Physical Characteristics and Field Performance of Mechanically Graded Acid Delinted Cottonseed

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EXPERIMENT STATION

CONTENTS

THE RESEARCH on which this report is based is in cooperation with the state agricultural experiment stations in other cotton-growing states with the Agricultural Engineering Research Branch of the U.S. Department of Argiculture as part of a regional research project on cotton mechanization (S-2), and with the Oklahoma Cotton Research Foundation.

Physical Characteristics and Field Performance of Mechanically Graded, Acid Delinted Cottonseeds

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Cotton planter development work has been greatly hampered by the non-uniformity in size and shape of cottonseeds. From an engineering standpoint, the development of a precise metering device to select and drop cottonseeds into the drill is impractical unless the seeds are uniform in size and shape.

This problem was overcome with corn seeds by mechanical grading to obtain seeds uniform in size and shape for planting. Planting corn is now a relatively precise operation.

A study was initiated in 1953 to analyze the physical characteristics of several varieties of acid delinted cottonseeds of several varieties, and to determine the practicability of mechanically grading acid delinted cottonseeds. This study also included an investigation of the effects of these physical characteristics on the field performance of acid delinted cottonseeds. The results obtained will be useful in future planter design and development work.

Both laboratory and field tests were conducted in 1953 and 1954. A commercial grading machine was used for the laboratory tests. This machine effects separation by means of perforated screens and has an adjustable air blast for cleaning the seeds. Round-hole screens were used to separate the acid delinted cottonseeds into diameter classes of one sixty-fourth inch graduation. The detailed procedure used in conducting the laboratory and field tests is described in the appendix, page 23.

1953 Results

Laboratory Test. Acid delinted cottonseeds of three varieties (Stoneville 62, Stormproof No. 1, and Lankart 57) were mechanically graded in the 1953 laboratory test. The average seed size (diameter) distribution and grading accuracy of these three varieties are shown in Table 1. Most of the seeds in Stoneville 62 and Stormproof No. 1 were between 11/64 and 13/64 of an inch in diameter, and most of the seeds in Lankart 57 were between 12/64 and 14/64 of an inch in diameter. The Lankart 57 seeds were not run over size 17 or 15 screens.

The accuracy of grading does not follow any definite pattern among the different seed sizes; however, more than one pass over a particular screen was required to achieve the accuracy shown in Table 1. There does seem to be a slight trend towards higher grading accuracy for the smaller seeds in each variety.

The apparent density or the number of seeds per pound for two varieties and seven diameter classes of acid delinted cottonseeds are shown in Table 2. The number of seeds per pound, as would be expected, increases as the seed diameter decreases. Empirical equations which closely express the relationship between seed size and number of seeds per pound are as follows:

Stoneville 62

$$Y = \frac{X}{0.64X - 5.19} 10^3$$

Stormproof # 1

$$Y = \frac{X}{0.51X - 3.59} 10^3$$

Where Y is the number of seeds per pound and X is the seed size (i.e. 12, 14, etc.)

The relationships are shown graphically in Figure 1.

The separation of acid delinted cottonseeds into diameter classes was relatively easy to accomplish with the commercial grading machine. Cottonseeds, however, vary in length as well as diameter. The average seed length of acid delinted cottonseeds for two varieties and seven diameter classes is shown in Table 3. Statistical analysis of the data summarized in this Table revealed a highly significant correlation between seed diameter and seed length for both varieties. The correlation coefficient for Stoneville 62 was 0.9731 and for Stormproof No. 1 it was 0.9995. In other words, 99% of the change in length of Stormproof No. 1 seeds was associated with the change in diameter. These correlation coefficients are based on the following regression curves which express the length-diameter relationship for these two varieties:

Stoneville 62

$Y = -0.0681 + 0.06056\ X - 0.00209\ X^2$
Std. Error of Estimate $= 0.00337$

Stormproof # 1

$Y = -0.3790 + 0.10105\ X - 0.00345\ X^2$
Std. Error of Estimate $= 0.00233$

Where Y is the seed length in inches and X is the seed size (i.e. 12, 14, etc.)

These relationships are shown in Figure 2. The highly significant correlation coefficients indicate that acid delinted cotton seeds of these two varieties might be graded on the basis of either length or diameter; i.e. separation by diameter automatically effects a separation by length, or a separation by length automatically effects a separation by diameter.

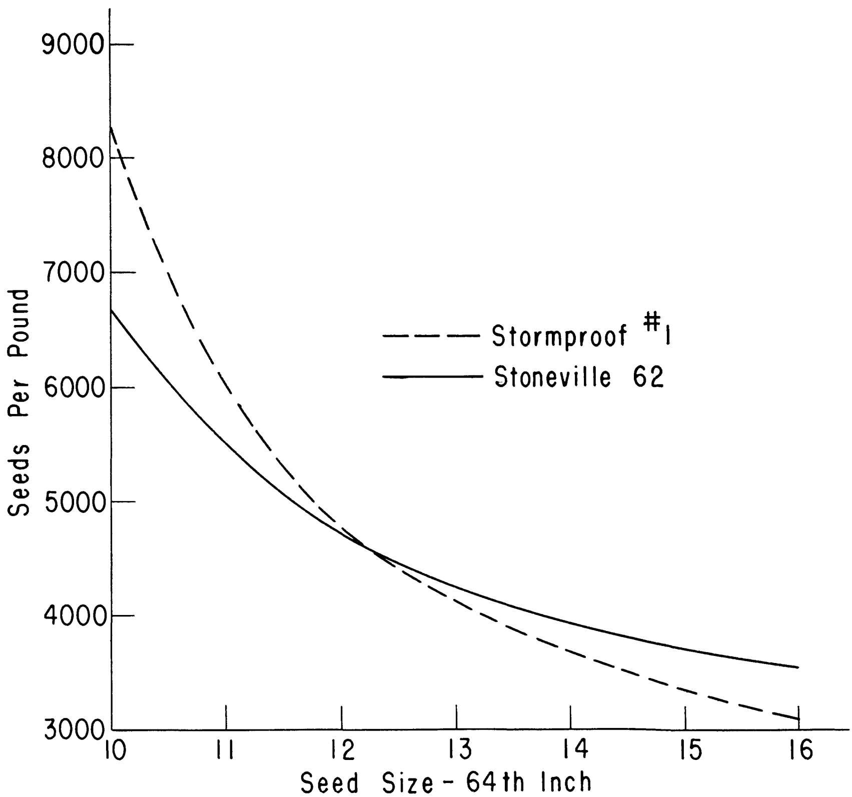

Figure 1. Relationship between seed diameter and number of seeds per pound.

