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Comparison of Supplemented Free Choice Corn Silage Rations With Other Forage Rations for Wintering Dairy Heifers

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SUMMARY

Corn silage has become a very important feedstuff for the ruminant dairy animal because of its high yield of forage per acre and its nutritional value. It is generally deficient in protein, calcium, and, possibly, vitamins A and D. Two feeding trials, each involving 40 Guernsey heifers, were conducted to gain more information concerning the supplementation of corn silage fed free choice to rapidly growing dairy heifers.

The data indicate that when 1.5 pounds of supplement C-2, a supplement containing soybean oil meal, alfalfa meal, molasses, dicalcium phosphate, vitamins and minerals, was fed to rapidly growing dairy heifers that were provided corn silage free choice, all animals made excellent winter gains. The data also indicate that in this trial the urea-containing supplement U-3 was not a satisfactory replacement for the soybean-oil-meal-containing supplement C-2 for a high corn silage ration when fed twice daily. One important advantage of a well supplemented corn silage ration is the earlier freshening of heifers due to rapid growth. Earlier milk production results, with the possibility of a higher first lactation record due to better body conditioning at the start of the lactation.

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INTRODUCTION

Corn silage has become a very important feedstuff for dairy animals. In most sections of the nation, the corn plant is unsurpassed by any other forage crop for yield per acre. Corn silage is nutritionally deficient in protein, calcium, and, possibly, vitamins A and D. Considerable research has been done to determine the feeding value of corn silage for the ruminant. However, few studies have been conducted to determine the value of feeding and supplementing high levels of corn silage for dairy heifers.

Several feeding trials have been conducted comparing corn silage with other forages, or in combination with other forages. In general, these trials indicate that when corn silage is properly supplemented, it compares favorably with other forages. In recent years, it has been realized that corn silage will give better beef cattle gains if it is supplemented with proteins, minerals (calcium), and vitamins A and D.

Van Arsdell *et al.* (1953) reported satisfactory gains with corn silage supplemented with soybean oil meal, molasses, bonemeal, mineral, and vitamins. These rations were considered satisfactory. Harshbarger *et al.* (1956) compared the feeding value of corn silage with that of rye silage ensiled at two stages of development for dairy heifers. The silage was fed free choice with 4 pounds of a grain mixture per animal per day. Daily weight gains were 1.02 pounds, 1.70 pounds, and 1.21 pounds per animal with rye silage, (dough stage), corn silage, and rye silage (prebloom stage), respectively. Lassiter *et al.* (1958) found that heifers fed oat silage gained only one-half as much as heifers fed corn silage. Kessler *et al.* (1960) concluded on the bases of gain in body weight, chest circumference, and height at withers, that good quality corn silage was a satisfactory roughage for young Holstein calves.

The objective of Trial I was to study the comparative value of corn silage and oat hay, supplemented with protein, energy, minerals, and vitamins for wintering and growing dairy heifers. In Trial II a further study was conducted to determine the level of protein supplement required for a high level corn silage ration, and also to evaluate urea as a corn silage supplement for dairy heifers.

Procedure

Two trials were conducted: Trial I was conducted during the winter months of 1961-62; Trial II was conducted during the winter months of 1962-63.

Trial I

Forty Guernsey heifers (12 to 18 months of age) were divided into four groups of 10, on the basis of age and weight. These heifers were used in a feeding trial conducted from December 7, 1961, through April 4, 1962—or for a period of 118 days. Animals in Group 1 were fed corn silage free choice (harvested in dough stage), plus 3 pounds of supplement C-1 (Table 1). Group 2

