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THE PREPARATION OF CORN FOR DAIRY COWS

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The corn crop of Iowa exceeds in acreage, yield and value all other grain crops combined. In this state, as well as in other sections of the corn belt, corn must be relied upon as the basis of the concentrate allowance for dairy cattle, as it generally is one of the most economical sources of energy. The extent to which it is used renders it essential that the feeding of it be carefully studied, as what are apparently small economies attain large proportions when considered in the aggregate.

The preparation of corn for other types of farm livestock has been studied to some extent, but the influence of the various preparations of corn on the total yield and economy of production of milk and butterfat has received little attention. The work reported here is but a part of a series of investigations being conducted on the influence of the method of preparation of corn on the production of milk, and is a comparison of ear corn, corn-and-cob meal, and corn meal.

PREVIOUS WORK

The only references to be found to work of this type with dairy cattle are in reports from the New Jersey station. Lane,[1] when comparing corn-and-cob meal with broken ear corn, fed these materials with an equal weight of wheat bran and a roughage ration of hay and corn stover. He found that the corn-and-cob meal gave 9.3 percent more milk and 4.9 percent more fat than the broken ear corn and reduced the cost of production. Cook[2] fed corn silage, alfalfa hay, corn stover and two parts of corn preparation to one of cottonseed meal. Under those conditions corn meal gave 4.6 percent more milk and 3.6 percent more fat than did an equal weight of corn-and-cob meal, but the corn-and-cob meal gave the most economical production.

METHODS

In this investigation, five young cows in either their first or second lactation were used. They were all in good milking condition, were good feeders and were either open or had been bred but a short time. Information concerning them is given in the first table and, where necessary, it is calculated to the date on which the experiment starts, January 13, 1918.

1. Lane, C. B. The Feeding Value of Ear Corn Compared with Corn-and-Cob Meal. N. J. Agr. Exp. Sta. Rep. 11, 211. 1898.
2. Cook, A. S. Corn-and-Cob Meal vs. Corn Meal. N. J. Agr. Sta. Rep. 25, 159. 1912.

TABLE I—ANIMALS USED

Cow No.	236	249	253	282	296
Breed	Grade Guernsey	Jersey	Grade Guernsey	Grade Holstein	Grade Guernsey
Age, years	3½	3½	3½	2½	2½
Fresh, days	136	174	160	142	113
Bred. days	43	0	42	0	0
Previous Lactations	1	1	1	0	0

The work was divided into five periods of 30 days each. The first ten days of each period were used as transitions, and in the consideration of the results only the last 20 days of each period are used.

The animals were fed a basal ration of corn silage, clover hay, and a grain mixture of 4 parts wheat bran, 4 parts old-process linseed oil meal, 2 parts cottonseed meal and 1 part of ground oats, by weight. In addition to this they were fed the corn preparation being studied. The silage and hay were fed according to the appetites of the animals, while the total grain ration allowed was determined by the individual production of milk and butterfat. The allowance of the corn preparation was such that corresponding quantities of corn grain dry matter were fed in the various periods and the amount of mixed grain given was equal as nearly as possible to the amount of corn grain dry matter allowed.

The corn preparations were fed in the order shown in the second table and it may be said that the corn meal periods were looked on as the check periods and every effort was made to have the amount of feed given in the ear corn and corn-and-cob meal periods equal in amount to the average of that given in the check periods immediately preceding and following them.

The shelling percentage of the corn used in this work was 80.2 and in order that the corn dry matter allowances should be kept uniform, careful checks were kept on the moisture content of the corn by the oil extraction method. The average moisture content of the corn fed during each ten-day period is tabulated.

TABLE II—CORN MOISTURE

Period No.	Corn Preparation Fed	Moisture Percent
I i	Corn meal	14.7
ii		15.1
II i	Ear corn	10.5
ii		10.9
III i	Corn meal	11.9
ii		11.3
IV i	Corn and cob meal	12.1
ii		11.0
V i	Corn meal	10.0
ii		12.1
	Shelling rate	80.2

The experimental animals were allowed salt at free will and were watered and weighed twice daily. The morning weights, after feeding hay and before watering, were used in determining the

average live weights of the animals. Hay, silage, and grain were each fed twice daily. The animals were milked twice daily and the composite sample for ecah cow was tested for butterfat at the end of each ten-day period.

For convenience in reference, the average live weights, total feed consumption and milk and butterfat production have been grouped together.

