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Oil and Protein Content of Seed

Of Leading Cotton Varieties in Oklahoma

OKLAHOMA A&M COLLEGES
DIVISION OF AGRICULTURE
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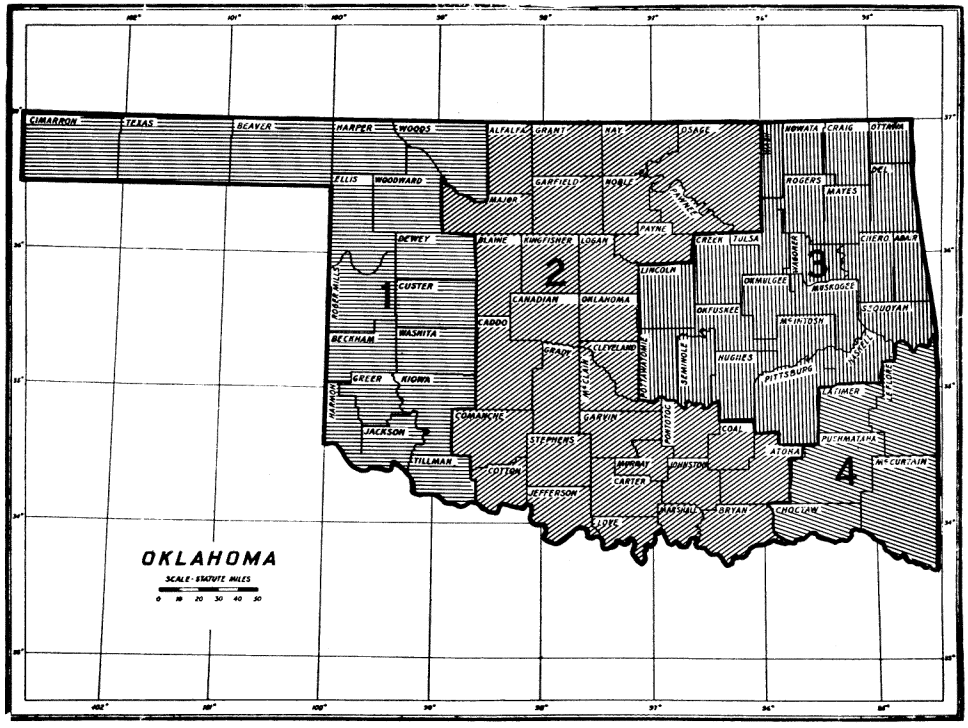

Figure 1. --Areas of Oklahoma for which cottonseed prices are determined on the basis of weekly averages of grade determinations

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Oil is the second most valuable product produced by cotton. Current prices indicate that of the components of cottonseed, oil is much more valuable than linters, meal, or hulls, all of which are properly considered by-products of oil extraction.

That oil content of cottonseed is influenced both by variety and conditions under which the variety is grown has been amply demonstrated by previous work. It appeared worthwhile, however, to determine the oil percentage of varieties currently grown in Oklahoma. Under the present system of marketing cottonseed, variety identity is lost before any quality determinations are made, and the value of a variety for oil production can be determined only by such tests as those reported here.

While primary consideration is given to quality and quantity of lint produced when a variety is chosen for planting, other factors are usually considered. Lint percentage, or gin turnout, influences cost per pound of lint in hand-harvesting and ginning costs, and characters such as maturity and degree of storm resistance often influence the choice of variety. If two varieties are equally acceptable in other properties but differ in oil content, growing the variety with the higher oil will result in greater total income from the crop.

For marketing purposes the state is divided into 4 areas, (Figure 1) and the price in each area is based on weekly determinations of the average grade of cottonseed in the area. Grade is based on both quantity index and quality index. Oil, ammonia, and linters percentages determine quantity index; and moisture, free fatty acids, and foreign matter determine quality index. To make comparisons based on data in this circular

1/Cooperation of Mr. D. J. Porter of the Chickasha Cotton Oil Company in making the analyses on the 1955 crop is gratefully acknowledged.

quantity index can be calculated, but quality index cannot, so it should be assumed constant for the varieties being compared.

PROCEDURE

In 1954 a preliminary test was run on 12 varieties in which complete analysis of the seed was made. Seeds were dissected by hand, and weights of the component parts were determined on a moisture free basis. Kernels were analyzed for oil content by the Agricultural Chemistry Department, and percentage oil in the seed was calculated from percentage kernel and percentage oil in the kernel.

