

protein bypass. The amount of protein presented to the small intestine to be used by the host animal as a protein source was significantly higher ( $P < .01$ ) for the 100 percent soybean meal, 25 and 50 percent urea supplemented diets when compared to the 75 percent urea supplement, certainly a reflection of the reduced protein nitrogen bypass on the 75 percent urea supplemented diet. Maximum microbial protein was produced in all rations for the energy level supplied regardless of the form in which nitrogen was supplemented.

## Conclusions

Equal microbial protein produced on diets ranging from 0 to 75 percent of the supplemental nitrogen as urea nitrogen illustrates that non-protein nitrogen can be utilized on low quality roughage rations if frequent ingestion can be facilitated or initiated by a sustained release product.

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# Performance of Four-Year-Old Hereford, Hereford X Holstein and Holstein Females As Influenced by Level of Winter Supplementation Under Range Conditions

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## Story in Brief

The productivity of winter-calving, 4-year-old Hereford, Hereford x Holstein and Holstein females under tallgrass range conditions was compared. Two levels of winter supplementation (Moderate and High) were imposed on groups within each breed at calving and extended through the rest of the winter. An additional group of Holsteins was fed a Very High level of supplement.

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As level of supplementation increased, winter weight loss decreased for each breed. Cows in each group regained their winter weight loss the following summer except the Moderate Hereford x Holsteins and Moderate and High Holsteins. Condition scores followed trends similar to winter weight losses and summer gains. Daily milk yields for the Hereford x Holstein and Holstein females were 13.5, 24.3, and 27.2 lb./day, respectively. Birth weights were 87, 94 and 101 lb., and weaning weights were 575, 642 and 708 lb., respectively. Low rebreeding performance of Holsteins fed Moderate or High levels of supplement was noted.

The Moderate Hereford, Hereford x Holstein and Holstein females returned the most profit above land and supplement costs per productive cow, although the low rebreeding performance of the Moderate and High Holsteins as 4-year-olds reduced their net efficiency and made them the least economical producers of weaned beef.

## Introduction

Weaning weight is one of the most important factors in beef production. Selection for weaning weight automatically results in selection for milk production because of the high correlation between level of milk production of the beef cow and the weaned weight of the calf. The most rapid method of increasing milk production is by infusing genes for high milking ability from dairy animals.

The conversion of milk to calf gain is a rather efficient process within the limits of milk production in the beef cow. Within this range the conversion is approximately 10 lb. of milk per pound of gain; the conversion may not be as efficient at high levels of milk production. Although it is possible to increase the level of milk production of range beef cows, the increased feed requirements of the cow may decrease the efficiency of beef production. The purpose of this study was to determine the influence of varying levels of winter supplementation on actual milk yield, calf performance and reproductive efficiency of range brood cows differing widely in milk production potential.

## Procedure

Groups of Hereford, Hereford x Holstein and Holstein females have been continuously maintained under native tallgrass range conditions at the Fort Reno Livestock Research Station since they were one year old. Since first calving, groups of the Hereford and Hereford x Holstein females have been subjected to two levels of winter supplementation (Moderate and High) while three supplement levels have been fed to the Holsteins (Moderate, High and Very High).

The Moderate level consisted of that amount of winter supplemental feed necessary to allow good rebreeding performance in the Hereford females. Previous experience at the Fort Reno Station suggested a winter loss (including weight loss at calving) from fall to spring of 15 percent for 3-year-old females, rebred to calve as 4-year-olds.

The high level of winter supplement was established by the Hereford x Holstein females and consisted of that amount of supplement estimated necessary to maintain a body condition and physiological activity comparable to the Moderate Herefords. Moderate and High levels were fed to groups of Hereford, Hereford x Holstein and Holstein females. An additional group of Holsteins received a Very High level of supplement. This level was calculated to maintain Holstein females in body condition similar to the Moderate Herefords and High Hereford x Holsteins. This level was fed only to Holsteins.

The base breed-treatment groups were the Moderate Hereford, High Hereford x Holstein and Very High Holstein females. These groups were fed (post calving) 2.6, 5.5 and 7.7 lb./head/day as 2-year-olds and 3.1, 6.3 and 9.2 lb./head/day as 3-year-olds of a 30 percent crude protein supplement, respectively. As 4-year-olds they were fed 2.7, 5.8 and 8.4 lb./head/day, respectively. Within each nutritional treatment, the quantity of supplement fed each female was adjusted for differences in body size. Supplement intake by treatment and breed is summarized in Table 1.