DISCUSSION OF RESULTS

When the total production of milk and butterfat during the ear corn period is compared with the average yields during the corn meal periods which immediately precede and follow it, it is found that with corn meal there was a production of 127.9 pounds more milk and 12.03 pounds more fat or 7 percent more milk and 14 percent more fat than was obtained when ear corn was fed. At the same time it is evident that the consumption of feed other than corn was practically uniform thruout. Similarly, the amount of corn grain of 14 percent moisture content consumed was very uniform.

TABLE III—LIVE WEIGHTS, FEED CONSUMPTION AND MILK AND BUTTERFAT PRODUCTION

Period No.	Cow No.	Av. Live Weight	Total Feed Consumption				Total Production	
			Corn silage	Clover hay	Grain Mixture	Corn preparation	Milk	Fat
		lbs.	lbs.	lbs	lbs.	lbs.	lbs	lbs.
I	236	1001	600	136	60	60	319.5	16.66
	249	834	500	144	70	70	385.7	20.45
	253	961	600	143	70	70	349.5	17.18
	282	1067	600	135	100	100	516.1	22.87
	296	833	500	127	80	80	478.9	24.33
	Group	939	2800	685	380	380	2049.7	101.49
II	236	1003	600	125	60	75	307.9	14.28
	249	837	500	138	70	88	361.5	17.81
	253	964	600	138	70	88	341.2	15.95
	282	1028	600	120	100	125	465.7	17.58
	296	833	500	112	80	100	423.6	19.70
	Group	943	2800	633	380	476	1899.9	85.32
III	236	1010	600	115	60	65	321.5	16.40
	249	839	500	120	70	75	385.1	19.45
	253	988	600	119	70	75	343.8	16.55
	282	1069	600	114	100	105	506.0	19.35
	296	830	500	110	80	85	449.5	21.46
	Group	947	2800	578	380	406	2005.9	93.21
IV	236	1029	600	102	50	50	290.0	14.25
	249	842	500	113	50	50	337.0	16.68
	253	1012	600	110	50	50	281.6	13.67
	282	1090	600	82	80	80	455.8	16.61
	296	834	500	85	70	70	366.3	18.20
	Group	961	2800	492	300	300	1730.7	79.41
V	236	997	600	81	40	15	259.4	13.64
	249	795	500	85	30	5	243.9	12.99
	253	986	600	85	30	5	200.0	10.38
	282	1058	600	85	60	23	403.8	15.01
	296	806	500	85	60	28	353.8	16.07
	Group	928	2800	421	220	76	1460.9	68.09

In comparing the corn-and-cob meal with corn meal, the same uniformity in feed consumption is found, and the corn meal induced the production of 2.7 pounds more milk and 1.24 pounds more fat or 2 percent more fat than the corn-and-cob meal.

As the feed consumption is uniform in all periods and no changes of note occur in the live weights of the cows, it may be concluded that the changes produced in the milk and butterfat yields are indicative of the relative values of the various corn preparations. Consequently, corn meal can be looked on as responsible for the production of 14 percent more butterfat than ear corn, while corn-and-cob meal and corn meal are of practically the same value when they are fed on the basis of the corn grain contained, of comparable moisture content.

If the corn preparations be figured on the actual weight basis and with a 14 percent content of moisture in the corn grain, then 100 pounds of corn meal will be equal, for butterfat producing purposes, to 125 pounds of corn-and-cob meal or to 140 pounds of ear corn.

Increasing the production is not the only object in feeding dairy cattle; a decrease in the cost of production and increased net returns must be aimed at.

Ear corn has been taken as worth $1.25 per bushel and the costs of making the other preparations have been taken into consideration. Equitable prices have also been fixed for the other feeds.

The feed cost of production per pound of butterfat was 45.1 cents where ear corn was fed as compared with 40.3 cents in the corn meal check periods. This is a significant difference and it

TABLE IV—SUMMARY

Period	Av. live wt.	Total production			Feed consumption other than corn			Corn consumption			
								As fed		14% moisture basis	
		Milk	Fat	Fat	Corn silage	Clover hay	Mixed grain	Corn prep.	Corn grain dry matter	Corn prep.	Corn grain
	lbs.	lbs.	lbs.	per cent	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
CORN MEAL VS. EAR CORN											
Ear corn	943	1899.9	85.32	4.49	2800	633	380	476	339	493	394
Corn meal	943	2027.8	97.35	4.80	2800	632	380	393	341	397	397
Increase		127.9	12.03	.31		1			2		3
Decrease								83		96	
Increase %		7	14	7					1		1
Decrease %								17		19	
CORN MEAL VS CORN AND COB MEAL											
Corn and cob meal	961	1730.7	79.41	4.59	2800	492	300	300	212	309	247
Corn meal	938	1733.4	80.65	4.66	2800	500	300	241	213	248	248
Increase		2.7	1.24	.07		8			1		1
Decrease	23							59		61	
Increase %			2	2		2					
Decrease %	2							20		20	

