HEIFER DEVELOPMENT ON RANGELAND

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INTRODUCTION

Heifer development is one of the three largest expenses for beef cattle operations when the opportunity cost for retaining heifers is factored in. You can purchase replacement heifers of breeding size or develop your own heifers in the feedlot, farm dry lot, irrigated pasture, or on range. In some areas of the country, companies which develop ranchers' heifers for a fee are available as well. The option you choose depends upon the timetable desired for heifer replacements and the economics of each option for a particular operation. Unless hampered by a lack of good quality, inexpensive feed, there is usually a cost advantage in developing heifers from the herd instead of purchasing them. An additional advantage is that you have knowledge of the performance of selected females' dams and the ability to more closely match replacement females to the particular environment. Inexpensive computer programs or worksheets are available ($1 for publication, $20 for computer program, Willett and Nelson, 1992) which allow you to calculate the costs of buying vs. retaining replacement heifers.

It has been well documented that in order to achieve puberty, heifers need to weigh around 60 to 65% of mature weight at breeding time. For British breeds this is around 650 to 700 lbs. at around 14 to 15 months, and for Continental breeds, 750 to 800 lbs. at the same age. (There are exceptions to this rule; a small percentage of heifers will be pubertal while still nursing). Achieving this level of weight gain following weaning is rather easy in the feedlot, dry lot, and possibly irrigated pasture, but can be rather difficult on rangelands with poor quality winter forage. The disadvantage with feedlot development is cost. One Arizona breeder calculated that when he utilized feedlot development of replacement heifers, the cost per pregnancy (90% conception rate) was over $160 compared to a little over $60 per pregnancy for heifer development on pasture with supplement (85% conception rate).

RANGE LIMITATIONS

The difficulty in developing replacement heifers on low quality feed is illustrated by Figure 1. The lower portion of each bar represents the amount of forage a 500 lb. heifer would have to eat of a given forage quality in order to maintain body weight. The shaded portion of each bar represents the amount of additional forage the heifer would have to eat in order to gain .5 lbs./day, a reasonable expectation for weight gain on winter range. The solid line represents the amount of forage a heifer can actually eat for that particular forage quality. With lower quality forages, forage intake could possibly be increased 10 to 15% by protein supplementation. However, from this diagram it can be seen that the heifer may not be able to gain any weight until forage quality approaches 56% digestibility. What often happens with heifers

Figure 1. Heifer Development on Rangeland

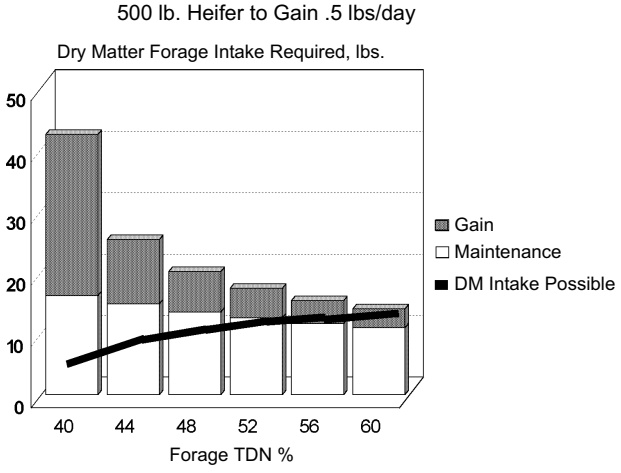

Table 1. Forage Quality and Heifer Weight Gains[a]

TDN, %[b]	ME,Mcal/lb. forage[b]	Neg,Mcal/lb. forage[b]	Est. forage intake lbs./day[c]	Est. weight loss or gain lbs./day
40	.66	.03	6.0	-4.2
42	.69	.07	6.0	-4.1
44	.72	.10	7.0	-3.5
46	.75	.13	8.5	-2.7
48	.79	.16	9.5	-2.0
50	.82	.19	9.5	-1.8
52	.85	.22	10.0	-1.3
54	.89	.25	10.0	-1.2
56	.92	.28	11.0	-0.3
58	.95	.31	11.0	-0.1
60	.98	.33	11.5	+.10[d]