The females were bred to Angus bulls as yearlings, and to Charolais bulls as 2 and 3-year-olds. Kropp *et al.* (1972) summarized their performance as 2-year-olds, while data as 3-year-olds was reported by Holloway *et al.* (1973). This report deals with their performance as 4-year-olds. The 3-year-old females were artificially inseminated to one Charolais bull for 60 days and pasture exposed for 30 days to seven Charolais bulls.

Table 1. Supplement Intake

Item	Hereford		Hereford x Holstein		Holstein		Very High
	Moderate	High	Moderate	High	Moderate	High	
Supplement, lb. <sup>1</sup>							
Total, winter <sup>2</sup>	221	565	263	564	313	626	891
Daily, winter	2.70	5.84	2.67	5.80	3.11	6.12	8.44
Daily, precalving	1	2	1	2	1	3	3
Daily, post-calving	2.70	5.84	2.67	5.80	3.11	6.12	8.43

<sup>1</sup> Soybean meal (44%), 60.1%; milo, ground, 30.3%; dehydrated alfalfa meal, 5.0%; dicalcium phosphate, 2.9%; Masonex, 1.3%; salt, 0.5%; plus vitamin A added at 10,000 IU/lb. of supplement.

<sup>2</sup> November 15, 1972 to April 15, 1973.

Monthly individual cow weights (after 12-hour shrink) were taken from November, 1972 to November, 1973. Cow winter weight losses were calculated from November, 1972 to the lowest weight after calving (early April). Cow condition scores were taken prior to initiation, after termination, and before re-initiation of supplemental feeding. The scale for condition scores was from 1 (very thin) to 9 (very fat).

All calves were weighed within 24 hours after birth and remained with their dams on native pasture until weaning; no creep was fed. During lactation, 24-hour milk production was estimated by the calf suckle technique. The first estimate was taken when calves were two to six weeks of age and then monthly until seven estimates were obtained. During milk productions, the first calf weight (after six hour shrink) was taken as the monthly calf weight.

Each calf was weaned at  $240 \pm 7$  days of age. Weaning weights were adjusted to 240 days by interpolation or extrapolation. Age corrected weaning weights of heifer calves were adjusted to steer equivalent by multiplying by a factor of 1.05.

## Results and Discussion

### Calf Weights

Birth weights and 240-day sex-corrected weaning weights are presented in Table 2. Calves from Holstein cows were the heaviest at birth, averaging 101 lb. compared to 93.5 lb. for Hereford x Holstein and 86.5 lb. for calves from Hereford females. The birth weight difference between calves out of Hereford and Hereford x Holstein females was not

Table 2. Calving and Weaning Data

Item	Hereford		Hereford x Holstein		Holstein		
	Mod- erate	High	Mod- erate	High	Mod- erate	High	Very High
No. of calves weaned <sup>1</sup>	14	13	12	14	10	11	11
Male	9	7	7	11	3	6	6
Female	5	6	5	3	7	5	5
Calving date <sup>2</sup>	40	21	16	25	18	14	8
Birth weight <sup>3</sup>	85	88	91	96	104	102	97
Adj. weaning weight, lb. <sup>4</sup>	574	576	625	659	732	699	692

<sup>1</sup> Calves weaned at  $240 \pm 7$  days of age.

<sup>2</sup> Day of year, January 1, 1973=001.

<sup>3</sup> Birth weights not adjusted for calf sex.

<sup>4</sup> Weaning weights corrected for sex by multiplying heifer weaning weights by 1.05.

noted in the first two calf crops from these females. At weaning calves from Hereford, Hereford x Holstein and Holstein cows weighed 575, 642 and 708 lb., respectively. Level of winter supplement within each breed had little apparent influence on weaning weight, as was noted in the two previous years.

### Cow Weight and Condition

The amount of winter weight loss decreased as level of supplemental feeding increased (Table 3), a trend also noted in the previous two lactations. The Herefords, High Hereford x Holstein and Very High Holsteins regained their winter weight loss during the summer months, but Moderate Hereford x Holstein, and Moderate and High level Holstein females did not. This suggests that the supplement levels for the base breed-treatment groups (Moderate Hereford, High Hereford x Holstein and Very High Holstein) were adequate, but that lower levels were not adequate for the heavy milking breeds.

