

HEIFER DEVELOPMENT ON RANGELAND

Jim Sprinkle & Doug Tolleson

Introduction

Heifer development is one of the three largest expenses for beef cattle operations when the opportunity cost for retaining heifers is factored in. One can purchase replacement heifers of breeding size or develop their 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 one chooses depends upon the timetable desired for heifer replacements and the economics of each option for a particular operation. When the cost of a replacement program and the reduction in herd size for yearling heifers is considered, sometimes it may be more cost effective if quality replacement heifers can be purchased at a reasonable price. Unless hampered by a lack of good quality, inexpensive feed and available rangeland, there may be a cost advantage (per head basis) in developing heifers from the herd instead of purchasing them. However, each replacement heifer being developed on the range will replace approximately 60% of a mature cow, lowering stocking rate during the grazing season. Because of a lack of capital and concerns related to herd bio-security and genetic progress, most producers choose to raise replacement heifers. There is an advantage in knowing the performance of selected females and their dams, thus providing the ability to more closely match replacement females to the particular environment. Computer programs or worksheets

are available online (Whittier and Miller, 2009; adapted from Willett and Nelson, 1992) which allow one to calculate the costs of buying vs. retaining replacement heifers.

The traditional approach to heifer development has been "feed them to breed them" (Funston et al., 2007; Roberts et al. 2008). Research from the late 1960s through the early 1980s documented that in order to achieve puberty, heifers needed to weigh around 60 to 65% of mature weight at breeding time (see Patterson et al., 1992 for a complete history). 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 the type of weight gain following weaning to meet this goal is rather easy in the feedlot and possibly irrigated pasture, but can be rather difficult on rangelands with poor quality winter forage. The disadvantage with feedlot development is cost. Cost comparisons in *Table 1* indicate that if replacement rangeland heifers weigh at least 450 lbs. at weaning and achieve at least an 80% conception rate, then costs can be reduced. *Table 1* includes the value of the heifer at weaning but when just considering development costs without the value of the heifer, the costs for a 450 lb. range heifer was \$187 (80% conception) compared to \$238 for a dry-lot heifer (60 days) achieving 85% conception. For a 500 lb. heifer, the cost differential was \$147 vs. \$213.

Table 1: Cost Comparison for Heifer Development

	Purchase all Bred Heifers	Range Development with 60 d Drylot & 85% Conception	Range Development with 80% Conception	Range Development with 70% Conception
Cost per Heifer with 450 lb. Weaning Weight*	\$750	\$711	\$660	\$655
Cost per Heifer with 500 lb. Weaning Weight*	\$750	\$738	\$672	\$669
Gross Profit less Replacement Cost for 150 Cow Herd with 450 lb. wwt**	\$56,794	\$50,063	\$50,843	\$49,735
Gross Profit less Replacement Cost for 150 Cow Herd with 500 lb. wwt**	\$63,488	\$55,283	\$56,360	\$55,079

* Includes value for selling heifers not bred.

** Includes value for 23 cull cows sold. Herds are 150 cows, 131 cows for drylot, 130 cows for 80%, 127 cows for 70%. Expenses for 450 lb. calf include 2 lbs. 36% CP suppl. at \$270/T for 30 d, 3 lb of same for 90 d, and 2 lb. suppl for 30 d, all fed twice/wk with \$66/wk. fuel (\$0.50/mi) and labor (\$9.00/hr). 500 lb. calf suppl. was 0.5 lb. 36% suppl. for 60 d and 2lb. for 90 d plus labor as described. Feed costs for dry lot heifers was \$0.07/lb. for 15 lbs. for 60 d plus \$0.65/d for yardage. Cost of breeding was \$21/head and grazing fees were \$1.35/AUM for either 10 (drylot) or 12 months. Value of heifers not bred was deducted at \$0.92/lb. for 750 lbs. Miscellaneous costs per group were \$30. Calves sold in herd were either 450 or 500 lb. at \$1.05/lb.

