOR FOUR IRRIGATION TREATMENTS AT PERKINS, 1957*

Treatment	T_4	T_3	T_2	T_1
Means	.0365	.0384	.0393	.0425

TABLE VI

MULTIPLE RANGE TEST OF RANKED MEAN SEED WEIGHT (GRAM) FOR FOUR IRRIGATION TREATMENTS AT PERKINS, 1957*

Treatment	T_4	T_3	T_2	T_1
Means	.3387	.3792	.3821	.4143

TABLE VII

MULTIPLE RANGE TEST OF RANKED MEAN TESTA THICKNESS (INCH) FOR FOUR IRRIGATION TREATMENTS AT PERKINS, 1957*

Treatment	T_1	T_4	T_3	T_2
Means	.0017	.0017	.0018	.0019

* Any two means not underscored by the same line are significantly different at the 5 percent level. The figures for each treat-mean (T) represent the mean of 160 samples.

one (Tables IV and V). In both positions the means of treatment one were significantly thicker than those of treatments three and four. Similarily, there were no statistical differences in the mean pod thickness between treatments one and two nor among treatments two, three and four. Pod thickness tended to decrease as the irrigation level was increased.

The variance of mean weight per seed for treatment one was significantly higher than treatments two, three and four. The seed of treatment four weighed significantly less than treatments two and three. There was no statistical difference between treatments two and three (Table VI). Seed weight tended to decrease as the irrigation level was increased.

The mean testa thickness for the various irrigation treatments were very similar and did not differ statistically. Apparently, a more sensitive measuring device will be needed to ascertain differences in testa thickness.

A summary for the analyses of variance for the seven variables on Argentine peanuts is shown in Table VIII. Significant differences among irrigation treatments were obtained for each variable except pod length and testa thickness. These data indicate that irrigation treatments had no appreciable effect on the length of pod. It was apparent that the equipment was inadequate for a critical measurement as testa thickness. This was further evidenced by the high coefficient of variation of 56.6 percent. The coefficients of variability for pod diameter, pod length and seed weight were 8.7, 18.4 and 22.3 percent, respectively. The coefficients of variability for positions one and four and for

TABLE VIII

ANALYSES OF VARIANCE FOR FOUR IRRIGATION TREATMENTS FOR SEED WEIGHT, POD THICKNESS AT POSITIONS ONE AND FOUR, POD DIAMETER, POD CRACKING STRENGTH, POD LENGTH AND TESTA THICKNESS, PERKINS, 1957

		Seed Weight	Pod Thickness Position One	Pod Thickness Position Four	Pod Diameter	Cracking Strength	Pod Length	Testa Thickness
Source	d.f.	M.S.	M.S.	M.S.	M.S.	M.S.	M.S.	M.S.
Total	639							
Replications	3	.0170	.0001	.0002	.0044	68.593	.0156	.00000000
Treatments	3	.1536**	.0010*	.0009*	.0078*	307.939*	.0411	.00000116
Exp. error	9	.0077	.0002	.0002	.0015	263.342	.0277	.00000101
Samp. error	624	.0025	.0000	.0000	.0000	280.612	.0064	.00000026
C. V. (percent)		22.3	44.5	36.0	8.7	46.9	18.4	56.6

* Exceeds 5% level of significance.
** Exceeds 1% level of significance.

cracking strength were 44.5, 36.0 and 46.9 percent, respectively. The latter are rather high, which would indicate a need for more precise equipment to measure testa thickness, cracking strength and pod thickness.

The correlation coefficients for each of the four irrigation treatments for combinations of the seven variables for Argentine peanuts grown at Perkins are shown in Table IX.

Seed weight was significantly correlated for all treatments with pod length, pod diameter and pod thickness positions one and four. Seed weight was significantly correlated with cracking strength in treatments two and four. Seed weight was correlated with testa thickness in treatments one, two and four. Seed weight was positively correlated with each of the six variables in each of the four treatments, except for treatment three in cracking strength and testa thickness, and treatment one in cracking strength.

Pod thickness position one was significantly correlated for each treatment with pod thickness position four, pod diameter, pod cracking strength and testa thickness. Pod length was highly correlated with pod thickness position one in treatments one, three and four. Pod thickness position four was significantly correlated with pod diameter and pod cracking strength for each treatment. Pod thickness position four was significantly correlated with pod length in treatments three and four and with testa thickness for treatments one, two and four. The data indicate that similar results may be obtained by measuring the pod thickness of either position one or position four. Pod thickness was not correlated with pod length sufficiently for an established

TABLE IX

CORRELATION COEFFICIENTS FOR EACH OF THE FOUR IRRIGATION TREATMENTS FOR THE SEVEN VARIABLES IN ALL COMBINATIONS, PERKINS, OKLAHOMA, 1957

