PLANT DISTRIBUTION ON A CENTRAL OKLAHOMA PRAIRIE*

(Abstract)

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This study of the ecological structure of a central Oklahoma prairie area located in northeastern McClain county, Oklahoma, was conducted during July and August, 1934. The tract used was the "Johnson's Pasture," a cattle range area which has been somewhat heavily overgrazed during past years and is burned nearly every spring. The range pasture has never been plowed, however, and probably presents a slightly disturbed approach to original conditions. Methods of observation included note-taking and the making of seventy-two quadrats. A portion of the quadrats were made with a quadratoscope, a camera-like device with the lens directed downwards. The image of the quadrat beneath the tripod was reflected on a translucent paper supported by a transparent glass placed in the location of the usual frosted glass of a plate camera. Little essential difference was found between the results obtained statistically by the quadrat method and the notes obtained by cruising and observation.

Sheet erosion together with the natural physiognomy of the rolling prairie seemed to be the more important factors limiting the distribution of the vegetation of the area studied. The community studied was an *Andropogon scoparius - Panicum oligosanthes* community with faciations dependant on edaphic factors. Most intolerant of all of the important plants to sheet erosion was *Manisuris (Roetbellia) cylindrica*, although *A. scoparius* was absent in the severely denuded areas. The community structure may be thus expressed with reference to the dominants and subdominants during the serotinal aspect:

Stipa - Koeleria ASSOCIATION

Andropogon scoparius - Panicum oligosanthes LOCIATION

—*Andropogon scoparius HIGH PRAIRIE FACIATION*

+*Bouteloua gracilis HIGH PRAIRIE FACIATION*

+*Manisuris cylindrica SLOPING PRAIRIE FACIATION*

+*Andropogon furcatus - Manisuris cylindrica LOW UPLAND PRAIRIE FACIATION*

+*Bouteloua hirsuta - Amphiacris dracunculoides EROSION FACIES*

OIL AND PROTEIN STUDIES OF OKLAHOMA GROWN SOY BEANS

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The growing of soy beans is becoming increasingly important on farms in several of the midwestern states. For centuries soy beans have held an important place in the diet of the Chinese people, but it is only recently

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that farmers and industrialists in this country have come to see what an important place it may fill in our future agricultural economy. The value of this plant is not limited to the one field, food alone, for it is a legume, thus being a soil builder. It also has much value as a forage plant and the oil has been found to have countless industrial uses such as in the manufacture of paints, lacquers, soaps, and human foodstuffs of many kinds.

Because of these facts it was felt that a study should be made of the chemical composition of the beans of some of the more important varieties which are, or might be grown in Oklahoma. The analysis of soy beans has been reported from many sections of our country, but as yet none has been published of beans grown in Oklahoma and closely adjoining areas. These many analyses are desirable since soy beans, as a class, are greatly influenced by environmental conditions and ideally there should be as many analyses as there are crop areas.

These analyses have been made of soy beans grown on the experiment station farm at Stillwater and to a lesser extent at two other points in eastern Oklahoma. The samples have been secured over a varying number of years, ranging from five years at Stillwater, to one year in the northeastern section of the state.

CHEMICAL METHODS

Cleaned, air dried samples of the beans were ground through the medium screen of a Wiley mill and moisture determinations run just previous to the determination of other constituents.

MOISTURE:—Samples were dried over night in an oven held at 105° C.

PROTEIN:—Nitrogen determinations were run according to the official Kjeldahl method*, three samples being used to secure a more accurate figure. Protein was calculated using the factor 6.25.

OIL:—Samples were first dried and then extracted in a drip extractor for twenty-four hours using anhydrous ethyl ether. The loss in weight is calculated as oil. The extra long extraction period was used to secure more concordant results.

IODINE ABSORPTION NUMBER:—Samples of ground soy beans were extracted in a Soxhlet for eight hours using a low boiling petroleum ether. The ether was then removed on a steam bath and the oil sample transferred to a distilling flask and distilled under reduced pressure for one hour. A continuous stream of CO_2 was passed through the flask, at such a rate as to maintain a pressure of about 35 mm. of mercury. The temperature was kept at not over 60° C. and conditions in general were so adjusted that each sample received comparable treatment. The Hanus official method* was employed for the determinations, which were repeated, if necessary, until two closely agreeing values were secured.

EXPERIMENTAL

Table I, presents the composite results of five years analyses of soy beans grown at Stillwater. Table II, presents the results of analyses for which samples were available only for three or four years. Since the only difference in these two tables lies in the number of years the samples were analyzed, they will be discussed together. Probably the most striking feature of the data is the relatively small varietal spread in protein content, (about 10 per cent) as compared to the variation in oil content (more than 50 per cent). Such a difference in protein content being in fact less than the yearly variation in a given variety. Normally the protein content of soy beans grown in other sections runs somewhat below the

* Association of Official Agricultural Chemists, Official and Tentative Methods of Analysis, Second Edition, 1925.

figures reported for this state, while the oil content is considerably higher. In fact several of the varieties grown in Oklahoma, such as Peking, Laredo, and Old Dominion, are notably low in oil content, although they compare quite favorably in protein with the other varieties. Most of the beans are below or just on the border line of the minimum oil content (more than 18 per cent of oil) which would make their use commercially economical for the purpose of oil extraction.