More recently, research has indicated that *Bos taurus* heifers can be developed to 55% of mature weight and still have acceptable conception rates at breeding (Patterson et al., 1991; Patterson et al., 1992; Funston and Deutscher, 2004; Funston et al., 2007; Roberts et al., 2008; Funston et al., 2009; Larson et al., 2009; Roberts et al., 2009; Whittier, 2009). Most likely, the improvement in conception with lighter weight *Bos taurus* has been influenced by genetic selection for puberty over the last several decades by such genetic parameters as increased scrotal size in yearling bulls (shown to be genetically correlated to puberty characteristics of female progeny). This genetic progress facilitates heifer development programs on rangeland with limited supplementation. Unfortunately, the progress made with *Bos indicus* heifers with respect to achieving puberty at lower body weights has not appeared to keep pace with their *Bos taurus* contemporaries. Limited research (Patterson et al., 1989, 1991) suggests that conception rates for Brahman x Hereford heifers developed to lighter body weights prior to breeding are lowered to such a point (at least 15 to 20% and sometimes more) to preclude any type of management program utilizing restricted feeding for replacement heifers. *Bos indicus* heifers have been genetically matched to environments with poor quality feed resources for much of the year and this appears to be genetically compensated for in part by increased age and size at puberty. Unless of sufficient size at weaning, it is our recommendation that *Bos indicus* heifers be developed to 60% of mature weight utilizing at least 60 to 90 days feeding in a dry-lot with improved rations.

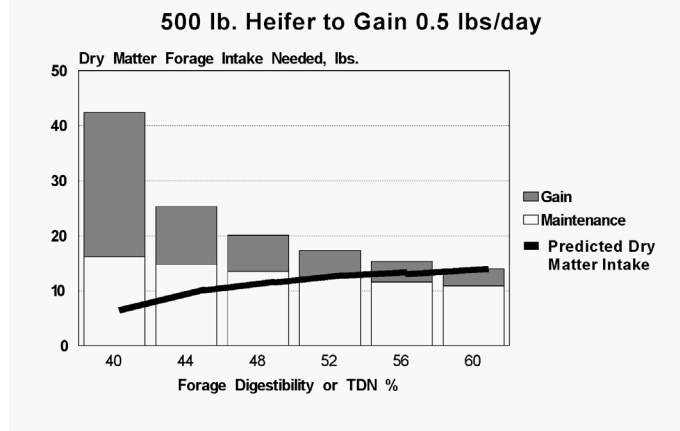
Range Limitations and Mitigation

Some of the challenges with developing heifers on rangeland are as follows:

1. Not as experienced in grazing (compared to cows)
2. Smaller rumen (compared to cows)
3. Reduced forage quality and quantity in winter
4. Reduced growth with poor quality winter forage
5. 8 to 10% less pubertal at breeding (restricted compared to full feeding)
6. Pregnancy 4.5% less for restricted feeding
7. Some metabolic inefficiency (borderline diabetic)
8. Can have increased dystocia (calving difficulties)

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 at that particular forage quality in order to maintain body weight. The dark portion of each bar represents the amount of additional forage the heifer would have to eat in order to gain 0.5 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.