Variables	Treatments T_1	T_2	T_3	T_4
Weight of seed vs. pod length	.588**	.437**	.691**	.547**
Weight of seed vs. pod diameter	.592**	.563**	.586**	.517**
Weight of seed vs. thickness position one	.372**	.533**	.346**	.432**
Weight of seed vs. thickness position four	.359**	.547**	.303**	.428**
Weight of seed vs. cracking strength	.129	.265**	.154	.245**
Weight of seed vs. testa thickness	.298**	.318**	.101	.185*
Thickness position one vs. thickness position four	.596**	.785**	.788**	.727**
Thickness position one vs. pod diameter	.510**	.576**	.442**	.482**
Thickness position one vs. cracking strength	.317**	.322**	.317**	.233**
Thickness position one vs. testa thickness	.187*	.307**	.187*	.226**
Thickness position one vs. pod length	.288**	.155	.210**	.213**
Thickness position four vs. pod diameter	.500**	.620**	.533**	.505**
Thickness position four vs. cracking strength	.199*	.327**	.349**	.259**
Thickness position four vs. pod length	.141	.132	.269**	.245**
Thickness position four vs. testa thickness	.179*	.249**	.135	.179*
Pod diameter vs. pod length	.416**	.297**	.384**	.248**
Pod diameter vs. testa thickness	.245**	.241**	.187*	.106
Pod diameter vs. cracking strength	.102	.196*	.176*	.239**
Cracking strength vs. pod length	.114	.105	.080	.235**
Cracking strength vs. testa thickness	.208**	.266**	.109	.141
Pod length vs. testa thickness	.133	.181*	.121	.153

* Exceeds 5% level of significance.
** Exceeds 1% level of significance.

trend. Pod thickness position one is closer than position four to the point where pods commonly broke when measuring the cracking strength.

Pod diameter was significantly correlated with pod length in each treatment, with testa thickness in treatments one, two and three, and with cracking strength in treatments two, three and four.

Pod cracking strength was significantly correlated with pod length in treatment four. Pod cracking strength and testa thickness were correlated for treatments one and two.

Pod length and testa thickness were significantly correlated in treatment two, while very low non-significant correlations were obtained for treatments one, three and four.

Among the 21 combinations, treatments two and four had the greater number of significant correlations than treatments one and three.

Correlation coefficients in an irrigated and non-irrigated test for four variables and six varieties grown near Albert, Oklahoma in 1957 are shown in Table X.

Pod length and pod diameter were significantly correlated for Dixie Spanish, Local Spanish and Stratford Spanish in the non-irrigated test and for Spantex in the irrigated test. Low correlation coefficients were obtained for pod length with cracking strength and pod thickness, and pod diameter with cracking strength for each variety in the non-irrigated and irrigated tests. Low correlations of these same combinations were also obtained in the non-irrigated treatment for the Perkins data except for pod thickness position one with pod length. In the irrigated test, Local Spanish, Spantex, Argentine, Stratford Spanish and Spanish 18-38-42 were highly correlated for pod diameter and pod thickness. No signifi-

TABLE X

CORRELATION COEFFICIENTS FOR PEANUT VARIETIES GROWN IN AN IRRIGATED AND NON-IRRIGATED TEST FOR POD LENGTH, POD DIAMETER, POD CRACKING STRENGTH AND POD THICKNESS POSITION ONE, ALBERT, OKLAHOMA, 1957

Variety	Pod Length vs. Pod Diameter	Pod Length vs. Cracking Strength	Pod Length vs. Pod Thickness	Pod Diameter vs. Cracking Strength	Pod Diameter vs. Thickness	Cracking Strength vs. Thickness
Non-Irrigated						
Dixie Spanish	.360**	.053	.082	.292*	.336*	.471**
Local Spanish	.431**	.158	.005	.143	.238	.101
Spantex	.082	.131	.074	.056	.007	.040
Argentine	.098	.182	.270	.033	.220	.150
Stratford Spanish	.334*	.104	.024	.103	.075	.106
Spanish 18-38-42	.215	.182	.208	.041	.178	.123
Irrigated						
Dixie Spanish	.029	.073	.036	.181	.163	.427**
Local Spanish	.123	.226	.074	.085	.361**	.343**
Spantex	.426**	.224	.242	.009	.393**	.431**
Argentine	.116	.090	.024	.356**	.478**	.477**
Stratford Spanish	.116	.072	.062	.021	.276*	.010
Spanish 18-38-42	.199	.273*	.012	.214	.303*	.032

* Exceeds 5% level of significance.
** Exceeds 1% level of significance.

cant correlation was obtained in the non-irrigated test for these varieties. A greater number of positive correlations was obtained for the varieties in the irrigated test than for those in the non-irrigated test. Pod diameter and pod thickness were significantly correlated for each variety in the irrigated test except Dixie Spanish. In the non-irrigated test, Dixie Spanish was the only variety significantly correlated for pod diameter and pod thickness.