TABLE V—COST OF CORN PREPARATIONS

	Per Bushel	Price Per Ton	Cost per 100. lbs
	Dollar	Dollars	Dollars
Shelling corn	.04		
Grinding corn	.06		
Grinding corn and cob meal	.12		
Ear corn	1.25	35.71	1.79
Corn Meal	1.35	48.21	2.41
Corn and cob meal	1.37	39.14	1.96

TABLE VI—PRICES FOR FEEDS OTHER THAN CORN

Feed	Price Per Ton
	Dollars
Corn silage	8.50
Clover hay	20.
Wheat bran	40.
Oil meal O. P.	75.
Cottonseed meal	75.
Ground Oats	50.

means that the net returns over feed cost were increased by $8.84 when ear corn was replaced by corn meal and butterfat is valued at 70c per pound and skim milk at $1 per 100 pounds.

In the comparison between corn-and-cob meal and corn meal there is a difference of only .6 cents in the feed cost of producing 1 pound of fat and of 96 cents in net returns over feed cost in favor of the corn meal. Consequently, there is little choice between them so far as economy is concerned, when they are fed under conditions similar to those which prevailed during the experiment.

The results obtained with corn-and-cob meal are apparently contradictory to those of Cook[1], but a close study of the two pieces of work indicates that they are actually in accord. In the work reported here the corn-and-cob meal and corn meal were fed with a bulky grain ration containing wheat bran and ground oats and under those conditions the additional bulk supplied by the cob of the corn-and-cob meal was of no value and the two preparations had a feeding value determined only by the

[1] See Ref. 2 p. 299.

TABLE VII—FEED COST OF PRODUCTION AND RETURNS OVER FEED COST

	Total yield		Feed cost					Feed cost per unit		Gross returns	Net returns
	Milk lbs.	Fat lbs.	Corn silage	Clover hay	Mixed grain	Corn prep.	Total	100 lbs. milk	1 lb. fat	B* 70c SM* $1.00	over feed cost
CORN MEAL VS. EAR CORN											
Ear corn	1899.9	85.32	$11.90	$6.33	$11.40	$8.82	$38.45	$2.02	45.1c	$77.87	$39.42
Corn meal	2027.8	97.35	11.90	6.32	11.40	9.57	39.19	1.94	40.3	87.45	48.26
Decrease								.08	4.8		
Increase										9.58	8.84
CORN MEAL VS CORN AND COB MEAL											
Corn and cob meal	1730.7	79.41	11.90	4.92	9.00	6.06	31.88	1.84	40.1	72.09	40.14
Corn meal	1733.4	80.65	11.90	5.00	9.00	5.98	31.88	1.84	39.5	72.98	41.10
Decrease									.6		
Increase										.89	.96

* B. Butter. S.M. Skim milk.

amount of corn grain they contained. In the New Jersey work, however, the corn preparations were fed with cottonseed meal as the sole supplement and the cob of the corn-and-cob meal rendered this preparation comparable to corn meal in feeding value, as the mixture of corn meal and cottonseed meal was not an ideal grain ration for a milk producing cow and the ground cob improved the physical character of the ration.

SUMMARY

1. Where corn meal, corn-and-cob meal and ear corn are fed with corn silage, clover hay and a mixture of old process linseed oil meal, cottonseed meal, wheat bran and ground oats, differences were found to exist in the values of these corn preparations as feeds for dairy cows.

2. When fed on the basis of the corn grain dry matter contained, corn meal and corn-and-cob meal were of about equal value, while with corn meal there was a production of 7 percent more milk and 14 percent more butterfat than with ear corn.

3. If they are compared on the basis of weight, with 14 percent of moisture present in the corn grain, 100 pounds of corn meal is equivalent, for butterfat producing purposes, to 125 pounds of corn-and-cob meal or 140 pounds of ear corn.

4. Where bulk is not provided in the grain ration by other constituents, corn-and-cob meal will have a feeding value for dairy cows equivalent to an equal weight of corn meal.