Field Test. Six diameter classes of one variety of acid delinted cottonseeds were planted in the 1953 field test. Details of the field testing procedure are included in the appendix. After the plants started to emerge, daily stand counts were made to determine the rate of emergence among the seed sizes and planting dates. The rate of emergence among the six seed sizes was not appreciably different. The plants from the small seeds seemed to emerge just as quickly as those from large seeds. The total emergence, however, did vary widely among the seed sizes, as shown in Table 4.

The difference in percentage of emergence among the seed sizes and between planting dates was highly significant. However, the performance of the different seed sizes was not consistent for the two planting dates. The intermediate seed sizes (14, 13, 12 and 11) emerged better than did the small or large seeds (10 and 15).

The emergence data were further examined to determine the influence of emergence in each hill on the total emergence. Table 5 shows the number of hills of each seed size containing 0, 1, 2, or 3 plants per hill for the two planting dates.

Analysis of the data in Tables 4 and 5 revealed a close correlation

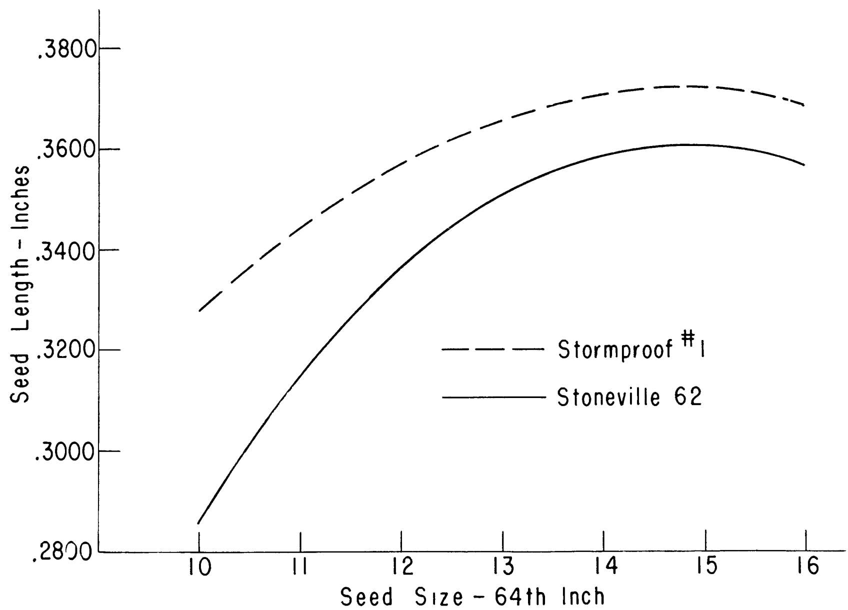

Figure 2. Relationship between seed diameter and seed length for two varieties.

between hill size (plants per hill) and total emergence. Table 6 gives these correlation coefficients for two dates of planting.

All of the correlation coefficients given in Table 6 are highly significantly different from zero, except 0.113. As the total emergence increased the number of hills with three plants increased and the number of hills with zero plants decreased. Indications are that planting three seeds per hill does not necessarily increase the chances of getting at least one of these seeds to emerge.

Plant growth characteristics, plant height, plant width, height of high boll, and height of low boll, were measured at harvest time. Analysis of the data revealed that these characteristics were not significantly affected by seed size, but were significantly affected by date of planting.

The harvest data taken on the 1953 field test included total yield, boll size, lint/seed ratio, and lint turnout. These harvest data are shown in Table 7. The total yield of lint was significantly different among the seed sizes and between planting dates. The seed sizes that gave the highest emergence also resulted in the highest yield. The correlation coefficient of emergence to yield for the cotton planted on May 27 was 0.991, and for cotton planted on June 10 it was 0.866. Both correlation coefficients were highly significantly different from zero. This high correlation between emergence and yield is unusual, because generally yield is relatively uniform over a wide range of plant populations.

The lint-seed ratio was significantly different among the seed sizes and between planting dates. There was no apparent pattern to the differences in the lint-seed ratio among the seed sizes. Analysis of these data did not reveal any definite relationship between lint-seed ratio and yield or emergence.

Boll size was significantly different among the seed sizes and between planting dates. The cotton planted on May 27 produced smaller bolls than did the cotton planted on June 10. There was no apparent boll size pattern among the seed sizes and the interaction of seed size and planting date was highly significant.

1954 Results

Laboratory Test. Acid delinted cottonseed of 10 varieties were graded in the 1954 laboratory tests. The seed size (diameter) distribution for the ten varieties is shown in Table 8. It is evident that the distribution of seed sizes varies over a wide range among the ten varieties. Most of the seeds in each variety fall into two of the intermediate diameter classes. In all varieties except Mebane 6801 and Lankart 57 an average of 73.95% of the seeds are between 14/64 and 11/64 of an inch in diameter. In Mebane 6801, 60.58% of the seeds are between 13/64 and 10/64 of an inch in diameter. Most (66.44%) of the Lankart 57 seeds are between 15/64 and 12/64 of an inch in diameter. Results of the 1953 field test indicate that these intermediate sizes give the best field performance. Figure 3 shows graphically the seed size distribution of three varieties of acid delinted cottonseeds.