In the irrigated test, cracking strength was highly correlated with pod thickness for Local Spanish, Spantex, Dixie Spanish and Argentine. The correlations were very low for these variables in the non-irrigated test except for Dixie Spanish. These data indicate that pod thickness was more closely related to pod diameter and cracking strength when moisture was available for maximum growth.

The mean length and width and correlation coefficients for preliminary studies on sized seed of three peanut varieties are shown in Table XI. A high correlation between length and width was obtained for each size and variety. This indicates that with screened material, pod size may be classified on the basis of either length or diameter. The results were similar to those obtained by Porterfield and Smith (7) with cottonseed.

In preliminary studies, analyses of variance for four irrigation treatments for pod thickness of six different positions of Argentine peanuts grown at Perkins, Oklahoma in 1957 are shown in Table XII. Position one appeared to give the most consistent results and more precision in measurements in each irrigation treatment, and hence was selected for the main study. As position one was at the distal dorsal suture,

TABLE XI

MEAN LENGTH, WIDTH AND CORRELATION COEFFICIENTS FOR THE SIZED SEED OF THREE PEANUT VARIETIES HARVESTED IN 1955

	Argentine			Spantex			Local Spanish		
Size (inch)	Mean Length (inch)	Mean Width (inch)	r 1/	Mean Length (inch)	Mean Width (inch)	r 1/	Mean Length (inch)	Mean Width (inch)	r 1/
Slotted Screens									
21/64 x 3/4	.478	.335	.995**						
19/64 x 3/4	.471	.348	.990**						
17/64 x 3/4	.454	.337	.988**	.432	.292	.995**	.437	.301	.994**
15/64 x 3/4	.393	.303	.995**	.396	.273	.993**	.409	.294	.995**
14/64 x 3/4				.386	.234	.988**	.397	.258	.989**
12/64 x 3/4				.366	.211	.988**	.364	.239	.987**
Round Screens									
21/64	.453	.355	.983**	.441	.337	.990**			
19/64	.419	.316	.996**						
17/64	.390	.277	.991**	.416	.300	1.000**	.417	.307	.994**
14/64				.358	.243	.990**	.381	.232	.996**

1/ Calculations are based on 25 measurements for each size and variety.

** Exceeds 1% level of significance.

TABLE XII

ANALYSES OF VARIANCE FOR FOUR IRRIGATION TREATMENTS FOR POD THICKNESS AT SIX POSITIONS FOR ARGENTINE PEANUTS GROWN AT PERKINS, OKLAHOMA, 1957

		Position 1	Position 2	Position 3	Position 4	Position 5	Position 6
Source	d.f.	M.S.	M.S.	M.S.	M.S.	M.S.	M.S.
Total	159						
Replications	3	.000,078	.000,006	.000,024	.000,027	.000,066	.000,038
Treatments	3	.000,062	.000,070	.000,119	.000,105	.000,074	.000,120
Experimental Error	9	.000,012	.000,037	.000,082	.000,037	.000,085	.000,026
Sampling Error	144	.000,036	.000,035	.000,063	.000,129	.000,065	.000,079
C.V. (percent)		11.7	22.7	26.1	17.2	21.4	14.7

position four was selected as the alternate position since position four was on the opposite side and end. The data obtained in subsequent studies indicate that measurements from either position one or four would have been adequate.

The analyses of variance on the preliminary data for pod diameter, pod length, pod cracking strength and testa thickness are shown in Table XIII. Pod diameter had the smallest coefficient of variation for irrigation treatments, followed by pod cracking strength, pod length and testa thickness. These data were based on a small number of samples and were used as a guide for further procedures.

In the final study of Argentine peanuts for four irrigation treatments of 640 peanuts, the number of pods cracked and the position of the crack are shown in Table XIV. The number of pods cracking within the irrigation treatments for each position was very similar except for points one and three. Fewer pods cracked at the distal suture in irrigation treatments three and four than in one and two. Conversely, fewer pods cracked at the lateral vertical point for irrigation treatments one and two than for treatments three and four. Fifty-nine percent of the breaks occurred at the distal suture. The basal suture and lateral vertical breaks accounted for 16 and 20 percent, respectively. The remaining seven points of breakage contained five percent of the breaks. It was noted in a large percent of the cases the basal end was the largest in diameter and, therefore, would take the pressure first. The crack occurred before the cracking caps of the device had placed pressure at all points along the sutures. The greatest percent of first cracking occurring at the distal suture which would indicate that the distal

TABLE XIII

ANALYSES OF VARIANCE FOR FOUR IRRIGATION TREATMENTS FOR POD DIAMETER POD LENGTH, POD CRACKING STRENGTH AND TESTA THICKNESS FOR ARGENTINE PEANUTS GROWN AT PERKINS, OKLAHOMA, 1957

