EFFECTS OF DIFFERENT SUPPLEMENTS AND LIMITED-DRYLOT FEEDING ON REPLACEMENT HEIFER DEVELOPMENT

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Story in Brief

A 2-year trial with 100 spring-born heifers used four different supplement/drylot feeding regimens to determine the effects of nutrition on weight gain, body condition score, puberty weight and age, and pregnancy rate. Two supplements of 40 and 20% Crude Protein, primarily made from soybean meal and hulls, were fed. Starting on November 1, heifers were fed 2.0 lb/day of a 40% Crude Protein supplement, 4.4 or 5.9 lb/day of a 20% Crude Protein supplement, or 2.0 lb/day of 40% Crude Protein supplement until February 6 and then limit-fed a high concentrate diet in drylot to achieve the predicted weight on April 29 as the heifers fed 5.9 lb/day of the 20% Crude Protien supplement. On April 29 supplementation ended and a 65-day breeding season followed. Heifers fed the high concentrate diet in drylot achieved puberty three to four weeks younger than the heifers in the other treatments. Seventy-one percent of the concentrate-fed heifers reached puberty before the breeding season compared to 0 and 8% for the other treatments. Weight at puberty was greatest for heifers fed 5.5 lb/day of the 20% supplement. Weight gains during supplementation were positively correlated to the amount of supplement or ration energy fed daily. Body condition scores of heifers fed the 40% supplement and the 4.4 lb/day of 20% supplement were less than heifers in the other treatments on April 29 (the start of the breeding season). All treatments had pregnancy rates greater than or equal to 84%.

(Key Words: Heifers, Puberty, Supplementation, Pregnancy Rate.)

Introduction

Cattlemen can implement one of several nutritional programs to develop spring-born heifers. For heifers to calve near their second birthday, they must reach puberty and conceive prior to 15 months of age. Feeding different

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supplements or complete rations affects the growth rate of heifers which may influence age and weight at puberty and thus reproductive efficiency.

This study was conducted to determine the effects of different levels of supplements for dormant native range on weight gain, body condition score, puberty weight and age, and pregnancy of replacement heifers. An additional treatment combining normal protein supplementation and drylot feeding was also compared to the supplement treatments.

Materials and Methods

A 2-year study was conducted at the Range Cow Research Unit located 12 miles west of Stillwater, Oklahoma, using Hereford and Hereford x Angus heifers. One hundred heifers (year 1, n = 48; year 2, n=52) were randomly allotted to one of four treatments by breed and weight.

One treatment (SBM) consisted of feeding 2.0 lb of a 40% all natural protein supplement, while two other treatments were fed either 4.4 (LOW 20) or 5.9 lb/day (HIGH 20) of a 20% all natural protein supplement. The supplements were fed from November 1 to April 29 both years (Table 1). A fourth treatment (DRYLOT) heifers were fed the 40% CP supplement until February 6, at which time they were moved to a drylot and limit-fed a high concentrate ration until April 29. Daily feed intakes of drylot heifers were limited so the projected weight on April 29 would be the same as the heifers in the HIGH 20 treatment. Each year, heifers grazed common pastures throughout the trial and had free access to salt and trace minerals. Five days/week, heifers were individually fed their supplements in covered stalls. After entering the drylot, DRYLOT heifers were group-fed daily. After January 20 of both years, heifers grazing pastures had free access to native grass hay (CP = 4.5%).

Beginning on January 15 and ending on July 1 of both years, blood samples were collected weekly and the plasma was harvested. Blood plasma was analyzed for progesterone concentration. When two consecutive samples had progesterone levels greater than 1 ng/ml (denoting luteal activity), heifers were considered to be puberal. Puberty weights and ages were calculated by regression analysis using intermediate weights before and after the date of puberty.

To start the trials on November 1 of both years, heifers were weighed for two consecutive days after overnight removal (shrunk) from feed and water. The average of these two weights was used as the beginning weights. Intermediate shrunk weights were taken at approximately 28-day intervals. On April 29, weights were recorded in the same manner as beginning weights. Heifers were exposed from April 29 until July 1 to at least two bulls that had passed breeding soundness examinations. Additional weights were taken on July 1 and November 1. After the summer grazing periods, heifers were

Table 1. Composition and nutrient content of supplements and the drylot ration (dry matter basis).

