CHEMICAL COMPOSITION OF SORGHUM FORAGE AT VARIOUS STAGES OF VEGETATIVE GROWTH

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INTRODUCTION

Sorghums are one of the major crops grown in Oklahoma and they are used to produce both forage and grain. Cooperative experiments have been directed toward securing a comprehensive knowledge of the chemical composition of the plant at all stages of growth. In collecting samples for detailed carbohydrate and nitrogen analyses, samples of the whole plant at various stages of growth up until heading time became available. Considerable published data regarding the composition of mature sorghum forage (Morrison, 1936) intended for feeding purposes is already available and can be used in connection with these figures. Since very little is known about the feeding value of immature plants and inquiries on this point are occasionally received, it was decided to use the available samples to determine the feeding value as shown by the conventional proximate analysis for feeding stuffs.

METHODS

Sampling. The plants used for these analyses were grown on bottom land, and were planted and cultivated according to the best practices recommended for such crops. Samples were secured by cutting the desired number of plants in the field and immediately bringing the samples into the laboratory where they were ground in a power meat grinder. Portions were taken from the well-mixed material and dried on a steam hotplate at about 80° C. Later the samples were oven-dried at 105° C and finely ground in a Wiley cutting mill before being stored in sealed glass jars. The number of plants used varied with the size of the stalk and ranged from several hundred when small to a minimum of twelve to fifteen at later sampling periods.

Moisture. Samples were removed from the freshly ground material and dried to constant weight at 105° C.

Proximate analyses. These analyses were performed according to the directions given by the A.O.A.C. (Anon. 1940) under the section headed *Grain and Stock Feed Analyses.*

RESULTS

Data are given in the tables for samples from two years. The stage of maturity is indicated by the age of plants given as days from planting and by the height of stalks (average height of the cut plants in the laboratory). At any one sampling there was a considerable range in height and quoted figures are to be considered accordingly. The varieties used are two strains of dwarf kafir, No. 60-21, a chinch-bug-resistant strain, and 58-19, a susceptible strain; and two durras, Pig Nose, C. I. No. 696, a chinch-bug-susceptible variety and Corneous C. I. No. 695, a resistant variety. In studying these figures one of the most interesting columns is that for water, where the value remains relatively constant during the period covered. This means that any appreciable change in the proximate analyses is chiefly due to changes during growth and is not due simply to an increase in dry matter, as is usually the case after heading. Ash values show the greatest changes and here we have to consider the fact that the small plants have a relatively large amount of soil on them which was not

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removed in the process of harvesting. The recorded figures are certainly too high for true ash but they are what would be found if the plants were harvested at this stage of growth. Another interesting value is the ether extract, where the results for the two years are quite dissimilar. No explanation is known for this difference unless it is due to seasonal differences, which were extreme. As indicated previously there is little published information regarding the composition of immature sorghum forage. Detailed carbohydrate, ash, and protein figures are given for the composition of Atlas and Milo at various stages of growth up until heading, in the bulletin by Webster and Heller (1942). The results in this bulletin, however, are not in a form that can readily be transferred into the usual feeding units.

Probably the most significant figure in the tables is that of protein because this value is relatively high. Examination of the values expressed on a dry-weight basis shows that protein comprises at least one-sixth and often a fifth of the total dry weight. These figures would indicate that the dried immature sorghum forage is higher in protein than average for good alfalfa hay and much higher than most of the hay crops ordinarily harvested in this country. The crude fiber is correspondingly low and the nitrogen-free extract is relatively high. These results point to the desirability of further chemical studies on the composition of immature sorghum forage.

LITERATURE CITED

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TABLE I

Proximate analyses of sorghum plants, 1942, green-weight basis

Name	Age	Height	H_2O	Ash	Ether extract	Protein	Crude fiber	N.F.E.
	Days	In.	%	%	%	%	%	%
Kafirs								
60-21	38	13	82.47	5.12	0.23	3.11	2.81	6.26
60-21	80	18	83.86	1.95	0.42	3.44	3.26	7.07
60-21	87	22	82.31	2.62	0.41	3.18	3.32	8.16
58-19	38	13	81.88	5.53	0.20	2.79	2.65	6.95
58-19	80	18	82.08	2.02	0.43	3.21	3.89	8.37
58-19	87	22	78.10	2.54	0.58	3.37	4.09	11.32
Durras								
C. I. No. 695	38	19	84.48	3.28	0.21	2.49	3.14	6.40
C. I. No. 695	44	29	85.94	1.88	0.18	3.32	3.32	5.36
C. I. No. 695	80	47	86.00	1.47	0.28	2.14	3.73	6.38
C. I. No. 695	87	63	84.08	1.47	0.30	1.99	3.76	8.40
C. I. No. 696	38	18	84.34	4.53	0.16	2.77	2.72	5.48
C. I. No. 696	44	27	86.39	1.98	0.21	2.83	2.98	5.61
C. I. No. 696	80	46	86.25	1.43	0.26	2.43	3.44	6.19
C. I. No. 696	87	74	84.32	1.38	0.33	2.39	3.70	7.88