The average number of acid delinted seeds per pound for ten varieties of cottonseeds is shown in Table 9. The difference in number of seeds per pound is highly significant among varieties and among diameter classes within each variety. The number of seeds per pound

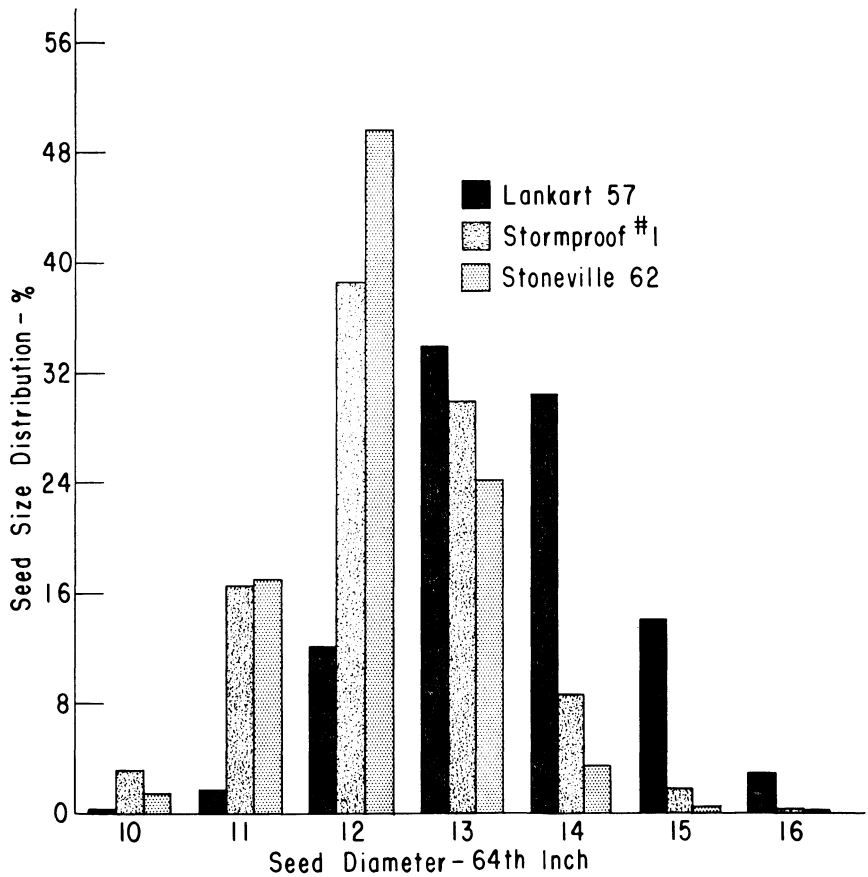

Figure 3. Seed size distribution for three varieties of cottonseeds.

increases as the seed diameter decreases. Table 10 shows the regression equations given by statistical analysis of the data summarized in Table 9. These equations express, very closely, the relationship between seed size and number of seeds per pound within the limits of the data used to find the constants. All of the correlation coefficients in Table 10 are highly significantly different from zero. The regression curves (Fig. 4) show the relationship between seed size and number of seeds per pound for three of the varieties of acid delinted cottonseeds.

The grading accuracy for ten varieties of acid delinted cottonseed, as shown in Table 11, is highly significantly different among varieties and among diameter classes in each variety. Some varieties resulted in a much higher grading accuracy, indicating that the seeds are more uniform in size and shape in some varieties than in others. For example, Deltapine 15 had the highest average grading accuracy with 95.28%, and Mebane 6801 had the lowest with 74.93%. The higher grading accuracy with the smaller seeds in all varieties (Table 11) indicates that

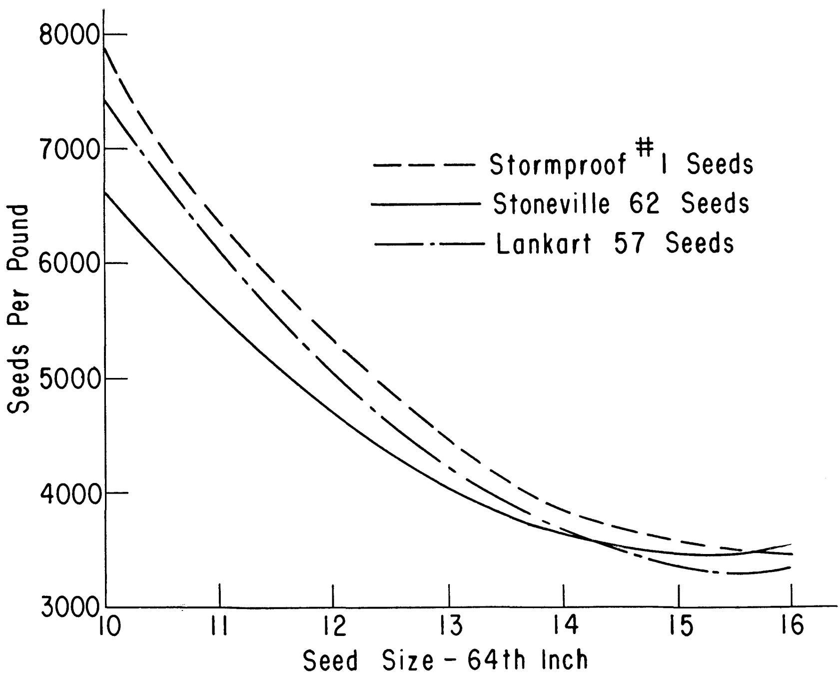

Figure 4. Relationship between seed size and number of seeds per pound for three varieties.

the smaller seeds are more uniform in size and shape. The diameter classes that represent the greatest quantity of seeds in each variety also have high grading accuracy. Regression equations based on statistical analysis of the data in Table 11 are shown in Table 12. These equations express, very closely, the relationship between seed size and grading accuracy for each of the ten varieties of cottonseeds. The correlation coefficients are all significantly different from zero, and all except those for Lankart 57 and Qualla are highly significantly different from zero.

The average seed length for each diameter class in ten varieties of acid delinted cottonseeds is shown in Table 13. Statistical analysis of these data gave a highly significant difference in seed length among varieties and among diameter classes. The variety and diameter class interaction was highly significant.

