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Oklahoma Agricultural Experiment Station,

BULLETIN NO. 46.

MAY, 1900.

DIGESTION TRIALS.

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STILLWATER, OKLAHOMA.

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DIGESTION TRIALS WITH CHICKENS.

SUMMARY.

- 1.—Chickens digested Kafir corn and corn more completely when the grain was fed whole than when the meal was fed.
- 2.—The Kafir corn and Kafir meal fed in this trial yielded but two per cent. less total digestible matter than the corresponding corn products.
- 3.—Kafir corn was a more suitable ration, considering only the relative amounts of growth-making and fat-forming materials, for chickens than Kafir meal, corn, or corn meal.
- 4.—Cowpeas were digested reasonably well and are desirable feed for growing chickens and hens. But little gain in digestibility was secured by grinding the cowpeas.

The extent to which Kafir corn is used in Oklahoma as food for poultry, and the lack of any information as to its digestibility when fed to chickens, led to the making of this series of digestion trials.

Three cockerels were used in these trials. They were medium sized individuals and of no particular breed. They were confined in separate wire cages fitted with a roosting pole, and removable tin trays entirely covering the bottom. These trays were removed and weighed twice daily, others being substituted during this operation.

A preliminary period of two days was followed by a digestion period of five days' duration, with the exception of Period 1, which consisted of two five-day periods combined. The legs and feet of the cockerels were washed at the beginning and at the close of the digestion period and adhering dung collected. Two samples of dung were taken daily, morning and evening.

Coarse sand and water were given the birds *ad libitum*. Feed was given in such amounts as was eaten completely, the meals being fed in the form of a thick mash.

Sand and grain were consumed in the following amounts. The amount of sand eaten was considerable, making the percentage of ash in the dungs correspondingly high.

Food and Sand Eaten.

	Chicken A. Grams	Chicken B. Grams	Chicken C. Grams
Period 1; two five-day periods.			
Kafir corn.....	430.8	444.7	311.8
Sand.....	146.4	241.0	254.5
Period 2; five days.			
Kafir meal.....	165.0	165.0	106.0
Sand.....	72.6	99.0	100.0
Period 3; five days.			
Corn.....	289.7	175.8	180.3
Sand.....	80.0	96.6	149.0
Period 4; five days.			
Corn meal.....	214.0	218.0	123.0
Sand.....	116.5	119.0	109.0
Period 5; five days.			
Cowpeas.....	100.5	227.5	185.3
Sand.....	181.5	197.0	296.0
Period 6; five days.			
Cowpea meal.....	342.0	262.0	236.0
Sand.....	192.0	197.0	296.0

The samples of dung for complete analysis were dried at 60 degrees, C. and the nitrogen was also determined in the fresh samples. In calculating the co-efficients of digestibility, the albuminoids of the dung were taken as representing the undigested protein of the feed. The following table contains the analyses.

Percentage Composition.

SAMPLE.	Water	Ash	Protein	Fiber	Nitrogen-free extract	Ether Extract	Albuminoids	Protein in fresh sample
Kafir corn.....	10.83	1.53	11.88	2.27	70.83	2.06	11.75	
Period 1.								
Dung A.....	27.65	49.49	15.97	3.22	2.50	1.17	10.05	16.16
Dung B.....	13.66	66.56	10.71	2.33	5.75	0.99	6.92	11.47
Dung C.....	15.94	71.63	8.21	1.69	1.93	0.60	5.22	8.57
Period 2.								
Dung A.....	12.55	66.63	14.96	2.41	2.67	0.78	10.68	16.52
Dung B.....	11.58	72.07	10.21	1.64	4.02	0.48	7.85	10.37
Dung C.....	7.18	82.50	7.02	1.10	1.81	0.39	5.74	7.85
Corn.....	10.11	1.30	9.00	1.63	73.24	4.72	8.75	
Period 3.								
Dung A.....	14.02	56.66	11.94	2.25	14.07	1.06	9.01	13.09
Dung B.....	9.40	74.65	6.90	4.23	4.47	0.35	4.60	8.28
Dung C.....	7.75	79.23	5.36	1.76	5.48	0.42	4.55	6.30
Period 4.								
Dung A.....	30.75	55.41	5.89	1.60	5.88	0.27	4.61	7.52
Dung B.....	21.11	63.73	5.60	1.77	7.37	0.42	4.60	6.35
Dung C.....	13.96	73.98	4.79	1.64	5.39	0.24	4.36	6.04
Cowpeas.....	10.37	3.65	21.44	5.02	57.14	2.38	19.94	
Period 5.								
Dung A.....	17.20	71.10	6.92	1.87	2.77	0.14	6.03	7.87
Dung B.....	27.61	57.36	8.24	1.74	4.88	0.17	6.81	9.49
Dung C.....	16.44	71.05	7.02	2.07	3.30	0.12	5.49	8.50
Period 6.								
Dung A.....	44.35	37.87	8.81	2.94	5.92	0.11	7.12	9.30
Dung B.....	37.49	47.31	8.69	2.64	3.85	0.02	7.33	9.13
Dung C.....	37.45	51.71	6.52	2.00	2.06	0.26	5.53	10.34

