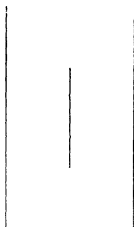
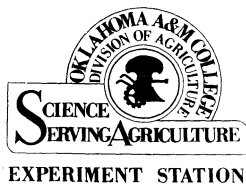
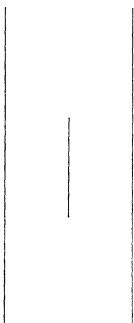


The Effects of Level of Grain Feeding Upon The Efficiency of Milk Production



**Eddie L. Thompson, Magnar Ronning
and E. R. Berousek**

Dairy Department



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The Effect of Level of Grain Feeding Upon The Efficiency of Milk Production

Eddie L. Thomason, Jr.,* Magnar Ronning, E. R. Berousek

Department of Dairying

Dairymen disagree on the amount of grain that should be fed for economical and efficient milk production. Variations in advocated "thumb" rule systems of feeding lactating dairy cows indicate such lack of agreement. Since feeds—particularly concentrate feeds—make up a large portion of the cost of milk production, more facts are needed regarding the best levels of grain feeding for economical and efficient milk production.

Because of this need for more knowledge, the Oklahoma Agricultural Experiment Station is conducting studies to secure information regarding the best levels of grain feeding. This bulletin reports the results of one feeding trial which was a part of this experiment.

Experimental Procedure

Fifteen purebred Ayrshire and Holstein cows were selected from the Oklahoma Agricultural and Mechanical College dairy herd for the study.

The cows were divided into three groups of five cows each. All three groups were as nearly balanced as possible with respect to breed, size, and previous lactation history. After reaching the peak of production under normal herd conditions, each cow was placed on trial for the remainder of the lactation period.

The cows were milked twice daily under the same system of management as the regular herd. Milk weights were recorded daily and butterfat percentage was determined monthly by the Babcock test.

The cows were stanchioned in the main dairy barn in individual stalls equipped with drinking cups and bedded with straw. Each animal was fed individually in a solid-partitioned, box-type manger. The cows received approximately five hours exercise daily in an outside lot.

A grain mixture consisting of one-half ground oats and one-half ground milo was fed with alfalfa hay and sorghum silage. Steamed bone-meal, finely ground limestone, and salt were added to the concentrate mixture at the rate of 1 per cent each. Grain was fed at the rates of 1.0 pound per 3.0, 5.0, and 8.0 pounds milk produced in groups I, II and III, respectively. Hay and silage were offered in a ratio of 1:3.9, with

*Now Dairyman, Middle Tennessee State College, Murfreesboro, Tenn.

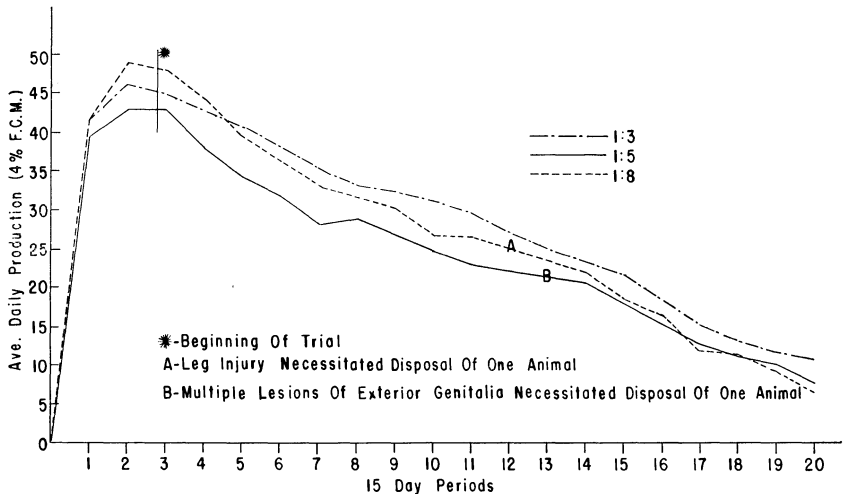


Fig. 1—Milk Production As Related to Level Of Grain Feeding

the total amount of roughage consumed being determined by total silage consumption.