Figure 1. Heifer Development on Rangeland



What often happens with heifers developed on native range is that replacement heifers will often survive the winter with little or 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 2* 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. Reduced forage quality and quantity will reduce gain and make it difficult to harvest enough forage when rumen turnover is low. Younger heifers have a smaller rumen capacity than do mature cows, making it difficult for them to harvest enough forage. Protein supplementation can increase protein availability to microbes needed for fiber digestion. Enhancing the supply of substrates to rumen bacteria will increase the population and metabolic efficiency of bacteria and speed up digestion of dormant forage. It is important to have protein supplements with a portion of the protein being ruminally degradable in order to supply these microbes. Common oil seed meals such as those from cottonseed and soybeans are typically around 60 to 65% degradable in the rumen. When cattle are in a period of nutritional stress such as when grazing poor quality winter forage, research (Hawkins et al., 2000; Kane et al., 2004) has shown that providing a portion of the protein supplement in an undegradable or “bypass” form that escapes digestion by the ruminal microbes can reduce weight loss or slightly improve gain and enhance reproduction and puberty. It appears that a metabolic signal is involved with bypass protein which reduces futile energy dissipation cycles, insulin insensitivity, ketone synthesis, tissue breakdown, and severe glucose shortages (Hawkins et al., 2000). The ideal combination of ruminally degradable to undegradable protein is about 50:50 for cattle being supplemented in stressful conditions (Petersen, 2006). Feedstuffs high in bypass protein include feather meal, fish meal, and corn gluten meal. *Table 3* lists the ingredients for a bypass protein supplement used by New Mexico State University.

Managers developing heifers on rangelands should consider utilizing a bypass protein supplement if heifers are 450 to 500 lbs when weaned. Using this type of supplement will help

Table 2: Forage Quality and Heifer Weight Gains^a

TDN, % ^b	ME, Mcal/lb. forage ^b	Ne _g , 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	-.3
58	.95	.31	11.0	-.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 Neg. Neg is energy available for gain after satisfying maintenance demands.

^c Estimates of forage intake at different forage digestibilities are best guesses based upon trends from 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 ate 13 lbs. of forage/day, average daily gain will be approximately .4 lbs./day. High growth potential cattle may exceed this gain projection. Compensatory gain following a period of nutrient restriction will also include lower maintenance requirements and increased intake

overcome some of the effects of reduced pubertal heifers and conception at breeding.

Feed restriction or reduced intake can reduce the release of the reproductive hormones GnRH, FSH, and LH. The feeding of bypass protein at moderate levels has been shown to increase the release of both FSH and LH, leading to improved conception (Hawkins et al., 2000).

It is important to remember, however, that more bypass protein is not necessarily better. In a study done in New Mexico (Kane et al., 2004), heifers fed a high level of bypass protein¹ had less FSH and LH in the anterior pituitary gland than did heifers either fed moderate² or low³ levels of bypass protein. The moderate bypass supplement group also had improved FSH levels in the anterior pituitary when compared to the low bypass supplementation group. Based upon these data, it would seem that the 50:50 ratio of degradable to undegradable protein recommended by New Mexico State University is ideal. In order to approximate the total amount of bypass protein for the moderate group, heifers should be fed no more than 3 lbs. per day of a 36% crude protein supplement with 50% bypass protein (3.00 lbs. X 0.36 X 0.50 = 0.54 lbs. bypass protein).

Table 3: Bypass Protein Supplement

36% crude protein	
Cottonseed Meal	33%
Feather Meal	17%
Fish Meal	5%
Molasses	11%
Ground Milo	24%

¹ 0.71 lbs. bypass protein, 2.5 lbs. 46% crude protein supplement; 61% bypass protein:39% ruminally degraded protein

² 0.48 lbs. bypass protein, 2.5 lbs. 38% crude protein supplement; 50% bypass protein:50% ruminally degraded protein

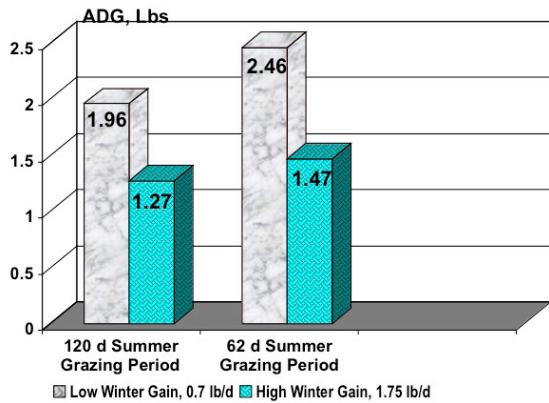
³ 0.25 lbs. bypass protein, 2.5 lbs. 30% crude protein supplement; 34% bypass protein:66% ruminally degraded protein