Since cottonseeds vary in both length and diameter, the relationship between these two physical dimensions was determined. The re-

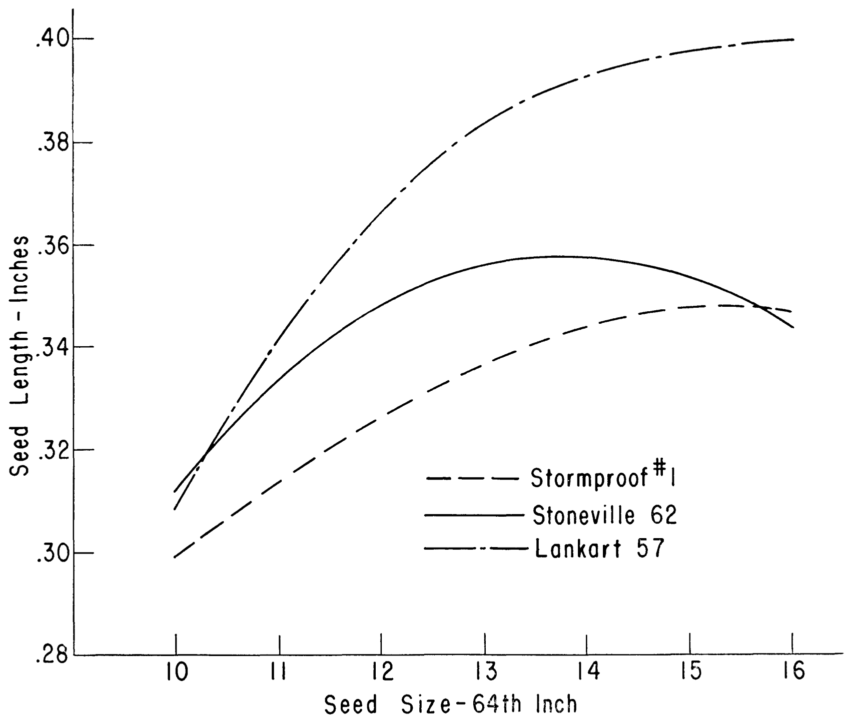

Figure 5. Relationship between seed diameter and seed length for three varieties.

gression equations based on statistical analysis of the data in Table 13 are shown in Table 14. The correlation coefficients in Table 14 are all highly significantly different from zero, which means that seeds separated into diameter classes are automatically separated into length classes. The regression curves for three of the varieties are shown in Figure 5.

The average percentage of germination for seven diameter classes and ten varieties of acid delinted cottonseeds is shown in Table 15. Germination was significantly different among the diameter classes and among varieties. The germination was highest for the diameter classes representing the greatest quantity of seeds in each variety.

Field Test. Three varieties generally grown in Oklahoma, selected from the ten varieties used in the laboratory tests, were planted in the 1954 field test. The average percentages of emergence for the three varieties, six diameter classes, and two planting dates are shown n Table 16. The emergence is significantly different among varieties, among diameter classes, and between dates of planting. The best emergence was obtained with the diameter classes that represent the greatest quantity of seeds in each variety.

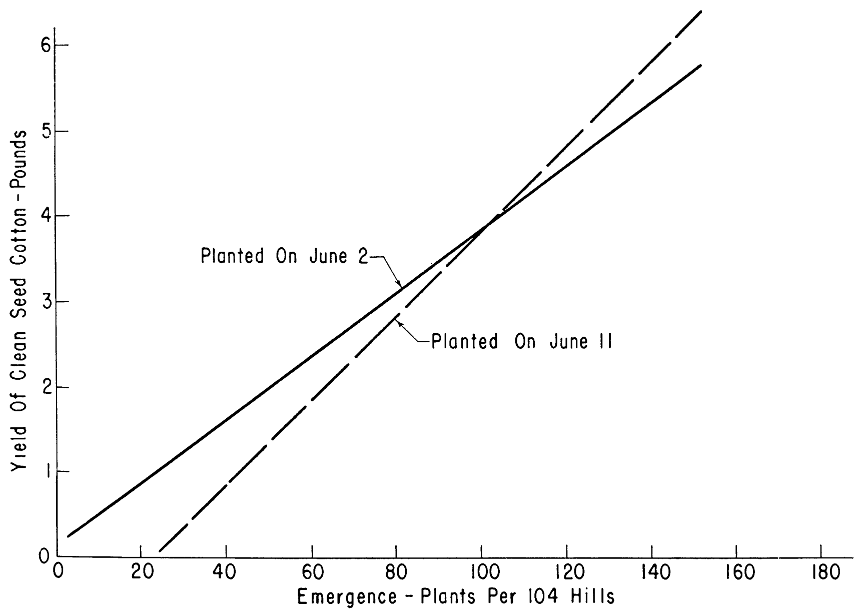

Figure 6. Relationship between yield and emergence for Lankart 57 cotton planted on two dates with graded seeds.

The procedure used in planting the field test (see appendix) made it possible to record the number of plants that emerged in each hill. Table 17 shows the number of hills containing 0,1,2, or 3 plants for the three varieties and six diameter classes.

Analysis of the data in Tables 16 and 17 showed a close correlation between emergence and hill size (plants per hill). Table 18 shows the correlation coefficients of emergence to hill size for the three varieties.

Plant height was the only plant growth characteristic that was significantly different among seed sizes and varieties. The interactions of variety and seed size, and of variety and seed size and date of planting were also significant.

The yield of clean seed cotton for six seed sizes and three varieties of cotton is shown in Table 19. The yield is highly significantly different among seed sizes. The interactions of variety and seed size and of variety and seed size and date of planting are significant. There is a close correlation between emergence and yield; i.e., the seed size that gave the highest emergence also resulted in the highest yield. Table 20 shows the correlation coefficients between emergence and yield for the three varieties. These correlation coefficients are based on straight regression lines.

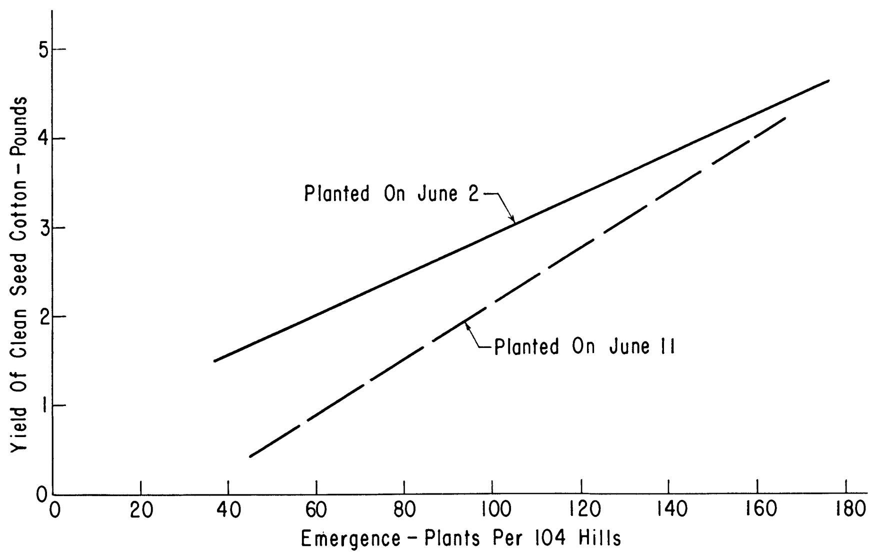

Figure 7. Relationship between yield and emergence for Stormproof #1 cotton planted on two dates with graded seeds.

