THE INFLUENCE OF GEOGRAPHICAL SOURCE OF SEED ON COTTON OIL

H. J. MORRISON AND L. W. BOSART

The authors of this paper attempted recently to collect data in order to determine, if possible, whether any relationship exists between the stearin content of cotton oil and the locality from which the oil was derived, or, more properly, in which the seed was grown, or to what other causes such differences were due. Inquiries directed to chemists expert in matters pertaining to cotton oil, and to the various experiment stations, brought forth little or no information which would make this matter clear. It was, therefore, decided to tabulate what information we had on hand and to see if this would point the way to a solution of the problem.

In the preparation of winter oil, it is found that some cotton oils are so high in stearin that they cannot be used at all for this purpose, whereas there are others which contain so little stearin that they will stand the ordinary chill test without the removal of any stearin by cold pressing. The latter condition may be in part due to stearin having grained out in storage.

The differences might conceivably be due to one or more of several causes, viz.: the variety of the cotton plant, the nature of the soil fertilization, methods of cultivation, climate, time of planting and harvesting, and the maturity of the seed from which the oil is pressed.

Except for Sea Island cotton, which forms a very small proportion of the total planting, the American cotton is produced practically from only one species, Gossypum hirsutum, or from forms which are merely variations of this due to local conditions of cultivation or climate. There appears, therefore, to be little likelihood of finding differences in the oil due to differences of species. No information was obtained regarding differences due to different varieties. Variety is probably closely coupled with soil, climate, and cultivation.

Any differences due to soil, cultivation, or fertilization, could be determined only by actual field tests covering a period of several years.

No data were available as to the probable effect of the maturity of the seed nor to the time of planting and harvesting. Owing to the ravages of the boll weevil, there has been a decided tendency toward early planting. This would give the seed a longer time in which to mature and this, in turn, may affect the character of the oil. In fact, for the past two seasons, the amount of oil which could be used for making winter oil has been less than in previous seasons, and there may be some connection between this and the tendency to early planting and, consequently, greater maturity of the seed.

Jamieson and Baughman* made tests showing the refractive indexes,

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iodine values, titers, and the proportion of saturated fatty acids to unsaturated, in oils from seed from various geographical locations. They found that there is only a slight variation in the characteristics of the oils from the various parts of the United States.

Their results show twenty-one oils from mills south of the thirty-fourth parallel and twenty north of it. We find that if we take the average figure for the characteristics which they found for oil south of this parallel and for those north of it, the northern oils are slightly higher in iodine value and refractive index and somewhat lower in titer and saturated fatty acids. The average figures are as follows:

TABLE I

	Iodine Value	Refractive Index	Titer	Saturated F. A.
Oils north of latitude 34°	107.87	1.46967	34.035	24.030
Oils south of latitude 33°	107.06	1.46951	34.276	25.057

Although the figures do not differ widely, they show that the more northerly oils are apparently softer, i.e., contain less stearin than the southerly ones. Moreover, curves plotted from their figures show a general but irregular trend toward softer oils going from south to north. The number of results obtained, however, are not sufficient to draw any definite conclusions, and this may be merely chance.

In order to learn whether there is actually a difference between oils according to geographical location, we examined oils received at Ivorydale from mills from various localities over a period of several months. These oils are refined in the regular course of procedure as they are received from the tank cars, and the butyro-refractometer reading is made on the refined oil. This determination is made as a matter of routine on all oils received. During this period, oils were received from the following states: Tennessee, Georgia, Alabama, Mississippi, Arkansas, Oklahoma, Texas and Louisiana. There were 822 different samples on which the refractive index was read, and these we have tabulated. Each represents a separate tank car lot received early in the year 1926. Mills in sixty-six different towns are represented. It was, of course, not practicable to make determinations of the iodine value, titer, and saturated fatty acids on such a large number of samples, but since there is a quite definite agreement between the refractive index and the other characteristics, it was considered that this determination alone was sufficient to establish the character of the oil. (It has been found that one degree on the butyro-refractometer scale means an average of 6.08 in the iodine value of cotton oil.)

In considering the results, it must be borne in mind that the oil from a particular mill is not necessarily representative of the oil from its immediate vicinity in all cases. The fact also must not be lost sight of that

some of the oils received may have grained out and separated stearin in storage. Some of the mills are large ones and may draw seed from a wide territory, e.g., all but a few of the oils from the section east of the Mississippi and north of the thirty-fifth parallel came from Memphis. It is quite probable that much of the seed from which this oil is obtained comes from Arkansas or Mississippi, therefore, from territory west of the Mississippi and south of the thirty-fifth parallel.