TABLE II

Proximate analyses of sorghum plants, 1942, dry-weight basis

Name	Age	Height	Ash	Ether extract	Protein	Crude fiber	N.F.E.
	Days	In.	%	%	%	%	%
Kafirs							
60-21	38	13	29.18	1.31	17.75	16.03	35.73
60.21	80	18	12.11	2.62	21.31	20.20	43.76
60-21	87	22	14.81	2.32	18.00	18.78	46.09
58-19	38	13	30.53	1.08	15.38	14.61	38.40
58-19	80	18	11.27	2.39	17.94	21.73	46.67
58-19	87	22	11.60	2.63	15.38	18.66	51.73
Durras							
C. I. No. 695	38	19	21.16	1.36	16.06	20.24	41.18
C. I. No. 695	44	29	13.35	1.25	23.63	23.64	38.13
C. I. No. 695	80	47	10.52	2.00	15.25	26.67	45.56
C. I. No. 695	87	63	9.21	1.91	12.50	23.59	52.79
C. I. No. 696	38	18	28.95	1.03	17.69	17.39	34.94
C. I. No. 696	44	27	14.52	1.53	20.81	21.88	41.26
C. I. No. 696	80	46	10.40	1.89	17.69	25.04	44.98
C. I. No. 696	87	74	8.77	2.10	15.25	23.59	50.29

TABLE III

Proximate analyses of sorghum plants, 1943, green-weight basis

Name	Age	Height	H_2O	Ash	Ether extract	Protein	Crude fiber	N.F.E.
	Days	In.	%	%	%	%	%	%
Durras								
C. I. No. 695	34	5	84.79	3.33	0.14	3.32	2.07	6.35
C. I. No. 695	55	10	85.56	1.70	0.23	3.38	2.51	6.62
C. I. No. 695	58	15	85.09	1.61	0.21	3.44	2.79	6.86
C. I. No. 695	65	21	83.57	1.65	0.09	3.15	2.95	8.59
C. I. No. 695	69	27	82.67	1.46	0.15	2.80	3.56	9.36
C. I. No. 695	76	39	83.60	1.37	0.12	2.41	3.73	8.77
C. I. No. 695	83	53	80.34	1.27	0.04	1.99	4.86	11.50
C. I. No. 696	34	5	84.98	4.12	0.20	3.24	1.70	5.76
C. I. No. 696	55	10	85.60	1.64	0.18	3.46	2.49	6.63
C. I. No. 696	58	14	84.49	1.50	0.24	3.58	2.61	7.58
C. I. No. 696	65	21	84.30	1.54	0.16	3.55	2.87	7.58
C. I. No. 696	69	28	83.41	1.43	0.13	3.38	3.30	8.35
C. I. No. 696	76	39	85.42	1.36	0.12	2.73	3.12	7.25
C. I. No. 696	83	56	84.24	1.23	0.11	2.72	3.38	8.32

TABLE IV

Proximate analyses of sorghum plants, 1943, dry-weight basis

Name	Age	Height	Ash	Ether extract	Protein	Crude fiber	N.F.E.
	Days	In.	%	%	%	%	%
			Durras				
C. I. No. 695	34	5	21.91	0.89	21.81	13.61	41.78
C. I. No. 695	55	10	11.76	1.58	23.44	17.39	45.83
C. I. No. 695	58	15	10.83	1.41	23.06	18.73	45.97
C. I. No. 695	65	21	10.03	0.56	19.19	17.96	52.26
C. I. No. 695	69	27	8.41	0.87	16.13	20.53	54.06
C. I. No. 695	76	39	8.38	0.71	14.69	22.75	53.47
C. I. No. 695	83	53	6.47	0.21	10.13	24.71	58.48
C. I. No. 696	34	5	27.40	1.31	21.56	11.34	38.39
C. I. No. 696	55	10	11.40	1.25	24.06	17.28	46.01
C. I. No. 696	58	14	9.69	1.56	23.06	16.86	48.83
C. I. No. 696	65	21	9.78	1.02	22.63	18.26	48.31
C. I. No. 696	69	28	8.63	0.76	20.38	19.91	50.32
C. I. No. 696	76	39	9.35	0.81	18.75	21.40	49.69
C. I. No. 696	83	56	7.93	0.70	17.25	21.45	52.67