Cow weights during pre-partum, lactation and post-lactation periods

Table 3. Weight, Weight Change and Condition Data<sup>1</sup>

Item	Hereford		Hereford x Holstein		Holstein		
	Mod- erate	High	Mod- erate	High	Mod- erate	High	Very High
No. head <sup>1</sup>	14	13	12	14	10	11	11
Weight, lb.							
Fall, 1972							
(pre-calving)	990	1030	1096	1051	1272	1183	1212
Spring, 1973							
(mid-lactation)	796	891	857	865	968	968	1056
Fall, 1973							
(post-lactation)	1011	1066	1034	1055	1218	1146	1244
Weight change, lb.							
Winter	-194	-143	-239	-186	-307	-215	-156
Summer	+215	+175	+177	+190	+250	+178	+188
Year	+21	+35	-62	+4	-57	-37	+32
Weight change, %							
Winter	-19.60	+13.83	-21.81	-17.70	-24.08	-18.17	-12.87
Summer	+21.27	+16.42	+17.12	+18.01	+20.53	+15.53	+15.11
Year	+2.08	+3.00	-5.66	+0.04	-4.47	-3.13	+2.57
Condition score <sup>2,3</sup>							
Fall, 1972							
(pre-calving)	6.58	6.40	4.90	4.92	3.00	4.00	4.50
Spring, 1973							
(mid-lactation)	3.90	4.65	3.00	3.60	1.73	2.06	3.69
Fall, 1973							
(post-lactation)	7.10	6.94	5.82	5.63	3.40	3.56	5.25

<sup>1</sup> Data based on cows weaning calves as both 3 and 4-year-olds on range.

<sup>2</sup> Condition score; very thin=1, . . . , very fat=9.

<sup>3</sup> Condition scores based on those cows which weaned calves as 4-year-olds on range.

are shown graphically in Figure 1. Weight losses between the first and second months were due primarily to calving. The lowest weights were generally noted during the second month of lactation as compared to the third month in the previous two lactations. An average calving date three to four weeks later than in past years may explain the difference, since lowest cow weights were observed in late March and early April in all three years. Estimates of forage intake obtained in March and June suggest that increased level of winter supplement resulted in decreased forage intake in winter and also in the subsequent summer months.

As in past years, condition scores generally followed the trends of winter weight loss. The largest difference at pre-calving could be seen within the Holsteins with the Moderate Holsteins being much thinner than either the High or Very High Holsteins. By mid-lactation, the High Holsteins were almost as thin as the Moderate group; both groups again being considerably thinner than the Very High Holsteins. At post-calving all groups except the High Holsteins were fatter than in the previous fall. It is somewhat surprising that the Moderate levels of the Herefords and Hereford x Holsteins were in higher condition post-calving

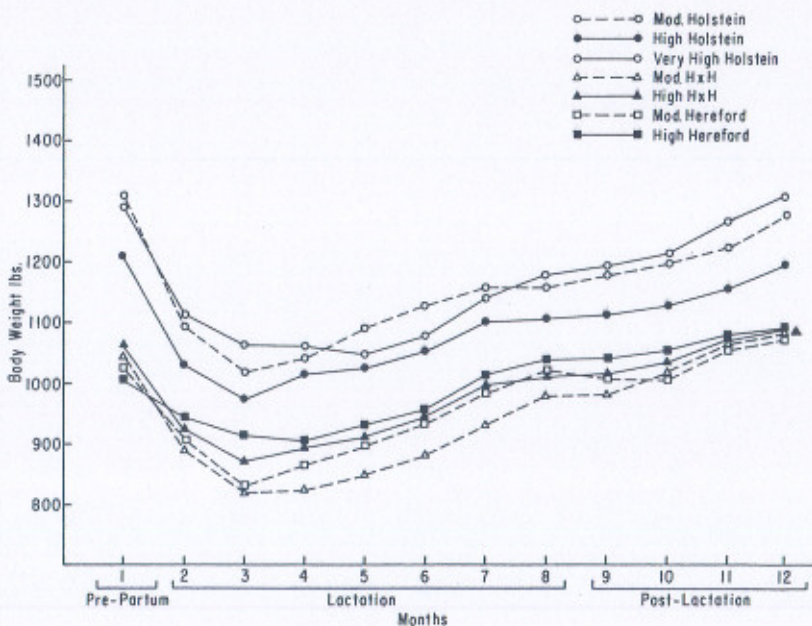


Figure 1. Body Weight Changes of Cows

than the High levels of their respective breeds.