The boll size was significantly different among varieties, among seed sizes, and between planting dates. The interactions of variety and seed size, and of variety and seed size and planting date, are also significant. The boll size seems to follow the same general trend as yield. Table 21 shows the boll size for three varieties and six seed sizes.

The seed/lint ratio was significantly different among varieties and seed sizes and the interaction of variety and seed size was significant. There is no apparent relationship between seed-lint ratio and yield, boll size, or emergence.

Summary

Acid delinted cottonseeds of varieties in this study contained at least seven different diameter classes of seeds (one sixty-fourth inch gradation) ranging from 16/64 to 10/64 of an inch in diameter. The intermediate diameter classes represented the greatest quantity of seeds in each variety. For example, in Lankart 57 cottonseeds about 66% of the seeds were 14/64 and 13/64 of an inch in diameter. Thus the data indicate that planting seeds can be graded very closely to an intermediate size and a high percentage of the seeds can be retained for planting.

The number of seeds per pound increased as the seed diameter de-

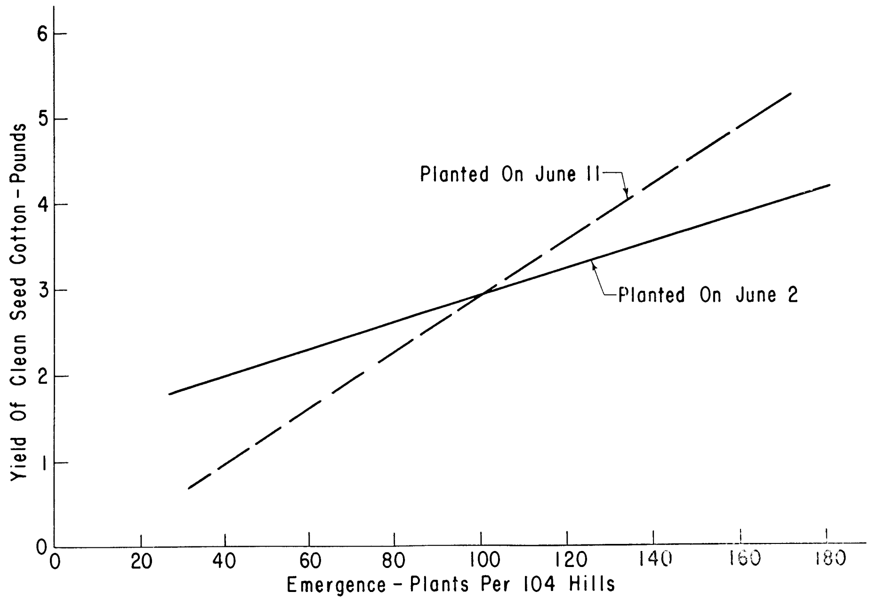

Figure 8. Relationship between yield and emergence for Stoneville 62 cotton planted on two dates with graded seeds.

creased. Regression equations were developed which show the approximate relationship between seed diameter and number of seeds per pound for acid delinted cottonseeds of 10 varieties. These equations can be useful in determining the pounds of seeds of a certain size needed for a desired seeding rate.

In each variety, higher grading accuracy was obtained with the smaller seeds, indicating that these smaller seeds are more uniform in size and shape than are the larger seeds. The intermediate size seeds in each variety fell into the range of high grading accuracy. Tests for grading accuracy also indicated that the uniformity in the size and shape of cottonseeds varies among varieties.

Cottonseeds varied in length as well as diameter; however, there was a close correlation between seed diameter and seed length. This close correlation indicates that cottonseeds could be effectively graded on the basis of either diameter or length.

The diameter classes of graded seeds that represent the greatest quantity of seeds in each variety gave the highest percent of germination.

The field emergence of intermediate size cottonseed was greater than the emergence of either small or large diameter seed.

There was a clase correlation between emergence and yield when graded seeds were planted, i.e., the intermediate diameter classes of graded seeds resulted in the best field emergence and the best yield of clean seed cotton. This relationship seems to be peculiar to graded seeds, but it has been consistent in the graded seed field tests. (Cotton plants usually adjust yield over a wide range of plant populations.)

Tests with commercial and experimental planters have shown that these machines perform much better using graded seeds than ungraded seeds. Results of these planter performance tests have been reported in Oklahoma Agricultural Experiment Station, Technical Bulletin No. T-50, entitled "Factors Affecting Cotton Planting for Mechanized Production."

Table 1.—Seed Size Distribution and Grading Accuracy for Three Varieties of Acid Delinted Cottonseeds (1953)

Seed Size (1/64 Inch)	Stoneville 62		Stormproof #1		Lankart 57
	Percent of Total Sample	Grading Accuracy %	Percent of Total Sample	Grading Accuracy %	Percent of Total Sample
17	0.01	29.6	----	---	----
16	0.16	69.2	0.17	86.8	2.25
15	0.24	92.0	0.67	96.0	----
14	1.83	94.2	5.75	97.8	43.70
13	21.76	80.5	31.61	95.8	40.28
12	56.53	89.2	46.40	98.8	12.00
11	16.47	95.5	13.57	98.8	1.68
10	2.53	97.0	1.56	97.5	0.05

Table 2.—Number of Seeds per Pound for Two Varieties of Acid Delinted Cottonseed

Seed Size (1/64 Inch)	Seeds Per Pound	
	Stoneville 62	Stormproof #1
16	3671	3125
15	3538	3434
14	3919	3703
13	4229	4154
12	4719	4800
11	5468	5854
10	6772	8159

