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PRAIRIE HAY:

ITS COMPOSITION AND FOOD PROPERTIES.

BY

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THESIS

Introduction.

The importance of grass culture is conceded by [illegible] Agriculturists in these times. Since wheat has assumed the present attitude in the commercial world and its low value has become apparent, the question [illegible] dairying and meat products are prominently before the farmers' minds.

The Eastern farmer and stock-raiser can't compete successfully with the Western farmer and stock-raiser. Is it because the hay and grains are [illegible] [illegible] there [illegible] which produce [illegible], or is it because of the vast areas of lands, climatic influences, ease of producing crops or other causes?

Purposes of paper.

This paper will treat principally of the chemical and food values of a limited number of samples and a comparison of some of the tame grasses of our country.

Crops.

"Rotation of crops," assumes great importance in every system of extensive agriculture. Successive cropping, without change, is known to [illegible] [illegible] the best of lands. Prairie grasses of [illegible] our country have grown upon these lands [illegible] [illegible] years, [illegible] have [illegible]

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leathery and which can be broken up with difficulty.

Description of prevailing prairie grass.

These grasses have sent their roots deep into the soil, even reaching out after the moisture found at great depths. In most regions, the country or home of these grasses is subject to extreme drouths and the hardy, tough grasses have adapted themselves to these conditions. The months of July and August are almost rainless, in Indian Territory, where the samples treated of in these analyses, were taken. The grass becomes dry and parched and, to all appearances, dead, but being a perennial of great root growth, it springs up in a very short time after rain falls. It grows from 6 to 20 inches high, is of tough fibre and very light when cured for hay. Its color is pale green.

The leaves or blades are numerous and of a pale green, the surface and edges of which are very rough and cutting. Three or four crops may be cut from a field in a year. Stock feeds upon it even in the winter time. One reason for its short growth may be attributed to its constant and continued growing for successive years: Another reason, to the small amount

of rainfall which moisture is soon carried off by the southwest winds.

Description of Prairie grass.

The Prairie grass analyzed, differed in results slightly from those given in "The Compilation of Analyses of Forage Feeding Stuffs" published by the U. S. Department of Agriculture in 1892.

Variety Analyzed.

The variety analyzed was Bisyrhinchium bermudiana, Var. inops. This is a small grass varying in height from 4 to 12 inches, and is of a dark green color. Like the prairie grass, it has numerous, dense, fibrous roots which reach down deep into the soil. The flower is a five-parted, beautiful deep blue one and is axillary and umbelled.

The stem is flat as well as the leaves. It is a tough, fibrous grass, the flowers of which are very abundant.

Samples of Hay.

The samples analyzed were taken from the Agricultural College farm of Okla. Territory, in the spring of 1892. After curing, enough was ground of each to fill a one-half pint jar. After being ground, the samples were mixed thoroughly and then with a coffee

holes 1 millimeter in diameter, and the material passed through was taken in each case for analysis.

Method of Analysis.

The method employed in the analysis, was that of the official method as given in "Bulletin No.35 of U. S. "Department of Agriculture" "Division of Chemistry."

Reagents used in analysis.

Anhydrous ether.

Diluted Hydrochloric acid. (1 to 3 parts water to 1 part acid).

Sulphuric Acid, (specific gravity 1.84,) free from nitrates and ammonium sulphate.

Mercuric Oxide, [illegible] complete oxidation.

Potassium permanganate, finely pulverized.

[illegible], to prevent bumping.

Potassium sulphide, 10 gr. to the liter (0.1 N).

Diluted solution of acid.

Indicator, [illegible] in dilute alcohol [illegible].

Sulphuric acid, 1.25 per cent. solution.

Sodium hydrate, 1.25 per cent. solution.

Preparation of some Reagents.

Anhydrous ether.- To prepare Anhydrous ether free of alcohol, required for estimation of fat, take any commercial ether, and wash two or three times with water, then add sticks of caustic soda or potash, to abstract nearly all the water, then add carefully cleansed bits of metallic sodium until there is no evolution of gas. Then keep over metallic sodium and stopper lightly to allow hydrogen gas to escape.