	Supplement/Ration		
	40% CP Supplement	20% CP Supplement	DRYLOT Ration
Ingredient			
Soybean meal	91.20	15.00	11.50
Soybean hulls	3.45	81.00	
Molasses	4.00	4.00	3.10
Dicalcium phosphate	1.80	.50	
Vitamin A	.10	.05	.015
Copper sulfate	.01		
Rolled corn			73.50
Alfalfa pellets			4.90
Cottonseed hulls			5.40
Limestone			1.30
Salt[a]			.30
Nutrient content			
Crude protein, %	42.96	19.83	13.52
NE_m, Mcal/cwt	84.72	80.50	93.30
NE_g, Mcal/cwt	56.83	43.10	59.60
Calcium, %	.59	.57	.68
Phosphorus, %	1.09	.40	.33
Potassium, %	2.48	1.50	.85
Amount fed, lb/day	2.0	LOW/HIGH[b]	See below[c]

[a] Heifers had free access to salt while grazing common pastures.
[b] Depending on treatment, heifers were fed either 4.4 or 5.9 lb/day.
[c] Heifers were fed 2.0 lb/d of SBM from November 1 to February 6 then 13.9 to 16.3 lb/day (as-is basis) of the DRYLOT ration.

pregnancy tested via rectal palpation by two examiners. Body condition scores were assigned on April 26 and November 1 each year. Condition scores were given by two independent evaluators using a nine point scale (1 = emaciated, 9 = extremely obese).

Statistical analysis used year, breed, treatment and appropriate interactions as independent variables and the starting weight as a covariate. Comparisons from least square means analysis are reported on weight gains, body condition scores, and puberty weight and ages. Pregnancy rates were compared using Duncan's multiple-range test. One heifer was removed from the study because of poor adaptation to the drylot ration and her data were removed from the analysis. Four heifers (year 1, n =1; year 2, n =3) failed to achieve puberty by the end of the breeding season and their data for puberty weight and age were not included in the comparisons but were included for pregnancy rate comparisons.

Results and Discussion

Mean starting weights were similar for both years of the study (459 ± 14 lb). Weight changes are shown in Figure 1. From November 1 to February 1, SBM heifers gained less (-.19 lb/day) than heifers fed LOW 20 supplement (.69 lb/day). During the same period, heifers fed HIGH 20 gained 1.13 lb/day which was greater than all other treatments (Table 2). From February 1 to April 26, heifers fed SBM or LOW 20 gained similarly (1.1 and 1.2 lb/day) and less than the HIGH 20 and DRYLOT heifers (1.5 and 1.9 lb/day). On April 29 the mean weight for either HIGH 20 or DRYLOT heifers was about 683 pounds (Figure 1). Daily gains during the supplementation and drylot periods reflected energy intake provided by the different types and amounts of feedstuffs.

During the breeding season, when no supplements were fed, SBM and LOW 20 heifers gained 1.68 and 1.58 lb/day, respectively, which was higher (P

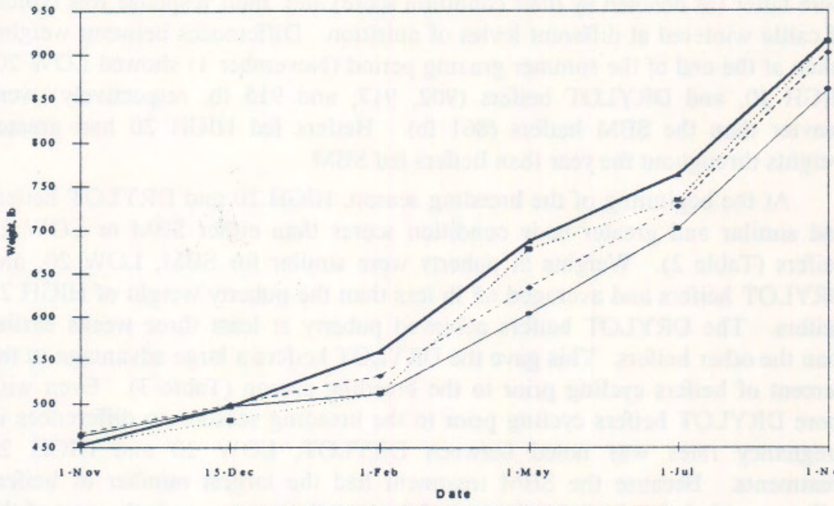

Figure 1. Weight gain of heifers.

Table 2. Effect of treatments on rate of gain and body condition.

Variable	Treatments			
	SBM	LOW 20	HIGH 20	DRYLOT
Daily Gains (lb)				
from 11/01 to 2/01	.50[a]	.69[b]	1.13[c]	.61[ab]
from 2/01 to 4/29	1.08[a]	1.20[a]	1.47[b]	1.92[c]
from 4/29 to 7/01	1.68[a]	1.58[a]	1.30[b]	.96[c]
from 4/29 to 11/01	1.41[ab]	1.47[a]	1.28[c]	1.32[bc]
Body Condition Score[d]				
on 4/29	5.2[a]	5.3[a]	5.7[b]	5.8[b]
on 11/01	5.6	5.7	5.8	5.7

[a,b,c] Least square means with uncommon superscripts differ (P<.05).
[d] Body condition score used scale of 1 to 9 (1 = emaciated, 9 = extremely obese).