Additional management actions that appear warranted in developing heifers on rangeland include using the best winter and early spring pastures for the heifers, using low birth weight EPD bulls, measuring pelvic areas at 12 months (should exceed 150 sq. cm) to identify and cull heifers likely to have calving difficulty, and keeping 20% additional heifers to account for reduced conception with lighter body weights. It is also helpful to select heifers with a reproductive tract score (LeFever and Odde, 1986) of 3 or greater at breeding. (i.e. cull heifers with immature uterine tracts with uterine horns less than 3/4" diameter and exhibiting no uterine tone). Furthermore, 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.

Compensatory Gain

Following a period of nutritional stress, cattle frequently exhibit a period of compensatory gain when average daily gain exceeds what is expected. Research has shown that this is most likely due to reduced gastrointestinal tract and liver size (Ferrell, 1988) caused by the period of nutritional stress which makes these organs shrink. Coupled with this reduced gastrointestinal tract and liver size are lowered maintenance requirements (20% less for up to 90 days; NRC, 2000). At the same time maintenance requirements are reduced, appetite increases by at least 20%. If abundant quality forage is available in the spring following winter development of heifers on rangeland, spectacular gains can be made prior to breeding.

Figure 2. Compensatory Gain of Steers on Rangeland



Klopfenstein et al., 1999 Nebraska Beef Report <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1411&context=animalscinbr> 5 years data

Several years data from Nebraska (Klopfenstein et al., 1999; Creighton et al., 2001) demonstrated the effects of compensatory gain with steers fed for a low rate of gain in the winter and then put on either bromegrass, warm season grass pastures, or rangeland for the summer. Figure 2 illustrates that summer daily gain for the steers fed to gain 0.7 lbs. during the winter was 50 to 60% higher than that observed for steers fed to gain 1.75 lbs. during the winter. Forage intake during the summer following either low or high winter gains is reported in Figure 3. Steers fed at a low rate during winter exhibited a compensatory level of summer intake on either cool or warm season grasses. Heifers grazing low quality forage during the winter can be expected to exhibit similar percentages of compensatory gain.

Examples of Range Heifer Development in the Southwest

NEW MEXICO

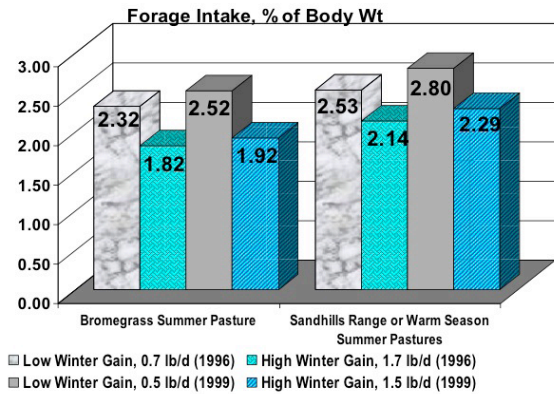
Researchers at New Mexico State University have been evaluating low vs. high input development of replacement heifers at the Corona Range and Livestock Research Center in central New Mexico (Hawkins et al., 2008). Annual precipitation is around 13 inches and elevation ranges from 5,701 to 6,720 feet. Vegetation includes varying cover of pinyon-juniper with a understory of warm season grasses (blue grama, sideoats grama, hairy grama, sand dropseed, wolftail, threeawns, and black grama).