Table II hows the average refractive indexes for oils in different latitudes across the country within the cotton-growing territory.

TABLE II

Group	Latitude	Number of Samples	Average Refractive Index
1	South of 32°	7	50.93
2	32°-33°	180	50.81
3	33°-34°	191	50.84
4	34°-35°	151	51.09
5	35°-36°	280	51.12
6	North of 36°	13	51.15

These results show an increasing refractive index going from south to north, with the exception of oil from territory south of 32°, but there are only seven oils in this group, and they cannot, therefore, be considered sufficient in number to be representative. Although the group north of 36° falls in line, it also contains too few oils to be representative.

The oils were then divided into two lots, as it was thought that there might be a difference due to climatic conditions east and west of the Mississippi. The results are shown in Table III.

TABLE III

		East of Mississippi River		West of Mississippi River	
Group		Number of Samples	Average Ref. Ind.	Number of Samples	Average Ref. Ind.
1	South of 32°	4	50.80	3	51.10
2	32°-33°	170	50.82	10	50.85
3	33°-34°	173	50.85	18	50.65
4	34°-35°	38	50.87	113	51.16
5	35°-36°	106	50.96	174	50.98
6	North of 36°	6	51.28	7	51.03

In the division east of the Mississippi, there is a definite trend toward higher results going from south to north. Groups 1, 4, and 6 do not have enough samples to give dependable figures. The division west of the Mississippi has only two groups with a considerable number of oils in each, and these show a higher refractive index in the more southerly group, which is out of line with the apparent trend.

If the country be divided into two sections, viz.: that east of the Mississippi and that west of it, or into two other sections, that south of 34° latitude and that north of 34°, we find the following results:

TABLE IV

	Number of Samples	Refractive Index
East of Mississippi River	497	50.87
West of Mississippi River	325	51.15
South of 34°	378	50.83
North of 34°	444	51.11

It will be seen from this that oils with higher refractive indexes are to be expected west of the Mississippi and north of latitude 34°.

Going a step farther, we can divide the country into four parts, using the thirty-fourth parallel and the Mississippi River as dividing lines.

TABLE V

	Number of Samples	Refractive Index
Southeast-east of the Mississippi and south of 34°	347	50.83
Northeast-east of the Mississippi and north of 34°	150	50.95
Southwest-west of the Mississippi and south of 34°	31	50.76
Northwest-west of the Mississippi and north of 34°	294	51.19

These four sections range according to their increasing refractive indexes as follows: southwest, southeast, northeast, northwest. The southwest section has too few representatives to give a reliable average, but certainly the northwest section, which includes most of Arkansas and Oklahoma and a portion of Texas, may be expected to furnish oils with the highest refractive indexes and, consequently, with the lowest amounts of stearin.

Further groupings were made leaving out oils south of 32° and north of 36°, as they are few in number and have little bearing on the general results. The results are shown in the following table:

TABLE VI

	Number of Samples	Refractive Index
East of the Mississippi 32°-36°	487	50.87
West of the Mississippi 32°-36°	315	51.15
East and west of the Mississippi 32°-34°	371	50.83
East and west of the Mississippi 34°-36°	431	51.11
Southwest section	28	50.72
Southeast section	343	50.83
Northeast section	144	50.94
Northwest section	287	51.19

These limitations in no way change the results or conclusions to be drawn. It was considered merely that there were not enough samples from oils south of 32° and north of 36° to make their consideration of much value.

Conclusions

The results indicate, in general, a higher refractive index, consequently, a higher iodine value, lower titer, and a lower amount of stearin in the oil the farther north the seed is grown. The seed from the northwest section of the cotton country—most of Arkansas and Oklahoma and part of Texas—should give oils with the lowest amount of stearin.

The authors wish it to be understood that they feel that conclusions cannot definitely be drawn from the data given, since they are taken from oils from a limited number of mills; there are no representatives of oils from some of the states; there are many samples from certain individual mills and only one or two from others; finally, they represent seed from the latter portion of the season and only one season's milling. The conclusions, however, agree with a very general impression, gained from determinations of titer and other characteristics, that the farther north the seed is grown the less stearin the oil contains. Pigulevski* has already pointed out an analogous variation in the case of the seed oil of certain essential oil bearing plants in which the iodine value increased as the geographical location extended toward the north. It will be necessary to carry on the work of collecting and tabulating the data in future seasons in order to know to a certainty whether the geographical origin of the seed has any influence on the character of the oil.

THE PROCTER & GAMBLE CO.,
Ivorydale, Ohio.

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