It is in the iodine number of the oil that the most striking deviation from other areas is shown. Jamieson* places soy bean oil in the class of drying oils and lists as its minimum specification (Am. Soc. Testing Materials) an iodine value of 128. Referring to the tables it is found that only one variety as grown at Stillwater gives a value equal to or greater than this minimum figure. Most of the samples run considerably below this value, many falling ten or more points below this minimum figure. Several of the varieties have in one year or another produced an oil with an iodine value of between 108 and 109. As far as can be found, these figures are the lowest recorded values and definitely classes the oil produced from beans grown in this section, as semi-drying.

In order to understand the yearly variations which might be expected in the composition of a given variety, Table III, is included in this paper. The Illini is selected since the variations in this particular variety are quite typical of the various other varieties. The one exception is in the protein content for which the variation is slightly greater than average.

In order to make these data of value in other parts of the state and to show how completely local conditions affect the chemical composition of the beans, analyses are presented for beans grown at two other locations in the state. Since only one year's results are presented from Craig County, the analysis for the same varieties grown at Stillwater in the same year is included in the table to emphasize the contrast. Most notable are the differences in the oil and protein content of the beans from the two areas. Craig County samples more nearly approximating the published figures for the other sections of the south and eastern parts of the country. Particularly is this true of the oil content.

Table V, shows results of the analysis of six varieties grown at Heavener in the southeastern section of the state. These analyses are for three years and in general may be compared to the results given in Tables I and II. In making such a comparison it becomes quite easy to note some striking differences. The Heavener grown beans are strikingly higher in oil and lower in protein than similar varieties grown at Stillwater. The iodine number is also higher although not in such a marked degree. No entirely satisfactory explanation is known for this difference although it is presumed to be the resultant of several environmental factors such as temperature, rainfall, evaporation, and the like. The detailed figures (not published) show that for one year (1932) the analyses for Stillwater and Heavener are almost identical as regards to oil and protein content, thus tending to minimize the influence of the soil factor.

SUMMARY

1. Chemical analyses are presented for nineteen varieties of soy beans grown at Stillwater.

2. Such data shows that these soy beans are low in oil and high in protein, when compared with samples from other sections of the country.

3. Exceedingly low iodine values for the oil are shown, the figure of approximately 108 for several of the varieties in certain years being considerably below those reported elsewhere in the literature. In general

* Vegetable Fats and Oils, by George S. Jamieson, The Chemical Catalog Company.

the oil from the beans grown at Stillwater must be classed as semi-drying rather than drying.

4. A smaller number of analyses are recorded from the eastern sections of the state, and emphasize the fact that the chemical composition of the beans is intimately associated with the environment and that soy beans from these areas are quite different in their chemical composition from those grown at Stillwater.

TABLE I.

Chemical Analysis of Stillwater Grown Soy Beans
(Five Year Averages)
Percentages Expressed on a Moisture Free Basis

Variety	Protein	Oil	Iodine Number Oil
Laredo	42.67	13.84	130.94
Pine Dell Perfection	42.97	16.84	116.73
Columbia	40.42	18.75	114.74
Morse	42.24	18.76	114.76
Wilson	43.42	16.77	121.50
Illini	41.31	19.75	118.96
Haberlandt	43.41	19.12	119.41
Dixie	43.04	18.80	118.56
Virginia	43.06	17.47	116.12
Pinpu	41.34	20.10	119.09
Old Dominion	44.50	16.29	125.98
Manchu	41.29	18.15	120.91
Hongkong	42.60	18.43	126.44

TABLE II.

Chemical Analysis of Stillwater Grown Soy Beans
(Three or Four Year Averages)
Percentages Expressed on a Moisture Free Basis

Variety	Protein	Oil	Iodine Number Oil
A. K.	43.84	17.04	121.87
Harbinsoy	43.57	19.64	115.26
Hollybrook	44.36	15.93	122.95
Chiquita	43.62	18.35	123.85
Arksoy*	43.94	19.42	118.22
Peking*	41.96	16.82	124.35
Herman*	42.68	19.43	112.30

*Three Year Averages.

TABLE III.

Annual Variation in the Chemical Composition of the Illini Variety Stillwater

Percentages Expressed on a Moisture Free Basis

	1929	1930	1931	1932	1933
Protein	40.99	42.55	44.69	37.44	40.90
Oil	20.83	18.81	17.88	21.06	20.19
Iodine No. Oil	114.54	117.07	114.22	124.57	124.44

TABLE IV.

Comparison of Craig County and Stillwater Grown Soy Beans, (1931)
Percentages Expressed on a Moisture Free Basis

Variety	Oil Content		Protein Content		Iodine No., Oil	
	Craig Co.	Stillwater	Craig Co.	Stillwater	Craig Co.	Stillwater
Chiquita	19.93	16.89	42.50	47.56	123.12	120.47
Dixie	20.41	17.10	43.13	46.87	120.05	116.87
Virginia	19.17	16.37	40.00	44.06	122.56	108.73
Laredo	16.75	13.43	35.00	47.50	127.76	127.81
Averages	19.07	15.90	40.16	46.50	123.37	118.47

TABLE V.

Chemical Analysis of Heavener Grown Soy Beans
Percentages Expressed on a Moisture Free Basis
(Three Year Results)

Variety	Protein	Oil	Iodine Number Oil
Manchu	35.02	22.81	128.10
Chiquita	38.33	20.91	126.75
Illini	37.31	22.29	124.89
Haberlandt	35.85	23.00	123.28
Dixie	37.26	21.99	121.24
Morse	37.60	20.98	118.92