[a] 500 lb. medium frame heifer with no supplementation, approximate Mcal ME required for maintenance=10.64/day.
[b] TDN=total digestible nutrients, ME=metabolizable energy, Mcal=megacalories (1,000,000 calories), Ne_g=net energy for gain. Each 1 lb. of gain requires 2.1 Mcal of Ne_g. Ne_g is energy available for gain *after* satisfying maintenance demands.
[c] Estimates of forage intake at different forage digestibilities are best guesses based upon the following research: Kronberg et al., 1986; Wagner et al., 1986; Havstad and Doornbos, 1987; and Sprinkle, 1992.
[d] Gain will probably be greater due to greater forage intake at this forage quality. If a heifer eats 13 lbs. of forage/day, average daily gain will be approximately .4 lbs./day. High growth potential cattle may exceed this gain projection.

Table 2. Heifer Development on the R100

San Carlos Apache Tribe			
	Supplement, lbs./day		
	0	4.2	5.6
Weaning Weight (10-6), lbs.	396	396	400
ADG, lbs.	-0.21	0.43	0.66
Ending Weight (3-23), lbs.	361	468	513
% Calving	0	31	54
% Calves Weaned of Total		20	36
% Calves Weaned of Those Calving		65	66

Study by University of Arizona, Ray et al.,1993, AZ Ranchers' Management Guide

developed on native range is that replacement heifers will often coast through the winter with no weight gain or a slight weight loss and then start gaining weight following "green up." This makes it difficult to achieve weight gains needed to get heifers cycling for early breeding. Table 1 presents some rough projections of anticipated weight gains with different forage qualities. From this, it should be quite clear that heifer development on rangeland usually requires some type of supplementation in addition to forage consumption.

Tables 2 and 3 contain data for two different studies relating to heifer development. Table 2 compares heifers at San Carlos (Ray et al., 1993) fed either 0, 4.2, or 5.6 lbs./day of a protein-energy supplement with 65% milo and 25% cottonseed meal (24% total crude protein). Heifers weighed around 400 lbs. at weaning and heifers gained -.21, .43, and .66 lbs./day for 0, 4.2, and 5.6 lbs. of supplement. Beginning in May, heifers were exposed to bulls for 60 days. Although the authors did not report weights at breeding, it is assumed that the weights were less than ideal target weights. None of the control heifers conceived, compared to 31% and 54% for the low and high feeding levels. However, due to small size of heifers at calving, approximately one-third of the heifers lost calves at or shortly after calving.

Table 3 reports the findings of Lemenager et al. (1980). Cattle in this study were fed poor quality fescue hay (9%, 8.5%, and 8.8% crude protein for trials 1, 2, and 3, respectively; TDN not determined). Heifers in this study appeared to be deficient in both protein and energy. When the control heifers had 1.8 lbs. of protein supplement added to their diet, they went from a small weight loss to an average daily gain of around .5 lbs. Addition of protein also nearly doubled weight gains for animals fed corn. If control heifers in this study had been able to eat 2% of their body weight daily, they

Table 3. Heifer Development with Different Levels of Corn

		Supplemental Corn Fed		
	Base Ration	0 Lbs.	2.7 Lbs.	5.4 Lbs.
		Starting Wt., lbs.		
Trial 1 (113 d)	fescue hay (poor quality)	516	516	510
Trial 2 (153 d)	fescue hay (poor quality)	494	493	475
Trial 3 (150 d)	fescue hay + 1.8 lbs. protein supplement (32%)	481	500	499
		Winter ADG, lbs.		
Trial 1 (113 d)	fescue hay (poor quality)	-0.18	0.35	0.62
Trial 2 (153 d)	fescue hay (poor quality)	-0.09	0.29	0.53
Trial 3 (150 d)	fescue hay + 1.8 lbs. protein supplement (32%)	0.49	0.79	1.15

