Feeding Management Systems for Wintering Replacement Heifers

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Wintering replacement heifers under conditions common to the Northern Great Plains can result in lowered reproductive performance if nutritional levels are inadequate. While it is known that heifers bred to calve at three years of age have less calving and rebreeding problems, economics of modern beef cattle production demand that heifers be bred to calve at two years of age. Timing becomes a very important factor because heifers must cycle and conceive at 15 months or earlier if they are expected to calve as two year olds. Attaining a high percentage of pregnancies by 15 months or sooner hinges directly upon the onset of the first ovulatory estrus in heifers, which has been shown to be quite variable. Numerous studies with heifers have shown that the interaction between heifer breed type and variations in winter energy level during the growing period can significantly alter the age at which heifers reach puberty (Bellows et al., 1965; Short and Bellow, 1971; Laster et al., 1972; Gombe and Hansel, 1973; Dufour, 1975; Varner et al., 1977; Long et al., 1979 and Stewart et al., 1980).

Timing becomes especially critical among heifers destined to become herd replacements because not only is the variation in the onset of puberty a factor, but gestation length is long and the interval between calving and rebreeding is normally longer than it is among mature cows. Those heifers that reach puberty early have a much better chance of conceiving early with their first calf, insuring them adequate time for uterine repair and return to normal estrus cycling before the start of their second breeding season. Lesmeister, et al., (1973), evaluated the effect of first calving date in beef heifers on lifetime production, and found that heifers calving early with their first calf tended to calve earlier throughout the remainder of their productive lives. Those calves that were born in the earlier calving groups grew significantly faster from birth to weaning and weighed significantly more than calves from later calving groups.

Current heifer management guidelines as outlined by Wiltbank, (1972), recommend that Hereford and Angus replacement heifers be wintered to gain from 1.25 to 1.50 pounds per head per day; that from 30% to 50% more heifers than are required for replacement purposes be wintered or purchased for breeding; and that a short 45 day breeding period be used, followed by pregnancy testing near the end of the grazing season. In addition to the recommendations by Wiltbank, more recent investigation by Varner et al., (1977), suggests that sorting replacement heifer calves into weight groups according to the amount of weight gain required to reach a specified weight at the beginning of the breeding season will result in a higher percentage of lightweight heifers reaching puberty before the beginning of the breeding season.

Two experiments have been conducted at the Dickinson Experiment Station with replacement quality weanling heifer calves to evaluate winter feeding methods and subsequent breeding success when managed according to the procedure as outlined by Wiltbank, (1972), and suggested by Varner et al, (1977). Self-feeding a complete mixed ration was compared with a conventional daily hand feeding of long hay and grain in experiment I. Sorting weanling Hereford heifer calves into uniform weight groups and feeding them according to the amount of gain required to reach a pre-determined target weight of 650-700 pounds at the beginning of the breeding season was evaluated in experiment II.

Experiment I

One hundred nineteen weanling Hereford heifer calves weighing approximately 430 pounds were randomly allotted to receive either a chopped complete mixed self-fed winter ration, or long form hay and ground oats. Mixed hay used consisted of about equal parts of alfalfa (*Medicago sativa*), crested wheatgrass (*Agropyron cristatum*), and bromegrass (*Bromus inermis*). Oat grain used in the trial was processed in a portable mixer-grinder while the mixed hay was chopped in a tub grinder equipped with a 1 inch screen. Ration ingredients; oats, chopped mixed hay, di-calcium phosphate and trace mineral salt were blended in a mobile mixing wagon equipped with an electronic scale. Straight sided self-feeders designed at the Dickinson Experiment Station for high roughage diets were used for the self-fed ration.

The complete mixed ration feeding method was compared to feeding a conventional long form of hay and grain supplemented with a free choice salt mineral mixture. The long hay group received ground oats as the first feed each day, followed by hay free choice.

Heifers in this study were housed in well drained feedlot pens equipped with pole shed shelters and automatic waterers. Straw bedding was provided on a weekly basis.

Calfhood vaccinations against clostridial diseases including blackleg, (*Clostridium chauvaei*); malignant edema, (*C. septicum*) and infectious hemoglobinaria, (*C. haemolyticum*), were administered at 2½ months of age. Two weeks before weaning, at approximately 6½ months of age, a 3-way vaccination booster was administered, and an initial injection for enterotoxemia

(*C. perfringens*). Once the initial stress of weaning subsided the calves were given a booster injection for enterotoxemia. Brucellosis vaccination was given in January of each year and was followed by a leptospirosis/vibriosis combination bacterin administered 30 days before breeding.