Weekly adjustments in the levels of grain were made at the beginning of each week in accordance with the previous week's production. Hay and silage were offered to each animal in amounts which would encourage maximum roughage consumption.

After going on trial, each cow was weighed at the end of each week until completion of her lactation period. All weights were taken at approximately the same time each Saturday.

Results

Figure I shows the average daily milk production and level of grain feeding by 15-day periods. Data relative to total and average daily production, prior to and while on trial, are summarized in Table II. The rates of production, calculated on a cow-day basis, were as follows:

The data relative to feed and total digestible nutrients (TDN) consumption for cows of all groups are summarized in Table III.

Roughage contributed 10.7 and 34.8 percent more TDN in Groups II and III respectively, than in Group I.

The returns above feed costs per hundred pounds of 4 percent fat corrected milk (FCM), summarized in Table I are \$3.31, \$3.46, and \$3.49 in the high—medium—and low—grain-fed groups, respectively. Milk

Table I.—Average Daily Feed Consumption and Milk Production and Return over Feed Costs.

	Rations Consumed (Lbs.)			Average Production		Returns over feed costs per cwt 4% FCM
	Grain	Hay	Silage	lb. 4% FCM	per day	
Group I*	9.5	9.9	35.0		27.5	\$3.31
Group II	5.0	10.2	40.0		23.1	3.46
Group III	3.6	13.6	44.9		25.7	3.49

* Group I fed 1 lb. grain per 3 lbs. milk produced, Group II fed 1 lb. grain per 5 lbs. milk produced, and Group III fed 1 lb. grain per 8 lbs. milk produced.

was calculated at \$5.00 per hundred pounds of 4 percent FCM. Feed prices were calculated as follows: Alfalfa hay \$25.00 per ton; sorghum silage \$4.50 per ton; oats \$59.40 per ton; and milo \$50.60 per ton.

The average gain or loss in bodyweight per group is shown graphically in Figure 2. The average bodyweight gain per cow at the end of 32 weeks on trial was 27.7, 29.5, and 36.5 pounds for groups I, II, and III, respectively. Average bodyweight gains beyond 32 weeks are not included in this figure due to variations in the length of lactation of several individuals which caused a lack of uniformity of numbers in the groups beyond the 32-week period. Total gain in bodyweight during the trial was comparable in all groups, but the high-grain-fed group began gaining weight earlier. This group began gaining after the eighteenth week on trial. The medium-grain-fed group began gaining in bodyweight at the twenty-second week. The low-grain-fed group did not begin to gain materially in bodyweight until after 28 weeks, after which the gain was rapid.

Discussion

Differences in production before the trial indicate a lack of uniformity among the three groups of cows. Assignments were based on predicted production arrived at by studying previous lactation histories. However, this system may result in error. It is possible, also, that the feed intakes of the cows prior to the time of the experiment were sufficiently variable to account for the differences in average production.

Although absolute production varied among the groups, the trend of the decline in production as lactation advanced may be of importance. The high-grain group showed a more gradual and uniform decrease in production than the other two groups through the third 15-day period. Thereafter, persistency of production appeared to be similar in all groups. This indicates that higher rates of grain feeding for about 60 days past the peak of production might have a favorable effect upon persistency of production later in the lactation period. This possibility needs to be investigated further.

Table II.—Age, Days Milked, and Bodyweight Change of Cows Fed Different Levels of Grain.