In 1955 seed from all variety tests grown by the Oklahoma Agricultural Experiment Station were tested for oil and ammonia in the laboratory of the Chickasha Cotton Oil Company. Ginned seed were analyzed using the standard procedure for testing commercial lots.

In both 1954 and 1955 seed analyzed were from replicated field tests. In 1954 seed were analyzed by plots and the experimental error was determined by analysis of variance for all properties measured except oil percentage. This was based on a bulk sample from all replicates. In 1955, seed were bulked from all replicates of each variety at each location, and experimental error was not estimated. However it was possible to determine the variety x location interaction, which in any event should be as large as experimental error, and if larger would be used to test variety differences if generalized conclusions were to be drawn. The multiple range test was used to test significant differences. In tables 2 to 5, all means included within one line in the "significant differences" column did not differ at the 1% level of probability.

RESULTS IN 1954

Severe drought conditions prevailed at the location of the test in 1954. However it was thought that results would be comparable, since only bolls set within the period July 20 to 24 were harvested for study. Results of the detailed analysis of seed appear in table 1. The percentages of kernels, hulls, and linters should add up to 100

per cent, these components comprising the entire seed. Since all three values were calculated from weights, and none of the three was obtained by difference, accumulated errors in weighing, loss of material, etc., resulted in deviations of -0.3 to +4.7. It appeared to be more desirable to report the calculated percentages than to obtain any one by difference since such a procedure would cause that percentage to absorb errors in the other two determinations.

The difference in weight of 100 fuzzy seed was large between the highest and lowest variety, and highly significant differences were indicated by statistical analysis. Differences among varieties in percentage kernels, hulls, and linters were also highly significant.

Percentage kernels would appear to be the most important single character determining oil percentage of whole cottonseed. The variation in percentage oil in kernels varied only from 32.05 to 34.58, while oil in whole seed varied from 15.93 to 20.71. Furthermore, the variety with the highest percent oil in kernels was not highest in oil in whole seed. Percentage kernels, hulls, and linters are all interrelated, and any change in one would be reflected in the others.

RESULTS IN 1955

Oil content of seed of 11 varieties grown at six eastern Oklahoma locations is given in table 2. Differences among varieties were highly significant, and these differences were fairly consistent at all locations. Differences among locations can be related to climatic differences, and differences this large or larger could be expected to occur from season to season at the same location. Protein content of these same varieties appears in table 3. Differences in protein content are somewhat smaller than are differences in oil, but variety and location effects are both highly significant.

Results obtained on four stripper harvested tests appear in tables 4 and 5. Variety and location effects were both highly significant.

TABLE 1. Seed size and composition of seed of 12 varieties of cotton grown in the Paradise Community in 1954.

Variety	Grams/100 Seed	Percentage					
		Kernels	Hulls	Linters	Oil in Kernels	Oil in Whole Seed	Protein in Whole Seed
Parrott	10.5	60.6	31.1	10.8	34.14	20.71	29.2
Lockett No. 1	10.4	59.8	32.9	9.9	34.22	20.47	29.3
Empire	13.2	58.3	30.8	15.4	33.71	19.68	28.0
Stormmaster	10.5	56.8	32.4	13.5	34.58	19.67	27.0
Stoneville 62	10.7	57.3	32.6	10.4	33.74	19.35	27.4
Paymaster 54	11.0	55.9	33.0	13.7	33.40	18.67	27.4
Hi-Bred	10.5	55.8	32.2	14.0	33.40	18.67	27.7
Deltapine 15	10.1	54.1	34.4	12.8	32.89	17.81	25.8
D & PL Fox	9.2	52.8	32.0	16.1	33.40	17.66	24.9
Lockett 140	10.4	52.4	31.6	15.7	33.04	17.33	25.6
Lankart 611	12.0	52.6	32.9	14.3	32.56	17.14	24.6
Lankart 57	11.8	49.7	36.9	17.5	32.05	15.93	23.3
Probability of significant differences	>.99	>.99	>.99	>.99			

TABLE 2. Oil content (percent) of seed of 11 cotton varieties grown at 6 locations in Eastern Oklahoma in 1956.