The wintering phase was terminated at the beginning of the breeding season on May 1 of each year, an average of 161 days. At the close of the wintering phase the heifers were re-allotted and exposed to either Angus or Texas Longhorn sires that had been semen evaluated prior to the beginning of breeding. A 60 day breeding interval, which is 15 days longer than suggested by Wiltbank, was used to allow additional exposure time to determine the number of females conceiving late in the breeding season. In September of each year pregnancy determination was made by rectal palpation.

Heifers grazed early spring pasture of crested wheatgrass at a stocking rate of 1.5 AUM's from mid May until the third week of June, when they were moved to native range. Predominant native grass species grased were blue grama (*Bouteloua gracilis*), needle and thread (*Stipa comata*), Western wheatgrass (*Agropyron smithii*), and thread leaf sedge (*Carex filifolia*). Weight gains on grass were monitored and are shown in table 5. Wintering weight gains, feed consumption and economics of feeding, comparing hand feeding long form roughages and complete mixed self-fed rations, are shown in table 1. Feeding method effects on reproductive performance have also been summarized in table 1.

Table 1. Four year average winter gain, feed consumption and economics among Hereford heifers hand-fed daily or self-fed.

	Hand fed-daily	Self-fed
Total no. of head	52	75
No. days fed	161	161
Gain summary		
Initial wt., lbs.	429	417
Final wt., lbs.	623	669
Winter gain, lbs.	194	252
Avg. daily gain, lbs.	1.20	1.57
Feed summary		
Feed/hd/day, lbs.	14.5	16.0
Feed/hd/gain, lbs.	12.1	10.2
Economics		
Feed cost/hd, $	57.87	61.41
Feed cost/hd/day, ¢	35.9	37.9
Feed cost/cwt. gain, $	29.82	24.32
Reproductive performance		
1st breeding cycle	5-10%	12-16%
2nd breeding cycle (45 days)	27-52%	38-51%
3rd breeding cycle	15-29%	19-25%
Open	5-10%	6- 8%

Experiment II

A total of 122 Hereford heifer calves, over a period of 3 years, were weaned in mid October and given a 45 day adjustment period before being weighed and assigned to one of four projected gain categories. Gain category assignments were made according to the amount of winter gain required for each heifer to weigh 650-700 pounds at the beginning of the breeding season on May 1. The four levels of gain, 1.00, 1.25, 1.50 and 1.75 pounds per head per day, were used to accommodate a wide spread in weaning weights. All heifer calves of replacement quality from the Dickinson Experiment Station herd were used. However, due to limited numbers, particularly in the lightweight group, additional heifers had to be purchased.

Complete mixed rations were fed an average 116 days and contained equal parts of hard red spring wheat and oats as the grain portion. Ration ingredients were blended with chopped mixed hay, as described in experiment I, and were self-fed in straight sided self-feeders designed for all roughage rations. The heifers were weighed at 28 day intervals, and adjustments in the ration energy levels were made each weigh period to achieve the levels of gain desired. During the first two winters, as shown in table 4, only small ration changes were required. However, two events occurred during the last winter of the trial which resulted in significant ration changes. First, wheat became uneconomical as a cattle feed and had to be replaced with oats. Second, prolonged cold weather during the 1979 wintering period, coupled with the lower energy level of oats, required substantial adjustments to the amount of oats included in the rations to offset significantly slower gains. Compensation for slower gains during the early part of the trial resulted in grain levels being increased several times.

Average levels fed were 30%, 39%, 53% and 63%, respectively, for those heifers projected to gain 1.0, 1.25, 1.50 and 1.75 pounds per day.

The winter growing phase was terminated at the beginning of the breeding season each year. Vaccination schedule, sire breeds, breeding season interval, pasture type, grass species composition and stocking rate described in experiment I did not change in experiment II. A flushing ration containing 4 pounds of oats extended with 2 pounds of chopped hay was fed daily in bottomless bunks on early spring crested wheatgrass pasture during the first 21 days of the breeding period.

Winter weight gains, feed efficiency, economics of feeding and reproductive efficiency have been summarized in table 2.

Summary

Experiment I

Self-feeding a complete mixed heifer wintering ration during the wintering period from December to May resulted in faster average daily gains, greater daily feed intake, more efficient gains and a total winter gain that was 50 pounds heavier than heifers fed the same ingredients in the long form.