Table 3.—Length of Acid Delinted Cottonseeds in Two Varieties and Seven Diameter Classes

Seed Size (1/64 Inch)	Average Seed Length (inches)	
	Stoneville 62	Stormproof #1
16	0.3648	0.3588
15	0.3758	0.3586
14	0.3647	0.3570
13	0.3633	0.3494
12	0.3594	0.3372
11	0.3477	0.3146
10	0.3273	0.2888

Table 4.—Total Emergence for Six Seed Sizes and Two Planting Dates

Seed Size (1/64 Inch)	Percent emergence for seed planted: May 27	June 10	Average
15	46	32	39.0
14	79	51	65.0
13	93	47	70.0
12	78	54	66.0
11	61	73	67.0
10	42	50	46.0
Average	66.6	51.3	

Table 5.—Number of Hills of Each Seed Size Containing 0, 1, 2, or 3 Plants

Seed Size (1/64 Inch)	Number of Hills of a Given Size							
	Planted May 27 Plants per Hill:				Planted June 10 Plants per Hill:			
	0	1	2	3	0	1	2	3
15	42	10	30	22	58	22	11	13
14	10	4	33	57	31	30	20	23
13	3	5	14	82	42	12	27	23
12	15	8	23	58	36	18	26	24
11	27	15	22	40	14	21	30	39
10	44	21	26	13	34	26	23	21

Table 6.—Correlation Between the Number of Hills of a Given Size and Total Emergence

Hill Size (Plants/Hill)	Correlation Coefficients Planted May 27	Planted June 10
0	—0.964	—0.959
1	—0.563	0.647
2	0.113	0.776
3	0.958	0.920

Table 7.—Harvest Data from 1953 Graded Seed Field Test

Seed Size (1/64 Inch)	Total Lint Yield (Gms.)	Lint Turnout (%)	Lint Seed Ratio	Boll Size (Gms.)
		(Planted May 27)		
15	503.0	36.63	0.589	5.41
14	699.1	37.21	0.595	5.65
13	744.9	37.00	0.591	5.48
12	681.2	36.25	0.572	5.57
11	564.4	38.66	0.639	5.13
10	448.6	37.12	0.598	5.46
		(Planted June 10)		
15	208.8	30.85	0.458	6.29
14	291.3	32.11	0.485	5.65
13	290.5	32.08	0.485	5.39
12	275.8	32.35	0.490	5.57
11	329.6	31.57	0.477	5.80

Table 8.—Seed Size Distribution for Ten Varieties of Cottonseeds (Percent)

Variety	Seed Diameter (1/64 inches) 16	15	14	13	12	11	10
Lankart 57	2.96	14.12	30.45	35.99	12.15	1.75	0.24
Stormproof # 1	0.39	1.95	8.73	28.91	38.63	16.63	3.19
Stoneville 62	0.13	0.48	3.49	24.13	49.84	16.93	1.47
Qualla	9.25	1.48	9.25	36.12	41.81	7.48	1.16
Empire	0.31	2.63	14.42	47.21	27.37	5.36	1.05
Deltapine 15	0.16	1.39	6.18	31.01	39.80	15.30	1.40
Hi-Bred	0.34	2.71	14.33	40.19	33.44	5.58	0.52
Lockett 140	0.18	1.73	10.56	39.67	39.25	5.36	0.51
Mebane 6801	0.20	1.46	6.55	20.39	39.18	21.40	6.88
CR - 2	0.16	1.32	9.41	34.25	40.00	10.59	1.32
Average	0.51	2.93	11.34	33.79	36.15	10.64	1.77

Table 9.—Number of Seeds per Pound for Ten Varieties of Cottonseeds

Variety	Seed Diameter (1/64 Inch) 16	15	14	13	12	11	10	Average
Lankart 57	3230	3505	3757	4259	5027	6050	7529	4765
Stormproof # 1	3311	3662	4068	4528	5214	6390	7993	5024
Stoneville 62	3427	3544	3836	4190	4537	5336	6771	4520
Qualla	3936	4288	4554	5040	5639	7049	9268	5682
Empire	2871	3003	3361	3896	4472	5597	7688	4412
Deltapine 15	3601	4051	4277	4627	5275	5969	8101	5129
Hi-Bred	3066	3255	3612	4096	4668	5853	7650	4600
Lockett 140	3630	3796	4162	4537	5041	5991	8084	5034
Mebane 6801	3559	3912	4153	4701	5682	6385	8015	5201
CR - 2	3583	3894	4221	4618	5503	6390	8410	5231
Average	3388	3651	3969	4427	5071	6065	7902	

Table 10.—Regression Equations which Express the Relationship between Seed Size and Number of Seeds per Pound for Ten Varieties of Cottonseeds.

Variety	Regression Equation*	Standard Error of Estimate (Seeds/lb.)	Correlation Coefficient
Lankart 57	$Y=35142.72-4065.55X+129.91X^2$	79.92	0.9982
Stormproof # 1	$Y=36614.70-4204.79X+133.36X^2$	129.05	0.9965
Stoneville 62	$Y=29947.60-3470.64X+113.82X^2$	146.74	0.9911
Qualla	$Y=47661.55-5768.57X+190.82X^2$	236.06	0.9909
Empire	$Y=42306.03-5194.09X+171.27X^2$	192.98	0.9927
Deltapine 15	$Y=37026.30-4339.76X+141.73X^2$	267.49	0.9819
Hi-Bred	$Y=39356.99-4727.79X+154.36X^2$	153.55	0.9999
Lockett 140	$Y=40084.50-4825.39X+160.00X^2$	233.90	0.9869
Mebane 6801	$Y=34122.96-3814.37X+119.45X^2$	125.30	0.9964
CR - 2	$Y=40262.68-4742.91X+153.91X^2$	168.05	0.9943

* Y is the number of seeds per pound and X is the seed size (i.e. 12, 14, etc.)