The similarity in condition of the Moderate and High Holsteins further suggests that both these levels of supplementation were inadequate for high milk producing females.

## Milk Yields

Milk yields (Table 4) for 4-year-old Hereford, Hereford x Holstein and Holstein females were 13.5, 20.3 and 27.2 lb./day, respectively. These groups produced 13.9, 21.7 and 28.8 lb./day as 3-year-olds and 12.5, 18.3 and 24.3 lb./day as 2-year-olds, respectively. In all three years, cows fed higher levels of supplemental feed tended to produce more milk within each breed.

Lactation curves (Figure 2) show that the differences in milk yield associated with supplement level occurred during the first three months of lactation. These differences ceased with the onset of spring grass during the fourth and fifth months. Lactation curves obtained for the first and second calf crops were relatively flat while curves from 4-year-old females exhibited a more typical decline in milk yield during the latter three months of lactation.

## Reproductive Performance

Hereford, Hereford x Holstein and Very High Holstein females showed good rebreeding rates (Tables 5). The low number of Moderate and High Holsteins rebreeding (40 and 56 percent, respectively) suggests that high milk producing Holsteins on range cannot maintain rebreeding performance without large amounts of supplemental feed. Generally, those cows which did not rebreed never showed estrus. The number of Moderate Herefords open is difficult to explain since 13 of 14 showed estrus. Except for the Herefords, a trend existed for apparent time of first estrus and conception to increase as supplement level decreased. The similarity of rebreeding performance, days to first estrus and days to apparent conception for the Moderate and High Holsteins

Table 4. Milk Production Data

Item	Hereford		Hereford x Holstein		Holstein		
	Moderate	High	Moderate	High	Moderate	High	Very High
Total lactation yield, lb.	3210	3227	4883	4860	6112	7142	6275
Daily yield, lb.	13.4	13.5	20.4	20.2	25.5	29.8	26.2

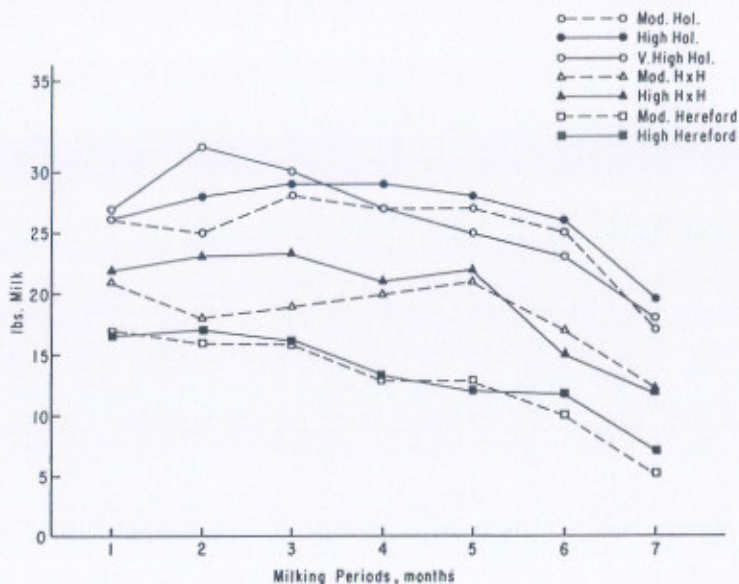


Figure 2. Daily Milk Yield

indicates that both levels of supplemental feeding were inadequate for Holsteins. The Moderate Holsteins have rebred poorly for two years in succession. The low rebreeding performance of the High Holsteins may further indicate an accumulative effect of range conditions and low winter nutrition on high producing cows.

### Economic Analysis

The economic analysis shown in Table 6 is based on Oklahoma 1973 prices. Different prices may be substituted as appropriate.