Heavier weights at the beginning of the breeding season reflected a 6.4% increase in the number of heifers pregnant at the end of the first breeding cycle. Only very small differences in pregnancy rates were measured in the second and third breeding cycles.

Table 2. Three year average weights, gains, feed summary, economics and reproductive performance among weanling Hereford heifers wintered at four projected levels of gain.

Projected daily gain	1.0 lb.	1.25 lb.	1.50 lb.	1.75 lb.
No. head	33	31	30	30
No. days fed	116	116	116	116
Gain summary				
Initial wt., lbs.	571	529	496	464
Final wt., lbs.	683	686	675	659
Gain, lbs.	112	157	179	195
Actual ADG, lbs.	.97	1.35	1.54	1.68
Feed summary				
Feed/hd/day, lbs.	16.4	15.5	16.3	14.6
Feed/lb. gain, lbs.	17.0	11.5	10.6	8.73
Economic summary				
Feed cost/hd, $	59.40	59.23	64.28	62.37
Feed cost/day, ¢	.51	.51	.55	.54
Reproductive performance[2]				
No. head	33	31	28[1]	30
1st cycle	10; 30%	16; 32%	13; 46%	6; 20%
2nd cycle (45 days)	14; 42%	6; 19%	7; 25%	15; 50%
3rd cycle	1; 3%	2; 6%	1; 4%	4; 13%
Open	8; 24%	7; 23%	7; 25%	5; 17%

[1]Two heifers removed.
[2]Per cent may not add due to rounding.

Heifers that were hand-fed long form roughage compensated for slower winter gains with .2 pound per day faster gain on pasture. The reduction in first breeding cycle conception rate would indicate that energy level during wintering should be adjusted upward when long form roughages are being fed.

Experiment II

Weanling Hereford heifer calves were sorted into uniform weight groups and self-fed a wintering ration according to the projected gain required for each group to weight 650-700 pounds at the beginning of the breeding season. Gain projection groups were 1.00, 1.25, 1.50 and 1.75 pounds per head per day. These gain projections were met each year, but adjustments in ration energy level were required to compensate for variations in temperature.

Only slight differences were measured in total wintering expenses because grain and hay costs were very close during the course of this experiment. While costs were not different, the results were different in many respects. Feed conversion to weight gain was significantly different between the low energy group (1.00 lbs/day gain) and the high energy group (1.75 lbs/day gain). No difference was measured between those heifers wintered for moderate gains, but did exist between each of them and those wintered at either the high or low energy levels.

Pregnancy rate, at the end of the first breeding cycle, was greatest among those heifers wintered for moderate gains and amounted to 51.6% and 46.6% respectively for groups projected to gain 1.25 and 1.5 pounds per head per day.

Cycling activity measured among heifers wintered to gain 1.00 pounds per head per day was lower than anticipated. A possible explanation is that the heavier weaning heifers in the Dickinson Experiment Station herd possessed larger frames. It is felt that the larger frame sized heifers would have responded more favorably when wintered to gain from 1.3 to 1.5 pounds per head per day.

Lowest pregnancy rates in the first breeding cycle were obtained among heifers in the high energy group wintered to gain 1.75 pounds per head per day, followed by the low energy group wintered at 1.0 pounds per head per day. Although the plane of nutrition on pasture during the first breeding cycle included 6 pounds of a flushing ration per head, the energy level was not great enough to offset the transition from drylot to pasture.

Combined pregnancy rates at the end of the second breeding cycle (45 days) varied only slightly, and ranged from 72.7% in the low energy groups to 70% in the high energy group.

In the study reported here, an average of six fewer heifers were pregnant at the end of the first breeding cycle in the high and low average wintering groups. Calf gains among BWF calves born to first calf heifers at this station have averaged 1.85 pounds per day. Using an average cyclic interval of 21 days, Hereford heifers of the type used in this experiment can be expected to produce 39 pounds less calf weaning weight for each cycle they fail to become pregnant. Each heifer that fails to settle on the first breeding cycle reflects a loss of 39 pounds in calf weaning weight. At 80¢ per pound, $31.00 per head is potentially lost.

Comparing these data with those of Varner, et al., (1977), the number of light weight heifers reaching puberty at the beginning of the breeding season and pregnant after 45 days of breeding was 9% less; and compared to group fed heifers in their study, 10% more heifers reached puberty and were pregnant after 45 days of breeding.