	Broken Arrow	Webbers Falls	Caddo	Lone Grove	Madill	Perkins	Variety Average	Significant 1/ Differences
Parrott	20.6	20.1	19.6	18.8	19.1	16.8	19.2	
Lockett No. 1	20.6	19.8	18.7	18.9	18.5	16.8	18.9	
Empire	19.9	20.2	18.9	18.0	17.8	17.1	18.7	
Western Stormproof	19.7	19.4	18.1	18.3	18.2	16.1	18.3	
Stoneville 62	19.8	17.8	17.5	17.5	17.3	16.5	17.7	
Lankart 611	19.0	17.5	18.2	16.6	17.8	15.0	17.4	
D & PL Fox	19.3	18.2	17.4	17.8	16.8	14.3	17.3	
Deltapine 15	19.3	17.9	17.4	16.2	16.6	15.3	17.1	
Lockett 140	18.3	17.8	17.4	16.5	16.8	15.4	17.0	
Hi-Bred	18.1	17.6	17.0	17.0	16.1	13.7	16.6	
Lankart 57	17.8	17.2	16.5	16.0	16.2	14.5	16.4	
Location Average	19.3	18.5	17.9	17.4	17.4	15.6		

1/ Varieties are ranked in descending order of oil content. Varieties (and locations) whose means are not bracketed by the same bar have been found to differ significantly according to statistical tests.

TABLE 3. Protein content (percent) of seed of 11 cotton varieties grown at 6 Eastern Oklahoma locations in 1955.

	Madill	Perkins	Webbers Falls	Caddo	Broken Arrow	Lone Grove	Variety Average	Significant 1/ Differences
Parrott	25.2	24.3	25.0	23.3	23.2	23.3	24.1	
Lockett No. 1	24.5	24.4	24.2	23.8	22.7	22.1	23.6	
Empire	24.0	24.3	24.0	23.5	22.5	21.8	23.4	
Stoneville 62	23.4	23.8	24.0	22.6	22.6	22.5	23.2	
Western Stormproof	23.7	24.2	24.2	22.9	21.6	21.8	23.1	
Lankart 57	23.5	22.9	23.5	24.0	22.1	21.6	22.9	
Hi-Bred	24.4	23.5	23.9	23.3	22.4	19.8	22.9	
Deltapine 15	22.8	23.4	23.4	22.9	22.2	22.4	22.9	
Lockett 140	23.0	23.5	23.2	23.2	21.8	21.2	22.7	
Lankart 611	22.4	23.0	23.8	22.6	22.5	21.5	22.6	
D & PL Fox	24.0	23.6	22.3	22.3	21.6	21.0	22.5	
Location Average	23.7	23.7	23.8	23.0	22.3	21.7		

1/See table 2. Varieties are ranked in descending order of protein content.

TABLE 4. Oil content (percent) of seed of 9 cotton varieties grown at 4 Western Oklahoma locations in 1955.

	Pocasset	Mangum	Chickasha	Elk City	Variety Average	Significant[1] Differences
Parrott	20.8	20.2	20.1	20.1	20.3	
Northern Star	20.1	19.8	19.8	19.3	19.8	
Lockett 88	20.3	19.5	19.0	20.0	19.7	
Lockett No. 1	19.8	19.5	19.3	19.9	19.6	
Wacona	19.8	19.1	18.9	18.6	19.1	
Stormrider	20.1	19.8	19.2	17.0	19.0	
Western Stormproof	19.1	19.0	17.5	18.0	18.4	
Lankart 611	17.7	18.5	17.4	16.8	17.6	
Lankart 57	16.4	16.8	15.8	15.3	16.1	
Location Average	19.3	19.1	18.6	18.3		

[1] See table 2.

TABLE 5. Protein content (percent) of seed of 9 cotton varieties grown at 4 Western Oklahoma locations in 1955.

	Pocasset	Elk City	Chickasha	Mangum	Variety Average	Significant Differences[1]
Parrott	24.9	25.1	25.3	22.9	24.6	
Lockett 88	24.6	24.6	24.0	22.8	24.0	
Lockett No. 1	23.7	24.4	25.1	22.4	23.9	
Western Stormproof	24.2	24.2	23.7	21.4	23.4	
Stormrider	24.0	23.3	22.4	21.9	22.9	
Northern Star	24.0	23.2	22.9	20.9	22.7	
Lankart 611	22.4	23.4	23.1	21.9	22.7	
Wacona	23.3	23.7	22.7	21.1	22.7	
Lankart 57	22.7	22.8	22.9	21.9	22.6	
Location Average	23.8	23.9	23.6	21.9		

1/See table 2. Varieties are ranked in descending order of protein content.

CONCLUSIONS

1. Varieties of cotton grown in Oklahoma differ significantly in percentage oil and percentage protein in the seed.

2. Varietal differences were relatively consistent over a wide range of conditions, and the relative value of varieties for oil production appears to be highly predictable.

3. Location effects are assumed to be largely due to weather conditions, and the rank in the locations listed would not be expected to be consistent from year to year.