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CHEMICAL COMPOSITION of OKLAHOMA GRAIN SORGHUMS

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SUMMARY

A complete chemical analysis of 28 varieties of Oklahoma sorghum grain grown at Perkins and Woodward indicates that there is some variation among varieties but that other conditions, especially temperature and moisture, are of the most importance. Drouth decreased the yield but increased the protein percentage. The protein, ash, fat, carbohydrate analysis of the sorghums is similar to corn and other cereals. Care in providing a carotene supplement would be required when sorghums replace yellow corn.

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The sorghums have become one of the most important feed grains in the semi-arid areas of the Great Plains. Due to their relatively small leaf surface and the tendency to curl up in dry weather, their transpiration is low, which enables them to produce grain and forage under drouthy conditions.

In Western Oklahoma, sorghums are the most important feed for livestock and poultry; and they rank high in acreage and total production for the entire state. The acreage planted for feed (grain and forage) in Oklahoma varies around two million acres. Average yields for the state vary from 6 bushels per acre in poor years to 12 bushels in good years; but these figures do not consider the forage, which is often as valuable as the grain.

Many determinations of the chemical analysis of sorghum grain have been made by various stations. A report by Green and Heller (1926) lists the analysis of Oklahoma varieties of 20 years ago. Since that date, many new varieties have been developed. It is also known that the analysis varies with the climatic conditions and the year. For these reasons, it seemed advisable to make analyses of the more commonly grown varieties. These analyses were made in 1941 and 1942, normal years, and 1943, a hot dry season.

To study the effect of location, or district, determinations were made on sorghum grain grown at Stillwater and at Woodward. These locations are 150 miles apart, in approximately the same latitude but varying as to soil texture and altitude. A number of the same varieties were grown at both places, and the direct comparison of these should indicate the effect of locality on chemical composition. Some of the varieties adapted for Woodward conditions are not included from Stillwater due to their susceptibility to damage by chinch bugs. Also, certain varieties which are satisfactory at Stillwater are not included from Woodward because of their low yield and relatively poor palatability.

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TABLE I.—Chemical Composition of the Grain of Sorghums Grown at Perkins and Woodward, Oklahoma.

(10% Moisture Basis)

Sample	ASH				CALCIUM				PHOSPHOROUS			
	Perkins		Woodward		Perkins		Woodward		Perkins		Woodward	
	'41-42*	'43	'41-42*	'43	'41-42*	'43	'41-42*	'43	'41-42*	'43	'41-42*	'43
Standard Kafir	1.43	1.82	1.37	1.52	.019	.020	.017	.014	.325	.316	.303	.309
Sharon Kafir	1.47	1.91	1.40	1.91	.050	.019	.017	.016	.458	.296	.330	.264
Sunrise Kafir	1.48	1.63	1.47		.018	.018	.017	.016	.402	.299	.315	.249
Club Kafir	1.53	1.60	1.35	1.60	.019	.030	.023	.017	.272	.287	.246	.258
Reed Kafir			1.33	1.76			.015	.022			.257	.281
Red Kafir	1.41	1.97			.016	.018			.345	.295		
Hydro Kafir	1.42	1.54			.024	.016			.277	.283		
Bishops Kafir			1.46	1.41			.019	.014			.262	.288
Rice Kafir	1.39	1.74			.013	.015			.284	.286		
Sedan Red Kafir			1.37				.016				.350	
Feterita			1.70				.019	.020			.362	.255
Cache Feterita	1.72				.019				.349			
Kaferita	1.57	1.52		1.52	.019	.016			.338	.267		
Chiltex			1.40				.021				.296	
Hegari 750	1.31		1.36		.016		.018		.399		.304	
Early Hegari			1.21				.018	.023			.226	.251
Dwarf Milo			1.35	1.67			.019	.015			.292	.234
Dwarf Yellow Milo**			1.49	1.39			.019	.017			.284	.244
Migari	1.53		1.47	1.62	.014		.019	.024	.550		.273	.274
Club×Day		1.59		1.46		.017		.041		.277		.307
Darso	1.29	1.33	1.23	1.33	.016	.022	.020	.024	.384	.232	.239	.244
White Darso	1.56	1.51	1.25	1.51	.017	.027	.017	.018	.441	.247	.324	.263
Yellow Darso	1.57	1.58	1.22	1.58	.021	.022	.022	.023	.428	.270	.310	.260
Sagrain	1.52	1.67			.015	.034			.309	.225		
Atlas	1.26	1.86	1.40	1.95	.014	.013	.018	.018	.301	.305	.295	.327
African Millet	1.85		1.40	1.58	.014		.014	.015	.328		.292	.340
Sumac Sorgo	1.54	1.28	1.26	1.52	.012	.016	.017	.015	.317	.266	.256	.316
Sugar Drip Sorgo	1.76		1.59	1.92	.016		.024	.022	.309		.297	.312
Leoti Sorgo	1.63	1.49	1.40		.017	.044	.018	.014	.329	.240	.277	.242
Average	1.51	1.63	1.29	1.60	.019	.022	.018	.020	.357	.277	.292	.278

* Average 1941 ad 1942.

** Average of Dwarf Yellow Milo and Finney Milo

TABLE I.—(Continued).