These data also agree with Wiltbank's recommendation that an additional 30% more heifers be wintered than are needed for replacement purposes when a short 45 day breeding season is used.

Table 3. Hand-fed and complete mixed self-fed wintering ration composition fed to weanling Hereford heifers.

	Self-fed		Hand-fed	
	lbs.	%	lbs.	%
Ingredients				
Oats	3.36	12.0	4.35	30.0
Mixed hay	11.46	71.6	8.48	58.4
Alfalfa	.8	5.0	1.45	10.0
Di-calcium phosphate	.12	.8	.08	.6
Trace mineral salt	.26	1.6	.15	1.0
	16.00	100%	14.50	100%

Table 4. Composition of rations fed to weanling Hereford heifers wintered at four projected gain levels.

	1977	1978	1979
Projected gain 1.0 lb.			
Oats, %	---	---	30
Oats & HRS wheat %	---	---	---
Mixed hay, %	98.6	98.8	68.0
Di-calcium phosphate, %	.5	.24	.4
Trace mineral salt, %	.9	1.0	1.6
Projected gain 1.25 lb.			
Oats, %	---	---	39.0
Oats & HRS wheat, %	14.6	19.2	---
Mixed hay, %	84.0	78.9	58.5
Di-calcium phosphate, %	.48	.4	.5
Trace mineral salt, %	1.0	1.5	2.0
Projected gain 1.50 lb.			
Oats, %	---	---	53.5
Oats & HRS wheat, %	25.7	29.0	---
Mixed hay, %	73.0	69.0	44.0
Di-calcium phosphate, %	.4	.4	.5
Trace mineral salt, %	.9	1.6	2.0
Projected gain 1.75 lb.			
Oats, %	---	---	63.0
Oats & HRS wheat, %	43.5	38.7	---
Mixed hay, %	55.0	59.2	34.7
Di-calcium phosphate, %	.5	.4	.5
Trace mineral salt, %	1.0	1.7	1.9

Table 5. Average gain on grass among weanling Hereford heifers wintered under two feeding systems.

Feeding systems	Self-fed	Hand-fed
Avg. grazing period/days	148	148
Range in days	138-159	138-159
Avg. gain/hd/lbs.	148	175
Range in lbs.	139-167	166-184
ADG, lbs.	1.0	1.18
Range in lbs.	.87-1.2	1.0-1.33

LITERATURE CITED

Bellows, R. A., O. O. Thomas, T. M. Riley, R. B. Gibson, N. M. Keiffer, J. J. Urick and O. F. Pahnish. 1965. **Feed effects on puberty in beef heifers.** Amer. Soc. Anim. Sci. West. Sect. Proc. 16:XII.

Dufour, J. J. 1975. **Influence of postweaning growth rate on puberty and ovarian activity in heifers.** Can. J. Anim. Sci. 55:93.

Gombe, S. and W. Hansel. 1973. **Plasma luteinizing hormone (LH) and progesterone levels in heifers on restricted energy intakes.** J. Anim. Sci. 37:728.

Laster, D. B., H. A. Glimp and K. E. Gregory. 1972. **Age and weight at puberty and conception in different breeds and breed-crosses of beef heifers.** J. Anim. Sci. 34:1031.

Lesmeister, J. L., P. J. Burfening and R. L. Blackwell. 1973. **Date of first calving in beef cows and subsequent calf production.** J. Anim. Sci. 36:1.

Long, C. R., T. S. Stewart, T. C. Cartwright and J. F. Baker. 1979. **Characterization of cattle of a fine breed diallel: II. measures of size, condition and growth in heifers.** J. Anim. Sci. 49:432.

Short, R. E. and R. A. Bellows. 1971. **Relationships among weight gains, age at puberty and reproductive performance in heifers.** J. Anim. Sc. 32:127.

Stewart, T. S., C. R. Long and T. C. Cartwright. 1980. **Characterization of cattle of a fine breed diallel. III. Puberty in bulls and heifers.** J. Anim. Sci. 50:808.

Varner, L. W., R. A. Bellows and D. S. Christensen. 1977. **A management system for wintering replacement heifers.** J. Anim. Sci. 44:165.

Wiltbank, J. H. 1972. **Management of heifer replacements.** In Commercial Beef Cattle Production, edited by C. C. O'Mary and I. A. Dyer. Lea & Febiger, 1972. pp. 150-187.