Forage Intake of Range Cows as Affected by Breed and Level of Winter Supplement

K.S. Lusby, D.F. Stephens, Leon Knori and Robert Totusek

Story in Brief

The effects of breed and level of winter supplement on forage dry matter and cellulose intake were measured with 49 lactating 4-year-old Hereford, Hereford x Holstein (Crossbred) and Holstein cows on native Oklahoma tallgrass range. Trial I was conducted in winter when two levels of protein supplement (Moderate and High) were fed to seven cows of each breed. An additional group of seven Holsteins received a Very High level. Trial II was conducted in summer with no supplement fed.

In Trial I (winter) cows fed the Moderate level of supplement consumed more forage cellulose than cows fed the High level. In Trial II (summer) cows previously wintered on the Moderate level of supplement tended to consume more forage than cows wintered on the high level. Holsteins consumed more forage in both winter and summer than Crossbreds. Crossbreds consumed more forage in winter, but only slightly more in summer than Herefords.

These results (1) verify drylot research indicating that land (forage) requirements increase as size and/or level of milk production increase, (2) show that it is difficult to markedly increase the total energy intake of cows on dry winter grass with supplemental energy, because less forage is consumed, and (3) illustrates compensatory summer forage intake by cows previously wintered on lower levels of supplement.

Introduction

Increasing milk production in range cows by introducing dairy genes results in heavier weaning weight and greater production of beef from forage. However, previous research has shown that Angus x Holstein females require a higher level of supplement than beef cows. Furthermore, Hereford x Holstein and Holstein females lose more weight in winter and have a lower rebreeding performance when fed a winter supplement at the same rate as Hereford cows. Information is available on the influence of milk yield on forage intake of dairy cows and the effect

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of supplementation on forage intake of weaner calves but little information is available on the influence of level of winter supplement on forage intake of lactating cows under range conditions. In order to evaluate the efficiency of high milking cows on range, estimates of forage intake are needed.

The purpose of this study was to determine the influence of level of winter supplement on winter and subsequent summer forage intake of cows differing widely in milk yield potential.

Materials and Methods

Trial I was conducted on winter range in March and Trial II on summer range the following June. Forty-nine 4-year-old Hereford, Hereford x Holstein (Crossbred) and Holstein females, nursing calves at least 6 weeks old, were allowed to graze in a single pasture of 80 acres for a period of 3 weeks during each trial. The pasture was not grazed previous to each trial to insure that adequate forage would be available. The pasture contained little bluestem (Andropogon scorpasius) as the predominant species.

At calving (December, January and February) groups of seven Hereford, Crossbred and Holstein females were subjected to two levels of winter supplementation (Moderate and High). An additional group of seven Holstein was also fed a Very High level of supplement. The supplement contained 30% natural protein.

The Moderate level of supplement was calculated to allow good rebreeding performance in mature Hereford females with a 10-15% weight loss from fall to spring. The High level of winter supplement was established by the Crossbred females and consisted of that amount of supplement estimated necessary to maintain a body condition and physiological condition comparable to the Moderate Herefords. The Very High level of supplement, fed only to Holsteins, was calculated to maintain Holstein females in body condition similar to the High Crossbreds and Moderate Herefords. Supplement levels are shown in Table 1.

Seven days were allowed for adjustment to the pasture prior to each trial. Chromic oxide (.7 oz/head/day) was then individually fed twice daily (7 am and 5 pm) to each cow for 7 days prior to and during a 7-day collection period when fecal grab samples were taken at the time of each feeding. Chromic oxide was administered via the supplement in Trial I and with .5 lb ground corn as a carrier in Trial II (when no supplement was fed). Fecal grab samples (3.6 oz from each sample) were composited over the 7-day collection period for each cow. Samples were dried at 212°F for 48 hr and analyzed for chromic oxide content and

Table 1. Supplement, Dry Matter and Cellulose Intake for Trials I and II

	Breed and level of winter supplementation[1]						
	Hereford		Hereford x Holstein		Holstein		
Item	Moderate	High	Moderate	High	Moderate	High	Very High
Daily supplement, lb							
Avg for winter	2.44	5.30	2.68	6.18	3.19	6.80	9.97
During Trial I	2.68	5.83	2.66	5.79	3.10	6.16	9.66
Estimated intake, lb/head daily							
Trial I							
Dry matter	14.43[5]	9.42[6]	19.49[3,4]	16.52[4,5]	28.56[2]	23.61[3]	18.11[3,4,5]
Cellulose	4.16[6]	3.74[6]	5.90[5]	5.34[3]	8.34[2]	7.57[3]	6.78[5]
Trial II							
Dry matter	19.73[4]	18.06[4]	21.91[4]	19.80[4]	37.07[2]	33.64[3]	33.20[3]
Cellulose	5.85[3]	5.39[3]	6.40[3]	5.72[3]	10.27[2]	10.03[2]	8.87[2]

[1] Soybean meal, 60.0%; alfalfa meal, 5.0%; calcium phosphate, 2.9%; Masonex, 1.3%; vitamin A, 24,500 IU/kg.
[2,3,4,5,6] Means on the same line with the same superscript letter do not differ significantly ($<$P.05).

cellulose. Use of the chromic oxide procedure makes it possible to estimate forage intake of grazing cattle by relating chromic oxide to forage components in both forage and feces.

Forage samples were collected by using six lactating Angus x Hereford cows fitted with esophageal fistulae. Forage samples (Table 2) from each cow were taken once daily for a period of 6 days during each trial and composited for laboratory determination of dry matter and cellulose digestibility. Forage digestible energy (DE) values for each trial were calculated from forage composition tables developed from 15 years' data on native Oklahoma grasses.