Carbical.- To prepare indicator, put 5 grams of pulverized carbical into 50 cc. of strong alcohol and 20 cc. of pure water and agitate at intervals for two days.

Cupric hydrate.- To prepare cupric hydrate, dissolve 100 grams pure cupric sulphate in 5 litres of water and add 2, cc. of glycerol. Add dilute solution of sodium hydrate till alkaline, filter, rub precipitate with water containing 5 cc. glycerol per litre and wash till no longer alkaline, rub precipitate again with 10 per cent. solution of glycerol in a uniform pulpy mass that can be measured by a pipette is obtained.

Moisture or volatile matter.

Two grams of the fine air-dried material were dried for five hours in a current of dry hydrogen, at a temperature of 100°C. and showed a loss of 6.5 per cent. in moisture.

Ash.

Two grams were burned to whiteness at the lowest possible red heat and ash found to be 6.58 per cent.

Ether extract.

Two grams of material, dried as for moisture determination, were extracted with anhydrous ether for sixteen hours, then dried at 100 degrees C. to constant weight, and the ether extract found to be 5.46 per cent.

Total Nitrogen.

One gram was treated with 20 cc. of sulphuric acid and 0.7 gram of mercuric oxide and digested at boiling temperature till liquid became clear; while hot, particles of pulverized permanganate of potash were added till, on shaking, the liquid remained purple or green. After cooling the solution was transferred to a distilling flask with 200 cc. water and some bits of granulated zinc, 25cc. of potassium sulphide were added and flask shaken, then, enough of the soda solution was added with care to make solution alkaline. The

flask was then connected with the condenser and 150 cc. distilled over into the standard acid. The distillate was then titrated with standard ammonia, using cochineal as the indicator and the total Nitrogen found to be .99 per cent.

Albuminoid Nitrogen.

One gram was boiled in 100 cc. of water for ten minutes and the proper amount of cupric hydrate added, the solution was agitated and when cold was filtered. Filter and contents were then put into the Sulphuric acid solution and the process continued as in the above method. The albuminoid nitrogen was found to be .85 per cent.

Proteins.

The proteins were found by multiplying .85 per cent. by factor 6.25 and found to be 5.51 per cent.

Crude fibre.

Two grams were extracted for 30 minutes with a 1.25 per cent. solution of Sulphuric acid, then washed thoroughly with water and residue extracted for 30 minutes with a 1.25 per cent. solution of sodium hydrate, washed thoroughly and dried at 110 degrees C. weighed, incinerated and loss gave 30.12 per cent. for crude fibre.

Nitrogen-free extract..

The nitrogen-free extract was found by method of differences to be 45.95 per cent.

Analysis of Bermuda grass.

The analysis of the Bermuda grass was made by the same method with the following results:

Water,	6.30 per cent.
Ash,	5.85 per cent.
Proteins,	4.75 per cent.
Crude fibre,	33.83 per cent.
Nitrogen-free extract,	44.54 per cent.
Fat,	4.90 per cent.

Table of Prairie hay.

Water,	6.38 per cent.
Ash,	6.58 per cent.
Proteins,	5.56 per cent.
Crude Fibre,	32.12 per cent.
Nitrogen-free extract,	45.12 per cent.
Fat,	3.46

Digestible Nutrients.

The value of grass, for feeding purposes, depends upon the amount of digestible nutrients which it contains. These nutrients consist mainly of three classes: Albuminoids, Carbo-hydrates and Fibre, and fats.

Grasses that contain large amounts of these and in the proper ratios are valuable.

Below we shall give tables of various grasses and compare them as to the relative amounts and values of these constituents.

Tables of Feed-stuffs.