Lemenager et al., 1980. *Journal of Animal Science*

would have had nearly adequate crude protein intake during trial 1, (although not all the protein may have been available) and would have been slightly deficient in crude protein in the other trials if no additional protein were supplied. In reality, forage intake during trials 1 and 2 may have been less than 2% of body weight. The addition of supplemental protein during trial 3 could possibly have increased both digestibility and forage intake. Heifers in this study were placed on good quality pasture following the study and pasture bred for 60 days. The heifers receiving lesser amounts of supplement during the winter exhibited compensatory gain while on pasture. Weight gains on pasture averaged over all years were 1.7, 1.5, and 1.3 lbs. for heifers fed 0, 2.7, and 5.4 lbs. of corn during the winter, respectively. Pooled data over all three years had 69%, 74%, and 84% conception for the heifers fed 0, 2.7, and 5.4 lbs. of corn per day.

UNIVERSITY OF NEVADA STRATEGY

Heifers in the Lemenager et al. (1980) study performed better than the San Carlos study (Ray et al., 1993) due to being larger at the beginning of the feeding period. Heifers need to reach an age and weight threshold to initiate puberty (Table 4). Chronic feed restriction will prevent or delay puberty in heifers. The University of Nevada, Reno (Torell et al., 1993) has developed a 4 point plan for heifer development with smaller framed range cattle.

1) Meet target weight of 600 lbs. at breeding time.
2) Have heifers at a body condition score of 5 or greater at breeding.
3) Have heifers at a reproductive tract score (LeFever and Odde, 1986) of 3 or greater at breeding. (No immature uterine tracts with less than 3/4" diameter uterine horns and no tone).
4) To ensure less calving difficulty, make sure pelvic areas exceed 150 sq. cm at 12 months of age.

Following these guidelines will improve reproductive success with replacement heifers. It is also important to avoid nutritionally stressing replacement heifers after breeding and prior to calving. This will reduce growth in the pelvic opening and nullify attempts to manage for less calving difficulty.

FEEDING STRATEGY

Achieving acceptable weight gains on winter range in order to reach target

Table 4. Puberty Traits

Breed	13.5 Mos., % pubertal	Adjusted age,[a] days	Adjusted Wt.,[a] lbs.
Red Poll	88.6	359	650
Hereford	39.9	411	695
Angus	57.4	393	697
Limousin	44.0	408	743
Braunvieh	94.2	350	732
Pinzgauer	92.1	360	739
Gelbvieh	92.9	353	745
Simmental	86.8	363	758
Charolais	60.6	391	814
Composite, 75% Continental	85.8	366	765
Composite, 50% Continental	89.3	361	738
Composite, 75% British	84.0	368	723

[a]Adjusted to 100% puberty basis.
Gregory et al., 1995. USDA-MARC, Clay Center, Nebraska

weights for puberty can be a challenge. If weaned heifers weigh from 450 to 500 lbs. in late October and the target weight for breeding in June is 650 lbs., then heifers need to gain from .7 to 1.0 lbs. per day. Achieving this level of gain will enhance fertility by allowing heifers to have at least one heat cycle before the breeding season starts.

Based upon computer modeling and limited research data available for Arizona rangelands, weight gains that can be expected on moderate quality winter range (50% TDN, 5% crude protein) in conjunction with 4.5 to 5.0 lbs. of supplement (protein or protein/energy) per day would be around .5 lbs. of weight gain per day. If the supplement costs $180 per ton, daily cost of the supplement alone would be from $0.41 to $0.45 per head per day.

Replacement heifers can be placed in a dry lot during the time period when winter forage quality is poor and achieve weight gains of 1 lb. per day on a high roughage diet (less than 20% grain) at a cost of $0.72 to $0.82 per head per day (based upon feed costs of $100 per ton or good quality alfalfa hay and $10 per cwt. for grain). Depending upon the genetics of your herd and the quality of your hay, you may be able to achieve this rate of gain with little or no grain. If you desire to increase average daily gain to 1.5 lbs. per day, this would require an additional 1.7 lbs. of corn, 2.3 lbs. of cottonseed meal, or 5.3 lbs. of good quality alfalfa hay. This is in addition to the 14.4 lbs. of feed previously allocated for a 600 lb. heifer fed in the dry lot.