Cow No.	Age at Calving Year-Mo.	Days Milked before Trial	Days on Trial	4% FCM before Trial (lbs.)	4% FCM on Trial (lbs.)	Body-weight Change (lbs.)
Cows Fed 1.0 lb. Grain/3 lb. Milk Produced						
3	7-11	39	265	1959.3	8030.0	1
4	7- 9	60	243	2470.6	4285.3	54
8	6- 3	30	275	1256.8	8958.0	44
11	7- 6	35	270	2463.2	7218.2	6
15	8- 7	35	226	1654.5	6633.9	98
Ave.	7- 7	40	256	1760.9	7025.1	41
Ave. Daily				44.2	27.5	
Cows Fed 1.0 lb. Grain/5 lb. Milk Produced						
1	6- 9	62	273	1768.1	3392.5	129
2	4- 7	50	256	2389.3	6658.0	163
9	7- 9	27	243	1153.7	5004.0	—45
10	8- 1	34	271	1983.2	8728.6	86
12*	8-10	35	174	1124.0	4302.9	—1
Ave.	6- 8	42	243	1683.7	5617.2	66
Ave. Daily				40.5	23.1	
Cows Fed 1.0 lb. Grain/8 lb. Milk Produced						
5**	6- 2	53	134	3387.6	5302.5	—7
6	6- 9	39	257	1448.8	4276.0	110
7	7- 9	38	257	2080.3	7362.6	101
13	3-11	42	263	1798.1	6690.1	54
14	8- 9	37	268	1250.0	6623.1	—128
Ave.	6- 8	42	236	1993.0	6050.8	26
Ave. Daily				47.7	25.7	

* Removed from trial due to multiple lesions of exterior genitalia.

** Removed from trial due to leg injury.

Some difficulty was experienced with sickness and “off-feed” conditions of one or two individuals in each group. This affected both rates of production and bodyweight changes. These “off-feed” conditions apparently were not the result of any particular level of grain feeding. Due to the influence of cows numbers 9 and 10, group II was affected to a greater extent than the other two groups as the result of “off-feed” conditions and the subsequent loss in milk yield and bodyweight. This apparently accounts for the decreased TDN intake of group II as compared to groups I and III. It is evident that the lower TDN intake in group II was the primary factor responsible for rate of production lower than that obtained in group III where an even lower level of grain was fed.

On the basis of the feeding conditions of this trial, decreases in the hay equivalent intake appeared to be between 0.6 and 0.8 pound for each additional pound of concentrate fed. The minimum hay decrease observed in this study was essentially the same as those reported in

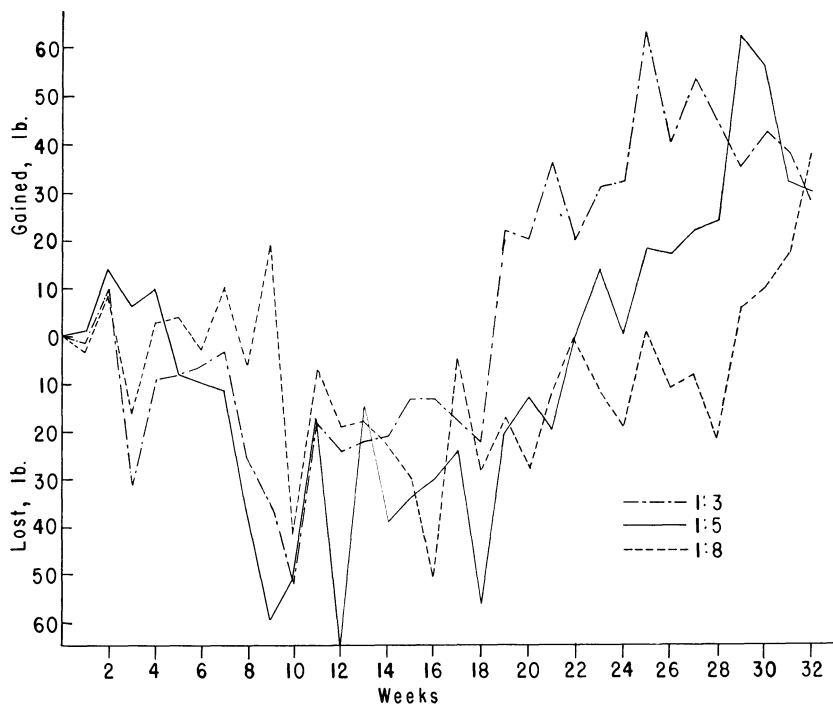


Fig. 2—Average Bodyweight Changes As Related To Rate Of Grain Feeding

other studies while the maximum was considerably higher. The range in amounts of hay reduction associated with grain-feeding increases was comparable to that reported by other investigators.