TABLE 1 - SUPPLEMENT AND GRAIN MIXTURES

Ingredient	Mixture			
	Herd Ration (lb.)	Supp. C-1 (lb.)	Supp. C-2 (lb.)	Supp. U-3 (lb.)
Corn, No. 2 Yellow (coarse ground)	900	--	--	1040
Oats (coarse ground)	360	--	--	--
Barley (coarse ground)	200	--	--	--
Soybean Oil Meal (Solvent process)	150	1200	1200	--
Urea (42% N)	--	--	--	160
Wheat Bran	150	--	--	--
Alfalfa Meal, dehydrated	100	400	400	400
Molasses, Blackstrap	100	400	400	300
Iodized Salt, Trace Mineralized	25	20	20	20
Dicalcium Phosphate	15	80	80	80
Vitamin A & D	--	5a	b	b
TOTAL	2000	2105	2100	2100

[a] Contained 2,000 U S P Units A and 300 I C Units D per gm.
[b] Mixture contained 12,000,000 Units Vitamin A and 1,200,000 Units Vitamin D per ton.

animals received approximately one-half the amount of corn silage consumed by Group 1 animals. They received, in addition, oat hay free choice and 2 pounds of supplement C-1 daily per head. Animals in Group 3 were fed oat hay free choice plus 4 pounds of herd ration per animal daily (Table 1). Group 4 received full-head orchard grass hay free choice, plus 4 pounds of herd ration per head daily. All groups of animals were housed in separate pens and were fed twice daily. Supplements and grains were fed on top of corn silage at each feeding. Water was provided at all times. Animal weight and wither heights were recorded on

three consecutive days for the start of the experiment, and every 28 days thereafter. The average for the three days was used as the body weight and height at the withers. Feeds were sampled periodically and were analyzed, using approved methods (A.O.A.C.).

Trial II

Trial II was conducted in the same manner as Trial I. In Trial II, four new groups of Guernsey heifers were used, and different rations were fed. In this trial, all four groups received corn silage free choice. In addition, Group 1 received 3 pounds of supplement C-2 daily (Table 1). Group 2 received 1.5 pounds of supplement C-2 (Table 1). Group 3 was fed 3 pounds of a urea containing supplement U-3 (Table 1), while Group 4 was fed only 1.5 pounds of this same supplement. The energy intake for Groups 2 and 4 was balanced by feeding 1.5 pounds of a grain mixture similar to the supplement, except the urea and soybean oil meal were not included. All supplements were spread on top of the silage twice daily. No forage other than corn silage was fed.

RESULTS AND DISCUSSION

Trial I

Results of Trial I are summarized in Table 2. The group fed corn silage gained significantly faster ($P \leq .01$) than any of the other three groups. The other three groups did not differ significantly from each other. The higher daily gain of Group I can be explained, in part, on the basis of increased consumption of estimated energy by this group.

TABLE 2 – EFFECT OF FEEDING CORN SILAGE, OAT HAY AND MIXED HAY ON THE BODY WEIGHT INCREASE AND FEED CONSUMPTION OF GUERNSEY HEIFERS

	GROUP I Corn Silage Free Choice Plus 3 lb. Supp. C-1	GROUP II Corn Silage, Plus Oat Hay Free Choice Plus 2 lb. Supp. C-1	GROUP III Oat Hay Free Choice Plus 4 lb. Herd Ration	GROUP IV Grass Hay Free Choice Plus 4 lb. Herd Ration
Body Weight Increase				
Initial wt. (lb.)	630.0	623.0	642.0	594.0
Final wt. (lb.)	775.8	715.4	716.9	695.6
Total Gain (lb.)	145.8	92.4	74.9	101.6
Daily Gain (lb.)	1.34	0.84	0.69	0.93
Increase in height of Withers (cm.)	6.4	6.9	5.2	5.9
Feed Consumption				
Total DM/100 lb. b. wt.	2.12	2.30	2.56	2.57
Roughage DM/100 lb. b. wt.	1.75	2.12	2.05	2.04
TDN (lb.)/Animal/day	10.92	10.25	10.73	10.63
Lb. TDN/lb. b. wt. Increase	8.44	12.12	15.50	11.47
Cost/100 lb. b. wt. Increase[a]	$22.57	$32.50	$42.83	$30.68
Total cost for 109 days	$32.01	$30.03	$32.08	$31.17