		Pod Diameter	Pod Length	Cracking Strength	Testa Thickness
Source	d.f.	M.S.	M.S.	M.S.	M.S.
Total	159				
Replications	3	.001,203	.006,873	20.94	.000,000,017
Treatments	3	.001,573	.021,517	22.36	.000,000,953
Exp. Error	9	.000,474	.009,654	13.27	.000,000,332
Samp. Error	144	.000,494	.007,296	30.34	.000,002,527
C. V. (percent)		1.50	10.68	2.21	32.46

TABLE XIV

THE NUMBER OF PODS CRACKED IN EACH OF TEN POINTS IN THE FOUR TREATMENTS, AND THE PERCENTAGES AT EACH POINT FOR 640 PEANUTS GROWN AT PERKINS, OKLAHOMA, 1957

	Points of Cracking*										
Treatment	0	1	2	3	4	5	6	7	8	9	Totals
No Irrigation (T_1)	2	101	28	21	2	1	2	1	2	0	160
7% Moisture (T_2)	4	102	22	25	3	0	0	1	1	1	159
9% Moisture (T_3)	3	92	22	43	1	0	0	0	0	0	161
11 % Moisture (T_4)	5	83	30	41	0	0	0	1	0	0	160
Totals	14	378	102	130	6	1	2	3	3	1	640
Percent	2	59	16	20	1	-	-	-	-	-	98%

* Position 0 - Distal and basal sutures (simultaneously)
Position 1 - Distal suture
Position 2 - Basal suture
Position 3 - Lateral vertical
Position 4 - Dorsal suture
Position 5 - Ventral suture
Position 6 - Distal ventral suture point
Position 7 - Lateral horizontal
Position 8 - Distal dorsal suture point
Position 9 - Dorsal and ventral sutures (simultaneously)

suture was the thinnest point and the most readily broken in Argentine pods. Actually, the thinnest point on the pod was at the distal suture (Table XV).

Richter (9) used water soaked chick peas, inserted in cut rings of the pod. As the chick peas swelled, the rings were broken at the ventral suture in all cases. He could not cut a ring from the distal suture as it tapers to a point; therefore, he could only show that the pod was broken at the ventral suture in preference to the dorsal suture. The point of first crack could not have been determined from his data since the distal or basal sutures were not under consideration.

In Table XV, position two or the distal suture was the thinnest of six measured positions. The other means ranked from thinnest to thickest including positions one, five, six, three and four. The corresponding names applied to these positions are dorsal distal suture, the basal suture, dorsal basal suture, ventral distal suture and the ventral basal suture (Figure 2). It should be noted that the thickest area of the pod is generally across the point of constriction which was not one of the positions of measure.

TABLE XV

RANKED MEANS FOR FOUR TREATMENTS OF POD THICKNESS AT SIX POSITIONS FOR ARGENTINE PEANUTS GROWN AT PERKINS, OKLAHOMA, 1957

	Positions *					
	2	1	5	6	3	4
Means	.0267	.0282	.0320	.0336	.0349	.0353

* Measurements were made on 160 peanuts for each position. These positions are illustrated in Figure 2.

SUMMARY AND CONCLUSIONS

Seven pod and kernel characteristics were studied for the Argentine variety in the Perkins irrigation test and characteristics were studied for the six varieties grown in an irrigated and non-irrigated variety test near Albert. Seed of three varieties grown in 1955 were also used for the sized seed length and width study. These studies were made to determine the most useful pod and kernel characteristics, to provide information for use in peanut improvement, and for selecting the planter and planting seed. The processor may also benefit from this study of pod and kernel characteristics.

In the Perkins test, the non-irrigated peanuts, without prolonged drouth stress, had heavier kernels, longer, wider and thicker pods, which required more weight to crack than the irrigated peanuts.

The data indicate similar results may be obtained by measuring the pod thickness at either position one or position four. Similarily, the size of the kernel may be obtained in sized seed by measuring either the length or the width of the kernels.

In most instances, the basal end of the peanut pod was wider than the distal end. The highest percent of first breakage and the thinnest point of the pod was at position two or at the distal suture. Conversely, a small number of breaks occurred at the ventral suture and the ventral basal suture was the thickest position measured. In a previous work, Richter (9) reported that the ventral suture broke in preference to the dorsal suture, which did not take the basal or distal sutures into consideration.

Further character and cracking studies are needed to establish dependability of expression for various varieties and environmental conditions. More precise and sensitive equipment should be employed to measure testa thickness, cracking strength and pod thickness.

Genetical and breeding studies on peanuts are needed to establish the breeding behavior of the various characters of the pod and kernel in each variety.

Evaluation of existing shelling machinery is needed to measure its effects on quality.

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