< .01) than weight gains of HIGH 20 (1.30 lb/day) and DRYLOT heifers (.96 lb/day). The abrupt change in diets for DRYLOT heifers at the start of the breeding season may have caused the reduced daily gains. Also these heifers were fatter (as denoted by their condition score) and their response was typical of cattle wintered at different levles of nutrition. Differences between weights taken at the end of the summer grazing period (November 1) showed LOW 20, HIGH 20, and DRYLOT heifers (902, 917, and 915 lb, respectively) were heavier than the SBM heifers (861 lb). Heifers fed HIGH 20 had greater weights throughout the year than heifers fed SBM.

At the beginning of the breeding season, HIGH 20 and DRYLOT heifers had similar and greater body condition scores than either SBM or LOW 20 heifers (Table 2). Weights at puberty were similar for SBM, LOW 20, and DRYLOT heifers and averaged 65 lb less than the puberty weight of HIGH 20 heifers. The DRYLOT heifers achieved puberty at least three weeks earlier than the other heifers. This gave the DRYLOT heifers a large advantage in the percent of heifers cycling prior to the breeding season (Table 3). Even with more DRYLOT heifers cycling prior to the breeding season, no differences in pregnancy rates was noted between DRYLOT, LOW 20 and HIGH 20 treatments. Because the SBM treatment had the largest number of heifers failing to acheive puberty by the end of the breeding season in both years of the study, the SBM treatment had significantly lower (P < .05) pregnancy rates (rate = 68%) then the other treatments (all > 86%).

Table 3. Effect of treatments on puberty and reproduction.

Trait	Treatments			
	SBM	LOW 20	HIGH 20	DRYLOT
Puberty weight, lb.	640[a]	651[a]	715[b]	658[a]
Puberty age, days	444[a]	441[a]	437[a]	413[b]
Pregnancy rate, %	68[a]	96[b]	96[b]	88[b]
Cycling by 4/29, %	0[a]	8[a]	8[a]	71[b]

[a,b] Least square means with uncommon superscripts differ (P<.05).

The economic cost of the different programs is important. For comparison between the treatments, supplement costs were estimated at $190/ton for the 40% CP supplement, and $160/ton for the 20% CP supplement. The high concentrate ration fed in the DRYLOT treatment was assigned a cost of $135/ton. The cost of native grass hay was estimated at $60/ton. Total diet intake was estimated to be 2.8% of body weight, therefore, hay intake was calculated to be the difference between total intake and the amount of the supplement fed daily. Yearly pasture costs were prorated on a monthly basis estimated at $10/acre. Stocking rate during the winter supplementation period was 4 acres/animal. As shown in Table 4, the heifers fed SBM had lower wintering cost (about $25/animal) than heifers in the LOW 20 and DRYLOT treatments. The HIGH 20 treatment was about $20/animal more than either the LOW SBH or the DRYLOT treatments.

Because of the greater percentage of heifers cycling prior to the breeding season in the DRYLOT treatment, producers using heat synchronization programs may prefer this procedure. Heifers fed high concentrate diets beginning at nearly one year of age achieve puberty younger than heifers grazing dormant native pastures. Heifers developed on three pounds of SBM supplement during year 2 did not gain enough weight which decreased pregnancy rates. Feeding large amounts of supplements containing 20% CP increased winter weight gains and puberty weight, but did not reduce the age of puberty.

Table 4. Estimated feed costs for different treatments.

	Treatments			
Feedstuff	SBM	LOW 20	HIGH 20	DRYLOT
Supplement[a], $/animal	33.44	61.95	83.07	16.72
Hay[b], $/animal	36.85	31.63	31.51	
Pasture[c], $/animal	20.00	20.00	20.00	10.00
Drylot ration[a], $/animal	____	____	____	89.69
Total feed cost, $/animal	90.29	113.64	134.58	116.41

[a] Feed costs were estimated for 40% CP supplement @ $190/ton, 20% CP supplement @ $160/ton, and drylot ration @ $135/ton..

[b] Total daily hay consumption estimated by difference of total intake (estimated at 2.8% body weight) and amount of supplement fed. Cost of native grass hay estimated @ $60/ton.

[c] Pasture cost was prorated by dividing rent ($10.00/acre/year) by 12 months and using winter stocking rate of 4 acres/heifer.