Forage cellulose and dry matter intakes were calculated with the assumption that digestibility coefficients for forage and supplement remained constant regardless of the proportion of each in the diet. Supplement dry matter digestibility was calculated to be 80% based on total digestible nutrients (TDN) values for supplement components. Forage

Table 2. Composition of Forage Selected By Cows with Esophageal Fistulae

Item	Cellulose	Digestibility of cellulose[1]	Digestibility of dry matter[1]
	%	%	%
Trial I	36.0	45.8	53.8
Trial II	28.7	56.2	62.3

[1] Laboratory determination.

dry matter intake was calculated by dividing fecal output from forage by the *in vitro* forage indigestibility. Forage cellulose intake was calculated similarly by assuming 35% of supplement cellulose to be indigestible.

Results and Discussion

Estimated daily forage intake for Trial I (winter) is shown in Table 1. Cows fed the Moderate level of supplement consumed more forage dry matter and cellulose than cows fed the High level. Holsteins fed the Very High level consumed less forage cellulose than Holsteins fed the Moderate or High levels and less forage dry matter than Moderate Holsteins. A comparison of DE intakes to theoretical requirements showed that cows fed the High level of supplement were only 0.1 to 2.5 Mcal/day closer to meeting their energy requirements than cows fed the Moderate level even though High level females received at least 4.6 Mcal/day more from supplement than Moderate females.

Holsteins within each supplement level consumed more forage dry matter and cellulose than Crossbreds which in turn consumed more than Herefords. The increased intake of Holsteins compared to the Crossbreds and Herefords was not surprising since the Holsteins were approximately 176 lb heavier than either Crossbreds or Herefords and were producing 5.5 and 11.0 lb more milk per day than Crossbreds or Herefords, respectively. Crossbreds produced 6.6 lb more milk per day but were similar in weight to the Herefords, suggesting that the increased forage intake noted for Crossbreds compared to that for Herefords was in response to the higher level of milk production in the Crossbreds.

Chromic oxide in Trial II was administered via .5 lb ground corn fed twice daily. This procedure proved successful in permitting fast administration of chromic oxide with minimum disturbance to the cows and allowed collection of fecal grab samples in the individual feed stalls as in Trial I. Few refusals of the corn-chromic oxide mixture occurred even though the cows were grazing lush summer forage. When refusal did occur, the refused portion was weighed and the proper amount of chromic oxide administered in a gelatin capsule.

In summer, cows previously wintered on the Moderate level of supplement tended to consume more forage dry matter and cellulose than cows wintered on the High level. Herefords and Holsteins fed the Moderate level of supplement did in fact gain 5% more weight from spring to fall than Herefords or Holsteins fed the High level. Other researchers have noted a tendency for animals wintered on suboptimal nutrition to compensate for losses when adequate nutrition was made available.

Estimates of DE intake (Table 3) indicate that Moderate Hereford and Moderate Crossbred cows consumed about 3 Mcal DE per day in excess of requirements during Trial II while Moderate Holsteins were 10 Mcal per day over requirements and High Holsteins were 8.5 Mcal over requirements.

The similarity of forage intakes between Herefords and Crossbreds was surprising since Crossbreds were producing 6.6 lb per day more milk than Herefords. The fact that both groups were similar in weight and were consuming about 2.5% of body weight as forage dry matter suggests that both breeds were eating to capacity even though the energy requirement of the Crossbreds exceeded that of the Herefords.

The inverse relationship of forage intake to level of winter supplement observed in Trial I does not agree with roughage intake data for cows of the same breeds and winter supplement levels fed free choice cottonseed hulls in drylot. In drylot cows fed the Moderate level of supplement consumed less cottonseed hulls than cows fed the High level. However, when baled winter range forage was substituted for cottonseed hulls in drylot, High supplemented females consumed only slightly more roughage than cows fed the Moderate level. Apparently roughage palatability was an important factor in determining the effect of protein supplementation on roughage intake. With a readily consumed roughage, intake increased with higher levels of protein supplementation, possibly due to improved roughage digestibility. Data from Trial I suggests an opposite response by cows grazing less palatable and less available mature winter forage on range; forage consumption decreased with increased supplementation.

Trial II DE intakes (Table 3) shows that energy consumptions for Herefords and Crossbreds were only slightly above their theoretical requirements for maintenance and lactation while Holsteins had the capacity to consume 8-10 Mcal DE/day over their requirements. This suggests that Holsteins had the greatest ability to compensate for suboptimal winter nutrition when abundant summer forage became available.

Table 3. Estimated Intake of Digestible Energy By Cows, with A Comparison to Their Requirement

	Breed and level of winter supplementation						
	Hereford		Hereford X Holstein		Holstein		
Item	Moderate	High	Moderate	High	Moderate	High	Very High
Trial I, March							
Cow weight, lb[1]	792	926	818	876	1008	1008	1063
DE, Mcal							
In supplement [2]	4.02	8.74	3.99	8.68	4.65	9.24	14.49
In forage[3]	10.41	6.79	14.06	11.92	20.58	16.46	13.06
Total intake	14.43	15.53	18.05	20.60	25.23	25.70	27.55
Requirement	19.30	19.90	22.93	23.33	30.27	30.03	30.07
Trial II, June							
Cow weight, lb[1]	878	968	895	935	1107	1071	1107
DE, Mcal							
In forage[4]	22.93	20.98	25.46	23.00	40.74	39.08	38.57
Requirement	19.80	20.70	23.53	23.93	30.35	30.30	30.50

[1] Cow weights taken 1 week prior to and 2 weeks after collection of fecal grab samples.
[2] Based on 3.300 Mcal/kg supplement.
[3] Based on 1.587 Mcal/kg winter forage.
[4] Based on 2.556 Mcal/kg summer forage.