(10% Moisture Basis)

Sample	PROTEIN				FAT				CRUDE FIBER				N. F. E.			
	Perkins		Woodward		Perkins		Woodward		Perkins		Woodward		Perkins		Woodward	
	'41-42*	'43	'41-42*	'43	'41-42*	'43	'41-42*	'43	'41-42*	'43	'41-42*	'43	'41-42*	'43	'41-42*	'43
Standard Kafir	10.15	15.00	8.86	9.10	3.36	3.11	2.96	2.73	1.44	1.52	1.56	1.71	73.29	68.60	73.94	73.77
Sharon Kafir	9.34	14.03	9.09	10.57	3.64	3.56	2.52	3.09	1.75	1.88	1.47	1.35	73.42	68.58	74.92	73.52
Sunrise Kafir	9.46	13.88	9.58	11.93	2.35	1.87	2.78	1.89	1.46	1.41	1.33	1.06	74.74	71.15	74.42	73.82
Club Kafir	9.51	13.04	8.09	8.98	2.59	2.26	2.62	2.75	1.54	1.72	1.22	1.48	75.33	71.26	76.53	75.25
Reed Kafir			7.75	9.39			2.62	1.71			1.32	1.31			73.35	75.82
Red Kafir	9.85	10.90			2.79	2.42			1.27	1.53			74.68	73.12		
Hydro Kafir	8.00	13.73			2.85	1.49			.97	1.48			76.15	7220		
Bishops Kafir			10.35	10.2			2.82	1.57			1.62	1.22			76.05	75.52
Rice Kafir	9.32	14.78			3.83	2.06			1.25	1.12			74.01	70.23		
Sedan Red Kafir			9.40					3.19			1.42				74.70	
Feterita			9.54	10.33			3.52	1.98			1.66	1.37			73.61	74.81
Cache Feterita	8.71				3.14				1.56				74.82			
Kafeteria	10.08	12.15			2.71	2.39			1.38	1.50		1.50	75.00	72.39		
Chiltex			9.49				2.80				1.24				75.02	
Hegari 750	9.16		9.12		2.92		3.03		1.45		1.45		75.83		72.08	
Early Hegari			6.87	9.48			3.27	1.90			1.25	1.37			77.36	75.68
Dwarf Milo			8.86	10.43			2.72	1.75			1.42	1.32			15.50	
Dwarf Yellow Milo**			8.75	10.51			3.08				1.34	1.29			74.92	75.17
Migari	10.48		8.65	9.58	2.71		2.72	1.41	2.19		1.29	1.31	73.02		75.86	76.00
Club×Day		11.61		8.86		2.61		2.85		1.52		2.18		73.67		73.52
Darso	9.65	11.75	7.82	9.85	2.98	3.08	3.03	2.91	1.32	1.37	1.28	1.33	74.75	72.46	76.82	76.14
White Darso	9.48	12.46	9.53	10.14	3.47	2.31	2.48	3.10	1.41	1.57	1.84	1.21	73.62	72.34	74.02	74.08
Yellow Darso	10.03	12.90	9.40	9.02	3.37	2.52	2.74	2.14	1.57	1.57	1.23	1.38	73.80	74.54	74.65	76.95
Sagrain	9.54	13.99			3.48	1.68			2.12	2.65			73.34	72.01		
Atlas	8.67	13.30	8.66	9.60	2.49	2.82	2.82	3.63	1.03	1.50	1.49	3.06	73.49	70.81	76.65	71.69
African Millet	7.70		8.89	9.84	2.34		2.71	2.30	1.65		1.63	1.53	76.44		75.15	74.79
Sumac Sorgo	7.32	13.02	7.16	9.08	3.21	2.41	3.43	3.00	1.58	1.11	1.36	1.36	76.37	74.19	76.62	73.02
Sugar Drip Sorgo	9.16		9.12	10.27	3.55		3.92	3.28	1.55		1.44	1.34	73.98		73.86	73.10
Leoti Sorgo					2.46	2.27	2.97	2.43	1.55	1.70	1.56	1.96	73.30	71.85	74.65	73.83
Average	9.28	13.07	8.83	9.84	3.03	2.41	2.95	2.44	1.53	1.54	1.42	1.52	74.47	71.84	75.03	74.55

* Avearge 1941 and 1942.
** Average of Dwarf Yellow Milo and Finney Milo.

Procedure

Twenty-eight varieties were grown at Stillwater and Woodward (indicated in Table I) under the direction of the junior author. When fully developed, ten or more representative heads were chosen from each variety. These were removed to the laboratory, dried, hand threshed, and all clinging hulls carefully removed. The grain was then ground in a Wiley mill and store in sealed containers in a cool, dark room. Analyses for the indicated constituents were carried out by A. O. A. C. methods during each of the three seasons. In *1941* and *1942,* similar favorable growing seasons were experienced; so, in order to save space the results were averaged. *1943* was a very hot, dry season which produced an inferior filling of the kernel, so these results are reported separately.

The results are summarized in Table I.

Results and Discussion

An examination of this data indicates that there is a considerable variation in the protein content of the different varieties. This variation among varieties is no greater than the variation within a particular variety as affected by soil or climatic conditions; however, the comparative trend between varieties is consistent under any given conditions. The average protein percentage is less than that reported in the survey of Edwards and Curtis (1943) for certain species grown at the Amarillo (Texas) Station in 1908-12. The most interesting point is the increased percentage of nitrogen in all samples grown during the hot, dry usmmer of 1943 at Perkins. This increased nitrogen, however, was accompanied by low grain yield, poorly filled kernels, and a decreased carbohydrate content. This trend is shown in a less marked degree in the average percentage of fats, crude fiber, and mineral constituents.

Certain members of the vitamin B complex—namely riboflavin, niacin, and panthothenic acid—have been reported for the same varieties by Knox, Heller, and Sieglinger (1943). The riboflavin and pantothenic acid content was comparable to that of other cereals, and the niacin content of the brown-coated seed was somewhat higher. The carotene content (closely correlated with vitamin A) of the varieties tested has been determined by Gross and Heller (1943). According to this report, the average carotene is less than one-half that of Oklahoma-grown yellow corn.

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