Digestion co-efficients, calculated from feeding data, and averages are presented in the following table:

MATERIAL FED	Chicken	Per Cent. Digestible				
		Organic matter	Protein	Fiber	Nitrogen-free extract	Ether extract
Kafir corn.....	A		50.4	17.3	97.9	73.9
Kafir corn.....	B		55.3	21.8	98.8	71.2
Kafir corn.....	C		53.0	21.1	97.1	75.9
	Average.....	87.7	52.9	20.1	96.3	73.7
Kafir meal.....	A		41.8	29.7	97.5	81.8
Kafir meal.....	B		42.3	35.1	95.0	84.1
Kafir meal.....	C		43.6	41.7	97.1	82.1
	Average.....	87.2	42.6	35.5	96.5	82.7
Corn.....	A		47.5		89.9	88.3
Corn.....	B		57.6		95.7	95.2
Corn.....	C		44.4		91.8	91.7
	Average.....	86.4	49.8		92.5	91.7
Corn meal.....	A		49.7		92.1	94.1
Corn meal.....	B		54.6		91.1	92.2
Corn meal.....	C		40.9		91.2	92.2
	Average.....	85.5	48.4		91.5	93.1
Cowpeas.....	A		32.1	10.0	88.3	87.5
Cowpeas.....	B		47.9	42.9	86.0	88.9
Cowpeas.....	C		41.5	2.2	86.9	89.6
	Average.....	71.5	40.5	18.4	87.1	88.7
Cowpea meal.....	A		48.8	9.9	84.0	92.6
Cowpea meal.....	B		42.1	11.3	88.5	98.4
Cowpea meal.....	C		40.1	7.6	80.8	75.0
	Average.....	72.2	43.7	9.6	87.8	88.7

The table which follows was calculated from the two preceding tables. Carbohydrates and fat includes the sum of the digestible fiber, nitrogen-free extract, and two and one-fourth times the fat.

MATERIAL	Total dry matter	Per Cent. of Digestible Matter			Nutritive ratio
		Protein	Carbohydrates and fat	Total	
Kafir corn.....	89.17	6.28	73.09	79.37	1: 11.6
Kafir meal.....	89.17	5.06	74.11	79.17	1: 14.6
Corn.....	89.89	4.48	77.49	81.97	1: 17.2
Corn meal.....	89.89	4.36	76.90	81.26	1: 17.6
Cowpeas.....	89.63	8.68	55.44	64.12	1: 6.4
Cowpea meal.....	89.63	9.37	55.40	64.77	1: 5.9

The results of a digestion trial with hens are summed up by Kalugine as follows: (E. S. R., Vol. 8, p. 915.) "In the ability to digest the crude protein of peas and barley, hens do not differ from the ordinary farm animals. In their ability to

digest the crude protein of buckwheat and wheat, they are much inferior. In ability to digest fat they resemble in some respects herbivora and in other respects swine. Hens digest nitrogen-free extract very completely. In this respect, they differ very little from farm animals. They digest crude fiber less completely than horses or swine."

The trials here reported show that the nutrients of Kafir corn and Kafir meal, with the possible exception of the fiber, are more completely digested by chickens than by steers. Nitrogen-free extract and ether extract were quite completely digested in all cases. The protein of cowpeas was less digestible than that of Kafir corn or corn, as was the case with nitrogen-free extract and ether extract. The work here reported is, however, incomplete and only preliminary and no definite conclusions can now be drawn.