Grasses,

	Water %	Ash %	Proteins %	Fibre %	Nitrogen-free extract %	Fat %
Prairie Hay of Okla.	6.55	6.58	5.51	32.12	45.95	3.46
Bermuda grass of Okla.	6.50	5.85	4.75	33.83	44.37	4.90
Blue Stem of Indian Ter.	14.50	3.50	3.59	26.72	49.36	2.73
Bermuda grass of Ala.	14.50	7.81	11.50	19.96	45.09	1.34
Red -Top of Pa.	14.50	5.90	8.48	21.71	46.77	2.84
Timothy of Conn.	14.50	5.27	4.88	32.81	45.29	1.[illegible]
Timothy of N. Y.	14.50	4.10	6.80	25.50	48.10	2.00
Timothy of Maine	10.70	3.80	6.00	27.70	48.50	3.30
Timothy of Pa.	14.50	4.35	7.82	21.72	49.66	2.77

Grasses con.

	Water %	Ash %	Proteins %	Fibre %	extract %	Fat %
Timothy of Ind.	14.30	3.92	4.96	24.25	48.99	3.60
Timothy of Mass.	8.30	5.61	8.95	27.68	47.12	2.34
Timothy of N. J.	8.67	4.30	9.19	30.30	46.02	1.62
Timothy of Vir.	6.65	5.38	9.69	31.61	43.00	3.77
Timothy of Mo.	7.20	5.54	7.19	29.55	47.88	2.84
Ken. Blue grass of Miss.	14.30	4.46	9.89	25.94	44.96	2.45
Ken. Blue grass of Ill.	14.30	6.70	12.94	21.36	41.47	3.33
Ken. Blue grass of N. H.	14.30	4.69	6.43	19.26	51.08	4.24
Ken. Blue grass of N. C.	14.30	7.72	12.48	20.68	41.09	3.73
Red Clover Unknown	10.15	4.39	11.51	27.12	39.68	7.15
Red Clover in bloom	30.73	6.59	13.58	21.35	23.92	4.13
Alfalfa	8.44	7.44	14.28	25.61	41.68	2.15
Cow-pea	10.69	7.53	18.37	20.19	42.22	1.19

Western. Baled Hay	6.84	5.82	8.12	51.70	44.62	4.90

Note. The above results are taken from the Compilations of the Analyses of American Feeding Stuffs.

Comparison of Moisture. The Oklahoma prairie hays contain the least moisture of those given in the above table. The timothy hays of Mass., New Jersey, Vermont and Missouri, the Alfalfa and Western-baled hay, and the Cow-pea come nearest to these hays in this regard.

Comparison of ash and proteins. Few of these grasses contain more ash than those of Oklahoma. None have so small percentages of proteins save the Blue-stem of the Indian Territory. A larger amount of proteins would add to their value.

Comparison of Fibre. Few are so rich in fibre, that of the Timothy hay of Connecticut being a mean between that of the prairie hay and the bermuda grass.

Comparison of Nitrogen-free extract. Nearly all of the Timothy hay and Kentucky blue grasses excel these hays only by small percentages in Nitrogen-free extracts. The red clovers and Al-

pecially low in this particular.

Comparison of Fat.

The Indiana and Vermont timothy grasses, the New Hampshire and North Carolina Kentucky Blue grasses, the red clover in bloom and the Western baled hay exceed them in the quantity of fat.

Discussion of the food elements.

The grasses analyzed with which this paper is concerned, are especially rich in the non-nitrogenous compounds, crude fibre, fats, and moderately so in the albuminoids. Formerly it was considered that the fibre was indigestible material, but we know by later experiments that weak acids convert the fibre into starch. The nitrogen-free extract is made up of carbo-hydrates, such as: grape sugar, cellulose, starch and other substances. These grasses are about as rich in these last named elements as the Timothy and Kentucky blue grasses.

The fat is found in considerable quantities, and hence we find all the properties and qualities which make a good meat-producing hay.

Conclusion.

As the fats are 2 1-2 times as nutritive as the

starches, sugars and kindred substances we can conclude, that from the large quantity of fat contained in these grasses, they are very nutritive.

A grass that contains large quantities of fats sugars, etc., is well adapted to supply the needed heat elements, and having a good proportion of the Nitrogenous elements, we find it of nearly as great value for a grazing grass as the domestic grasses found in the North and East, especially timothy and blue grasses.

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