Table 11.—Grading Accuracy for Ten Varieties of Acid Delinted Cottonseeds (Percent)

Variety	Seed Diameter (1/64 Inches) 16	15	14	13	12	11	10	Average
Lankart 57	86.00	97.50	95.50	95.00	98.00	94.00	86.50	93.22
Stormproof # 1	62.00	91.50	93.50	97.00	99.00	99.00	97.50	91.36
Stoneville 62	15.50	85.50	97.50	97.00	98.00	96.00	97.00	83.78
Qualla	86.50	92.00	86.00	90.00	94.50	93.50	97.50	91.22
Empire	71.00	86.00	91.00	96.00	96.00	93.00	94.50	89.64
Deltapine 15	88.50	98.50	96.50	93.50	96.50	96.00	97.50	95.28
Hi-Bred	72.00	80.00	89.00	91.50	91.50	94.50	96.50	87.86
Lockett 140	70.00	83.50	85.50	84.00	95.50	97.50	99.50	87.92
Mebane 6801	53.00	69.00	71.50	78.00	77.00	83.00	93.00	74.78
CR - 6	76.00	92.00	90.50	92.00	93.00	94.00	100.00	91.06
Average	68.05	87.50	89.65	91.40	93.90	94.05	95.95	

Table 12.—Regression Equations which Express the Relationship Between Seed Size and Grading Accuracy for Ten Varieties of Cottonseeds

Variety	Regression Equation*	Std. Error of Estimate (%)	Correlation Coefficient
Lankart 57	$Y = -100.45 + 30.97X - 1.15X^2$	2.90	0.7804
Stormproof # 1	$Y = -209.45 + 52.15X - 2.18X^2$	4.53**	0.9293
Stoneville 62	$Y = -632.57 + 122.84X - 5.09X^2$	12.01**	0.9050
Qualla	$Y = 146.74 - 7.049X + 0.21X^2$	2.13	0.8367
Empire	$Y = -123.12 + 36.86X - 1.54X^2$	2.06	0.9687
Deltapine 15	$Y = 60.35 + 6.32X - 0.273X^2$	2.52	0.8684
Hi-Bred	$Y = 1.61 + 17.52X - 0.818X^2$	1.89	0.9755
Lockett 140	$Y = 86.68 + 4.94X - 0.364X^2$	2.98	0.9837
Mebane 6801	$Y = 55.98 + 8.71X - 0.545X^2$	3.52	0.9524
CR - 2	$Y = 52.61 + 9.00X - 0.454X^2$	3.45	0.8607

* Y is the grading accuracy (%) and X is the seed size (i.e. 12, 14, etc.)

** Caution should be used in applying regression equations having a high standard error of estimate.

Table 13.—Average Seed Length for Each Diameter Class in Ten Varieties of Cottonseeds (Inches)

	Seed Diameter (1/64 Inch)							
Variety	16	15	14	13	12	11	10	Average
Lankart 57	0.3857	0.3831	0.3862	0.3768	0.3599	0.3320	0.3060	0.3614
Stormproof # 1	0.3455	0.3436	0.3390	0.3362	0.3283	0.3118	0.2923	0.3281
Stoneville 62	0.3384	0.3459	0.3565	0.3498	0.3536	0.3360	0.3113	0.3416
Qualla	0.3336	0.3366	0.3404	0.3308	0.3230	0.3046	0.2842	0.3219
Empire	0.3640	0.3715	0.3784	0.3733	0.3607	0.3375	0.3184	0.3577
Deltapine 15	0.3518	0.3510	0.3566	0.3528	0.3421	0.3358	0.3123	0.3432
Hi-Bred	0.3625	0.3639	0.3644	0.3643	0.3574	0.3400	0.3179	0.3529
Lockett 140	0.3410	0.3370	0.3377	0.3397	0.3341	0.3237	0.3084	0.3316
Mebane 6801	0.3408	0.3253	0.3128	0.3191	0.3128	0.3079	0.2907	0.3156
CR - 2	0.3396	0.3339	0.3409	0.3296	0.3238	0.3086	0.2902	0.3238
Average	0.3503	0.3492	0.3513	0.3472	0.3396	0.3238	0.3032	

Table 14.—Regression Equations which Express the Relationship Between Seed Diameter and Seed Length for Ten Varieties of Cottonseeds.

Variety	Regression Equation*	Standard Error of Estimates (Inches)	Correlation Coefficient
Lankart 57	$Y = -0.4089 + 0.1077X - 0.0036X^2$	0.00259	0.9959
Stormproof # 1	$Y = -0.0956 + 0.0580X - 0.0019X^2$	0.00188	0.9945
Stoneville 62	$Y = -0.1715 + 0.0770X - 0.0028X^2$	0.00394	0.9631
Qualla	$Y = -0.2276 + 0.0782X - 0.0027X^2$	0.00147	0.9969
Empire	$Y = -0.3455 + 0.1025X - 0.0036X^2$	0.00226	0.9994
Deltapine 15	$Y = -0.1165 + 0.0663X - 0.0023X^2$	0.00265	0.9983
Hi-Bred	$Y = -0.1530 + 0.0726X - 0.0025X^2$	0.00271	0.9987
Lockett 140	$Y = -0.0962 + 0.0626X - 0.0022X^2$	0.00366	0.9933
Mebane 6801	$Y = 0.3046 - 0.0052X + 0.0004X^2$	0.00569	0.9212
CR - 2	$Y = 0.0391 + 0.0490X - 0.0016X^2$	0.00299	0.9985

* Y is the seed length in inches and X is the seed diameter (i.e. 12, 14, etc.)

Table 15.—Germination for Ten Varieties of Cottonseeds—%

	Seed Diameter (1/64 Inch)							
Variety	16	15	14	13	12	11	10	Average
Lankart 57	97.00	95.50	97.00	95.00	95.00	93.50	89.50	94.64
Stormproof # 1	97.00	96.50	95.50	95.00	97.50	93.00	83.00	94.14
Stoneville 62	--	92.50	96.50	99.00	99.50	99.00	97.50	97.34
Qualla	95.50	94.50	99.00	95.00	95.50	79.50	71.00	90.00
Empire	98.50	93.00	91.00	88.50	93.00	85.00	65.00	88.06
Deltapine 15	91.00	95.50	92.50	95.50	92.50	93.00	73.50	90.72
Hi-Bred	95.00	99.00	98.00	96.00	89.50	79.00	69.50	89.64
Lockett 140	91.50	96.00	98.00	97.00	94.50	91.50	62.00	90.06
Mebane 6801	85.00	78.00	87.50	91.00	84.50	91.00	82.00	85.70
CR - 2	98.50	98.00	99.50	99.00	94.50	98.00	91.00	96.92
Average	94.32	93.84	95.44	95.20	93.54	90.84	78.54	