[a] Herd Ration $47.78/ton; Supplement C-1 64.30/ton; Mixed Hay 24.00/ton; Oat Hay 24.00/ton; Silage 8.00/ton

The comparison between oat hay and corn silage in this trial agrees with the comparison between oat silage and corn silage made by Lassiter *et al.* (1958) in that the corn silage performed best. The heifers in Group 2 did not gain significantly faster than those in Group 3, even though they were fed corn silage plus supplement C-1 in addition to oat hay. In light of the fact that all groups consumed nearly the same amount of estimated TDN, it would appear that oat hay is not conducive to body gain. However, had the oat and grass hays been harvested at an earlier stage of maturity they probably would have performed

more nearly equal to the corn silage.

The total cost of feed per 100 pounds body weight increase was about one-third less for Group 1 than for the other groups. Also, Group 1 was about one-third more efficient in terms of TDN per pound of body weight increase than the other three groups.

This trial indicates that free choice corn silage supplemented with supplement C-1 is an excellent ration for growing dairy heifers. Since the heifers in Group 1 were in very desirable condition after being on this ration for 118 days, one important advantage of a corn silage ration appears to be earlier freshening and thus earlier milk production, with the possibility of a higher first lactation record due to better body conditioning at the start of the lactation. In this study oat hay proved to be an unsatisfactory roughage for growing dairy heifers rapidly.

Trial II

Since Trial I indicated that corn silage and supplement C-1 was a suitable ration for growing dairy heifers, more information was needed concerning level and type of nitrogen supplementation to be used. Trial II, which was conducted for a period of 98 days, is summarized in Table 3. The only change made in the

TABLE 3 - EFFECT OF DIFFERENT LEVELS OF SUPPLEMENTATION FOR GUERNSEY HEIFERS CONSUMING CORN SILAGE FREE CHOICE

	Group 1 Corn Silage Free Choice Plus 3 lb. Supp. C-2	Group 2 Corn Silage Free Choice Plus 1.5 lb. Supp. C-2	Group 3 Corn Silage Free Choice Plus 3 lb. Supp. U-3	Group 4 Corn Silage Free Choice Plus 1.5 lb. Supp. U-3
Body Weight Increase				
Initial wt. (lb.)	645	649	655	646
Final wt. (lb.)	814	814	779	780
Total Gain (lb.)	169	165	124	134
Daily Gain (lb.)	1.72	1.68	1.26	1.37
Increase in height at withers (cm.)	6.30	6.70	4.20	5.80
Feed Consumption				
Total DM/100 lb. b. wt.	2.24	2.23	2.23	2.23
Roughage DM/100 lb. b. wt.	1.88	1.86	1.85	1.87
TDN (lb.)/animal/day	10.87	10.83	10.48	10.60
Lb. TDN/lb. b. wt. increase	6.30	6.43	8.15	7.76
Est. Cost/100 lb. b. wt. increase[a]	$17.55	$17.08	$21.73	$20.52
Total Cost for 98 days	$29.66	$28.19	$26.94	$27.49

[a]Corn Silage $8.00/T
Supplement C-2 $72.25/T
Supplement U-3 $60.31/T

soybean meal containing supplement C-1 was a decrease in the content of blackstrap molasses which was decreased from 400 to 300 lbs. per ton. This supplement, which was less sticky and did not tend to cake, was numbered C-2 (Table 3).

The heifers in Group 2 which received only one-half as much supplement C-2 per day as heifers in Group 1 gained at an equal rate to those in Group 1. Thus, this trial indicates that heifers can grow rapidly and satisfactorily when fed corn silage free choice plus only 1.5 pounds of supplement C-2.

Although the heifers in Groups 3 and 4 which were fed the urea containing supplement gained satisfactorily, they gained significantly slower ($P \leq .01$) than the heifers which received the soybean oil meal supplement. There was no significant influence due to level of urea supplementation. The data from this trial indicate that the urea-containing supplement U-3 was not a satisfactory replacement for the soybean-oil-meal-containing supplement C-2 as a supplement for a free choice corn silage ration when fed twice daily.

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