An ideal strategy for meeting target breeding weights when developing heifers on rangeland could be as follows. After calves have the “bawl” out, turn them into excellent quality riparian pastures (rested all year for winter grazing) or on hay stubble for about a month (November) or until forage utilization goals are reached. When forage quality declines significantly on rangeland (approximately November 1 to February 15 for low elevation or November 1 to March 15 for high elevation range sites), feed heifers in a dry lot with excellent quality hay. If winter precipitation is favorable and annual grasses are growing well, turn the heifers out after the dry lot feeding period to utilize the cheap range forage. Heifers will exhibit compensatory gain when placed on excellent quality forage. If average daily gain on spring pasture is 1.2 lbs. per day for 75 days, then weight gains in early winter for 450 to 500 lb. British cross replacements will only need to be from .5 to .9 lbs. per day. By monitoring weight gains regularly and by looking at forage quality and quantity closely, you will be able to decide when grazing winter range is appropriate and when additional feed is required.

Since you will probably have to supplement your replacement heifers to achieve desired weight gains before breeding, you may want to consider adding an ionophore (Rumensin® or

Bovatec®) to the grain, protein, or liquid molasses supplement. In a recent review in the Oct. 21, 1996 issue of *Feedstuffs,* Huntington reported that grazing ruminant animals supplemented with ionophores had increased nitrogen digestibility and 6% greater weight gains than controls. These findings were determined on more than 2,000 cattle in over 30 studies.

An additional advantage which has been observed by feeding Rumensin® to replacement heifers may be inducement of puberty at an earlier age (Lalman, et al., 1993).

CONCLUSION

When considering a breeding program, you may wish to use breed combinations to improve puberty traits. Table 4 shows that there is a great deal of variation in puberty traits for the percentage of females showing estrus at 13.5 months. Dual purpose breeds of cattle generally express puberty earlier than most other breeds except Red Poll. You may desire to include a percentage of one of the earlier puberty breeds in your breeding herd if you need to improve conception for yearling heifers.

When replacement heifers are selected at weaning, weigh the heifers and then determine how much weight heifers will need to gain by breeding time (see Table 4). Next, count the number of days until the start of breeding time and calculate average daily gain needed. Target weights for heifers should be achieved at least one heat cycle (21 days) prior to the start of breeding season. It is to your advantage to select heavier heifers (at least 450 to 500 lbs.) so that the desired weight gain can be achieved without excessive cost. Tailor the heifer development program so that the feeding program will accommodate the desired weight gains without allowing heifers to get too fat. If heifers gain weight too rapidly, it will increase feed costs and decrease lifetime productivity due to excessive fat deposition in the udder. Feeding tables are available from the National Research Council or your local Cooperative Extension office which will predict the nutrient requirements needed for your heifer development feeding program.

I would recommend that if you develop breeding heifers on rangeland that you analyze forage for protein and TDN and supplement accordingly. Supplement to achieve desired weight gain according to “Matching Forage Resources with Cow Herd Supplementation,” in this Guide. Do not let heifers become deficient in protein, or weight loss will accelerate. Keep mineral supplements out to heifers according to mineral deficiencies in your area by season of the year. Certain areas of Arizona are deficient in selenium, copper, or zinc, and most areas will be deficient in phosphorus when forage is dormant. If you need help in balancing rations for your forage base, contact your local extension office.

Though the Nevada system of heifer development works for the most part, scoring reproductive tracts has limited value for Arizona. However, having heifers in good body condition and selecting for adequate pelvic area are good management practices to follow. The bottom line is to achieve target breeding weights and ages in replacement heifers at breeding time (Table 4). Combined with genetic selection for puberty and matching forage deficits to nutritional supplements, heifer development on rangelands can be made more cost effective.

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Arizona Ranchers' Management Guide
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