Table 16.—Emergence for Three Varieties of Graded, Acid Delinted Cottonseeds — %

Seed Size (1/64 Inch)	Lankart 57		Stormproof No. 1		Stoneville 62		
	Planting Date						
	June 2	June 11	June 2	June 11	June 2	June 11	Average
15	35.26	40.70	47.76	43.26	72.43	42.95	50.87
14	48.72	35.58	38.78	49.35	50.64	45.19	48.43
13	41.67	41.99	67.62	57.05	74.68	54.81	60.99
12	59.93	40.06	53.20	58.05	69.87	51.60	57.99
11	46.15	24.47	50.00	36.22	76.60	59.92	49.65
10	1.92	6.41	23.40	22.11	27.56	36.66	23.03
Average	38.93	31.04	46.79	44.18	57.74	49.90	

Table 17.—Number of Hills Containing 0,1.2, or 3 Plants for Three Varieties of Cotton

Seed Size (1/64 Inch)	Lankart 57				Stormproof No. 1				Stoneville 62			
	Hill Size (Plants per Hill)											
	0	1	2	3	0	1	2	3	0	1	2	3
15	70	59	59	20	24	60	71	53	46	66	62	34
14	64	63	43	38	55	50	62	41	50	69	58	31
13	61	62	56	29	17	48	69	74	29	41	69	69
12	44	54	70	40	41	51	51	65	36	57	61	54
11	79	67	44	18	29	44	71	64	57	66	50	35
10	185	20	3	0	78	56	48	26	115	54	31	8

Table 18.—Correlation * Between Emergence and Hill Size for Three Varieties of Cotton

Variety	Hill Size (Plants per Hill)			
	0	1	2	3
Lankart 57	—0.977	0.498	0.954	0.875
Stormproof # 1	—0.645	—0.183	0.819	0.588
Stoneville 62	—0.525	—0.332	0.479	0.717

* Based on straight line regression.

Table 19.—Yield of Clean Seed Cotton for Three Varieties of Cotton-Pounds/Acre

Seed Size (1/64 In.)	Lankart 57		Stormproof No. 1		Stoneville 62		
	June 2	June 11	June 2	June 11	June 2	June 11	Average
15	698.5	694.3	545.7	510.1	844.5	471.9	627.4
14	754.5	568.8	469.3	443.2	455.7	464.6	525.8
13	530.6	714.2	853.9	644.6	555.1	672.9	662.9
12	964.3	661.9	446.8	533.7	563.5	617.9	630.5
11	656.1	169.5	466.7	354.2	433.8	587.1	444.7
10	21.9	35.6	363.1	116.2	526.9	448.4	252.2
Average	604.3	474.0	524.3	433.8	563.0	543.1	

Table 20.—Correlation Coefficients Between Emergence and Yield For Three Varieties of Cotton at Two Planting Dates

Variety	Planting Date	
	June 2	June 11
Lankart 57	0.959**	0.979**
Stormproof # 1	0.822*	0.936**
Stoneville 62	0.667	0.780

** Highly significantly different from zero (1% c.l.)
* Significantly different from zero (5%c.l.)

Table 21.—Boll Size for Three Varieties of Cotton—Grams.

Seed Size (1/64 In.)	Lankart (Planting Date)		Stormproof No. 1 (Planting Date)		Stoneville 62 (Planting Date)		
	June 2	June 11	June 2	June 11	June 2	June 11	Ave.
15	5.98	6.35	4.32	5.03	4.22	4.33	5.04
14	5.76	6.59	4.33	4.77	3.94	4.11	4.92
13	5.31	6.25	4.30	4.98	3.96	4.35	4.86
12	5.48	6.64	4.11	5.14	4.13	4.53	5.00
11	5.26	5.53	4.14	5.21	3.45	4.44	4.67
Average	5.56	6.05	4.24	4.88	3.94	4.32	

APPENDIX: Description of Tests

Laboratory Tests. Acid delinted cottonseeds of three varieties (1953) and ten varieties (1954) were mechanically graded to determine their physical characteristics and to study the effects of these characteristics on the performance of the seeds. The physical characteristics and methods used to determine them were as follows:

(1) Seed size distribution. Three samples of 25 pounds each from each variety were separated into diameter classes with a small cleaner-grader equipped with round hole screens (1/64 of an inch gradation).

(2) Grading accuracy. After grading by machine, four samples of fifty seeds each were taken at random from each diameter class in each variety and each of these seeds was measured to determine its maximum diameter. The grading accuracy in percent was determined by dividing the total number of seeds in each sample into the number of seeds in that sample which had a maximum diameter less than the diameter class that the sample was taken from.

(3) Seeds per pound. Four samples of fifty seeds each (accurately sized by hand) were taken from each diameter class and weighed to determine the number of seeds per pound.

(4) Seed length. Four samples of twenty-five seeds each (accurately sized by hand) were taken from each diameter class. Each of these seeds was measured with a micrometer to determine its length.

(5) Germination. Four samples of fifty seeds each (accurately sized by hand) were taken from each diameter class and placed in a germinator to determine the percent germination.

Field Tests. The 1953 field test was a split-plot with four replications. Six-row plots twenty-five feet long were planted on two dates, May 27 and June 10. These main plots were divided into six sub-plots on which six diameter classes of graded seeds were planted: 15, 14, 13, 12, 11, and 10/64 of an inch in diameter. Twenty-six hills of three seeds each, spaced 12 inches apart, were hand planted with each seed size in each replication. Stoneville 62 was the variety used in the 1953 field test.

The 1954 field test was a split-plot design with four replications. Twelve-row plots 25 feet long were planted with three varieties, Lankart

57, Stoneville 62, and Stormproof No. 1. These main plots were divided into two plots which were planted on two dates, June 2 and June 11. The two plots were divided into six subplots on which six diameter classes of graded seeds were planted: 15, 14, 13, 12, 11, and 10/64 of an inch in diameter. Twenty-six hills of three seeds each, spaced 12 inches apart, were hand planted with each seed size in each replication.

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