FODDER CROPS.

DIGESTION TRIALS WITH SHEEP.

The following fodder crops were grown on the station farm during the season of 1898 and digestion trials made during the winter of 1898-'99. These results represent but one season's work and have been duplicated with steers. This last work will not be completed for perhaps a year, and this article is only in the nature of a report of progress and not to be regarded as final.

The crops were drilled in rows and cultivated until mature when they were cut and shocked. When cured, the fodders were run through a cutter and fed in this manner. The usual methods were followed in making the digestion trials.

In the following table is given the composition of the fodders when harvested and weighed.

FODDER.	Pounds in 100 Pounds When Sampled.					
	Water	Ash	Protein	Fiber	Nitrogen-free extract	Ether Extract
Kafir	55.25	2.51	3.02	10.48	27.97	0.77
Corn	66.49	1.56	2.41	8.23	20.52	0.79
Small sorghum	58.03	1.85	1.94	10.18	26.92	1.08
Large sorghum	66.76	1.46	1.74	7.64	21.38	1.02
Black rice corn	63.08	2.06	2.28	7.55	24.34	0.69
Milo maize	65.79	2.10	2.27	10.08	19.02	0.74

The digestion co-efficients as determined by trials with sheep are given in the following table. It was found that the rations were too wide for successful, continued work with sheep and future work along this line will be conducted entirely with steers.

FODDER	No. trials	Per Cent. Digestible.					
		Dry matter	Ash	Protein	Fiber	Nitrogen-free extract	Ether extract
Kafir.....	3	57.9	11.1	41.7	54.1	66.9	64.8
Corn.....	3	62.1	4.6	44.3	52.5	71.1	75.5
Small sorghum.....	1	56.0	12.4	15.7	46.3	67.0	75.2
Large sorghum.....	2	54.0	16.4	17.0	53.1	60.3	80.1
Black rice corn.....	2	52.0	20.6	25.3	44.5	62.1	64.2
Milo maize.....	3	51.7	7.7	16.2	50.9	60.7	65.0

From these tables of composition and digestibility, the following showing the amount of digestible nutrients per 100 pounds has been calculated.

FODDER	Total dry matter	Per Cent. of Digestible Matter			Nutritive ratio
		Protein	Carbohydrates and fat	Total	
Kafir.....	44.75	1.26	25.48	26.74	1: 20.2
Corn.....	33.51	1.07	20.26	21.33	1: 19.9
Small sorghum.....	41.97	0.36	24.56	24.92	1: 68.2
Large sorghum.....	33.24	0.30	18.79	19.09	1: 62.6
Black rice corn.....	36.92	0.58	19.47	20.05	1: 33.6
Milo maize.....	34.21	0.37	17.84	18.21	1: 48.2

The table which follows shows the total yield per acre of the different fodders and the total amount of digestible matter.

FODDER	Yield per Acre, Pounds	
	Total fodder	Digestible matter
Kafir.....	22,875	6,116
Corn.....	26,280	5,606
Small sorghum.....	44,550	11,102
Large sorghum.....	59,500	11,359
Black rice corn.....	35,000	7,018
Milo maize.....	55,000	10,016

When making a practical application of these results to Oklahoma conditions, two chief factors should be considered. These are the amount and quality of the fodder produced by the different plants. While the sorghums greatly surpass Kafir and

corn in the total yield of digestible nutrients, their nutritive ratio is in each case so wide that their fodders are not desirable when they are the only food given, as is usually the case with stock cattle. The protein, or growth-making material, of the sorghums was uniformly low in digestibility in this trial. It does not appear from this trial that they are as desirable as Kafir or corn, even though the total yield per acre with the last two is smaller. Where it is possible to procure concentrated foods, such as bran and cotton-seed meal, at a low price and feed them with sorghum fodder, it may be well to do so. The average stockman, however, succeeds best when his farm produces what is fed to his stock.

An extended series of digestion trials with Kafir and its products fed in different ways to steers has been made by the station. A report of this work was made in bulletin No. 37, which will be sent to those wishing information along this line.