The assumptions for the economic analysis presented in Table 6 will be explained. Cost of the native range was set at \$75.00 per year per female for the Moderate Herefords. A drylot trial involving the same breed-treatment groups as this experiment was conducted concurrently. Individual roughage intakes were determined in the drylot trial and served as the basis for forage consumption of the range cows. The percent of forage consumed by each breed-treatment group in drylot compared to that of the Moderate Herefords was multiplied by \$75.00 to estimate the land cost of each group. The cost of supplement was estimated at \$120.00 per ton.



Table 5. Reproductive Performance Data<sup>1</sup>

Item	Hereford		Hereford x Holstein		Holstein		Very High
	Moderate	High	Moderate	High	Moderate	High	
No. of females	19	18	17	19	15	16	16
No. of females exhibiting estrus	17	18	15	17	7	9	15
Days post-partum to first estrus <sup>2</sup>	58	51	69	58	83	91	63
No. of females bred	16	17	15	17	6	9	15
Days post-partum to apparent conception <sup>3</sup>	66	65	78	67	111	100	71

<sup>1</sup> Based on both range and drylot females which calved as 4-year-olds to provide a larger number of cows from which to calculate reproductive data.

<sup>2</sup> Based on those females which showed estrus.

<sup>3</sup> Based on those females which were determined pregnant at pregnancy examination.

Table 6. Economic Analysis

Item	Hereford		Hereford x Holstein		Holstein		Very High
	Moderate	High	Moderate	High	Moderate	High	
Land requirement, % <sup>1</sup>	100	113	122	128	145	147	138
Land cost per female, \$	75.00	84.75	91.50	96.00	101.25	110.25	103.50
Supplement cost per female, \$	13.26	33.90	15.78	33.84	18.78	37.56	53.46
Total land and supplement cost, \$	\$88.26	118.65	107.28	129.84	120.03	147.81	156.96
Avg. value of calf	310.21	310.19	326.06	336.33	348.74	351.97	352.26
Return above land and supplement cost, \$	221.95	191.54	218.78	206.49	228.71	204.16	195.30
Return adjusted for conception, \$ <sup>2</sup>	186.44	180.90	193.04	184.75	91.48	114.84	183.09

<sup>1</sup> Expressed as % of Moderate Herefords as determined by forage intake in drylot trial.

<sup>2</sup> Based on conception rate as 4-year-olds rebred for calving as 5-year-olds.

The calves from the Hereford, Hereford x Holstein and Holstein females were estimated to be worth \$58.00, \$57.00 and \$55.00/cwt. for steers with a \$6.00/cwt. discount for heifers and a \$3.00/cwt. discount for weight above 575 pounds. Estimated calf value was calculated by multiplying the 240-day weaning weight of the steer and heifer calves

by their respective price/cwt. and then calculating a weighted steer-heifer average.

The Holstein females weaned calves with the highest total value, although adjustment for land and supplement costs removed most of this advantage. On the basis of return above land and supplement costs, it would appear that cows on the Moderate level of supplement returned the most profit, \$221.95, \$218.78 and \$228.71 respectively for Moderate Hereford, Hereford x Holstein and Holstein females. In past years Holsteins have returned less profit due to increased feed requirements but the high value of calves in 1973 overcome the increased feed and land costs.

A more realistic profit picture is provided by adjusting for rebreeding performance. This was done by multiplying the return above feed cost per calf by percent conception of the cows as 4-year-olds. On this basis the Moderate Hereford x Holsteins were the most profitable with the Herefords, High Hereford x Holsteins and Very High Holsteins slightly behind. The low rebreeding performance of the Moderate and High Holsteins made them uncompetitive. It should be noted that in previous years when calf prices were lower the Very High Holsteins were also uncompetitive when compared to the Hereford and Hereford x Holstein cows.

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## The Influence of Ambient Temperature on Blood Serum Prolactin In Heifers

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### Story in Brief

Four heifers were exposed to 50°F and 80°F for 5 days after pre-conditioning to 70°F in a controlled environment chamber. Blood serum prolactin decreased from 13 to 4 ng/ml during the 4-hr. interval when ambient temperature was reduced from 70° to 50°. Prolactin increased from 8 to 22 ng/ml during the 3-hr. period when ambient temperature was increased from 70° to 80°. During 5 days of exposure to 50°, serum prolactin was 38 percent lower than during a control period