In terms of economic efficiency, the lower-grain-fed groups showed a greater return over feed cost per 100 pounds 4 percent FCM than did the high-grain-fed group. Returns over feed cost would have been even more in favor of the low-grain-fed groups if a higher priced concentrate had been fed. Naturally no certain level of grain feeding will always result in greater economic returns; it will be influenced by the hay-grain-milk price ratio and the inherited capacity of the cows. During periods of low grain prices, high hay prices and favorable milk prices, it is obvious that increased grain feeding with a subsequent increase in milk production would yield greater profits over feed cost.

On the basis of the results secured in this study and the comparable results of other workers, it appears that the most critical periods in feeding the lactating dairy cow to maintain persistency of production are prior to and immediately following the peak of production. Therefore, it seems apparent that dairy cows of moderate productive ability may maintain equal efficiency and persistency of production and have greater

economic efficiency when fed a full grain ration until after reaching their peak of production, and then a limited grain ration for the remainder of the lactation period.

Summary

The Oklahoma Experiment Station is currently conducting research aimed at determining the amount of grain that should be fed for efficient milk production. The first year's trial compared the performance of three groups of cows fed grain at varying levels. The group fed at the rate of 1 pound of grain for each 8 pounds of milk showed a greater return over feed cost per 100 pounds of 4 percent milk than did two other groups fed at the rates of 1 pound of grain for each 3 and 5 pounds of milk, respectively.

Table III.—Feed and TDN Consumption of Cows.

Cow No.	Days Milked before Trial	Days on Trial	Feed Consumed			TDN Consumed*		
			Hay (lbs.)	Silage (lbs.)	Hay Equiv. (lbs.)	Equiv. (lbs.)	Roughage (Con.) (lbs.)	(Con.) (lbs.)
Cows Fed 1.0 lb. Grain per 3.0 lbs. Milk Produced								
3	39	265	2648.8	9405.4	6072.9	2669.1	3053.5	2004.5
4	60	243	2398.6	6504.7	4363.2	1520.5	2193.2	1141.9
8	30	275	3106.0	11685.9	7337.1	3050.7	3700.8	2291.1
11	35	270	2228.2	8444.8	5241.7	2476.8	2666.2	1860.1
15	35	226	2231.1	8728.9	5288.1	2394.6	2719.6	1798.3
Total	199	1279	12612.7	44769.7	28303.0	12111.7	14333.3	9095.9
Ave.	40	256	2522.5	8953.9	5660.6	2422.3	2866.7	1819.2
Daily Ave.			9.9	35.0	22.1	9.5	11.2	7.1
Cows Fed 1.0 lb. Grain per 5.0 lbs. Milk Produced								
1	62	273	2249.0	8562.0	5507.6	769.7	2698.0	578.1
2	50	276	2661.0	10101.0	6477.7	1391.2	3182.0	1044.8
9	27	243	2819.1	12110.1	7121.8	1057.2	3634.1	794.0
10	34	271	3318.1	11841.7	7542.1	1900.9	3836.0	1427.6
12**	35	174	1344.3	6090.0	3426.2	978.6	1790.6	734.9
Total	208	1217	12391.5	48704.8	30075.4	6097.6	15140.7	4579.4
Ave.	42	243	2478.3	9741.0	6015.1	1219.5	3028.1	915.9
Daily Ave.			10.2	40.0	24.7	5.0	12.4	3.8
Cows Fed 1.0 lb. Grain per 8.0 lbs. Milk Produced								
5***53	134	1972.3	7357.4	4674.3	809.6	2338.6	607.3	
6	39	257	2750.0	8715.9	5940.5	589.0	2978.3	442.3
7	38	257	3925.7	13604.8	8863.1	1061.9	4464.3	797.5
13	42	263	3090.3	10268.9	6695.9	882.9	3433.6	663.1
14	37	268	4296.6	12943.7	8810.1	927.9	4529.9	697.0
Total	209	1179	16034.9	53890.7	34983.9	4271.3	17744.6	3207.2
Ave.	42	236	3207.0	10578.1	6996.8	854.3	3548.9	641.4
Daily Ave.			13.6	45.9	29.7	3.6	15.1	2.7

* Calculated according to Morrison's Tables.

** Removed from trial due to multiple lesions of exterior genitalia.

*** Removed from trial due to leg injury.