Table 4: Cumulative Body Weights and Pregnancy Rates

Heifer body weight (lbs) and pregnancy data (2003-04 & 2005-06)

	Bypass (n=41)	CSM only (n=42)	Feedlot (n=40)
October/November	531	526	528
January	580	576	578
March	605	600	629
May	634	641	712
Pregnancy Rate	97%	91%	81%

Figure 3. Compensatory Gain of Steers on Rangeland



Klopfenstein et al., 1999 Nebraska Beef Cattle Reports <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1411&context=animalscinbr> & Creighton et al., 2001 Nebraska Beef Cattle Reports <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1290&context=animalscinbr> In 1999, cattle grazed bromegrass first then warm season pastures

Some of the first experiments were to compare traditional supplementation of 500 lb. heifers starting in November and extending to May, versus delayed supplementation with smaller amounts of protein supplement from November to January followed by more protein supplementation through May. The researchers determined that they could feed limited protein supplement from weaning to mid January (0.5 lbs./day fed once per week) followed by 2 lbs./day of bypass protein supplement (fed 2 or 3 times/wk.) to May with little reduction in heifer performance and body weight at breeding.

The next experiments were to compare bypass protein supplementation to traditional cottonseed meal supplementation and to partial development in the feedlot. All heifers were placed on rangeland and fed 0.5 lbs./day (fed once/wk.) of a cottonseed meal supplement from October weaning until mid-January. From mid-January to mid-February, heifers developed on cottonseed meal and heifers that were to be placed in the feedlot received 2 lbs./day of cottonseed meal (fed 2 or 3 times/wk.) while the bypass heifers were placed on 2 lb./day (2 or 3 times/wk.) of 50:50 degradable protein to bypass protein for that time period. In mid-February, feedlot heifers were moved to the feedlot for 90 days until mid-May. Heifers left on the ranch continued with their respective treatments until mid-May. Heifers were artificially inseminated once followed by a 45 day exposure to bulls. Results for two years of the study are shown in Table 4. As expected, the heifers developed in the feedlot were heavier at breeding time. However, there was no advantage in conception for these two years for feedlot heifers. Table 5 compares four years

Table 5: Cumulative Body Weights and Pregnancy Rates

Heifer body weight (lbs) and pregnancy data (four years)

	Bypass (n=122)	CSM only (n=117)	± SE
October	510	515	4.9
January	512	519	8.1
March	543	547	9.3
May	565	573	10.4
Pregnancy Rate	80%	66%	P<0.05

Table 6: Enterprise Budget, 10 yr Avg.

Item	High input - Feedlot & Range	Low input - Range
Conception, %	88	71
Value at weaning	\$446.35	\$446.35
Total Costs	\$765.44	\$708.40
Gross Income	\$793.16	\$798.96
Net Income	\$27.72	\$90.54

data for conception for rangeland heifers developed on bypass protein vs. those developed on cottonseed meal. There was a 14% increase in conception for bypass protein heifers over the traditional cottonseed meal developed heifers while both groups were similar in body weight. It indeed appears that feeding moderate levels of bypass protein alters metabolic functions and initiates signaling for reproductive hormones.

Table 6 presents the enterprise budget over 10 years at the Corona Research Station for heifers developed in the feedlot vs. those developed on rangeland. Heifers developed on rangeland returned \$62.82 more to the ranching operation than did the feedlot developed heifers.

ARIZONA

Heifer development on the Yavapai Ranch south of Seligman Arizona is described below. Heifers are weaned at 550 lbs., placed in a dry lot for 5 days until they get the bawl out, then placed in a fresh pasture that hasn't been grazed for a year. While in the dry lot, heifers are trained to come to the horn with 32% protein cubes. Heifers remain separate from the cowherd during the entire development period. The first 60 days, heifers receive 0.5 lbs./day supplement fed every other day, followed by 1 lb./day for 90 days fed every other day while it is wet and cold. For the last 30 days, heifers are increased to 2 lbs./day (fed every other day) of 32% protein in order to flush them prior to breeding. Heifers gain 0.5 lbs./day for 150 days then 1.5 lbs./day the last 30 days. The long term average for conception rate for these heifers is 85%. This has been achieved with 180 lbs. of total protein supplement for each heifer.

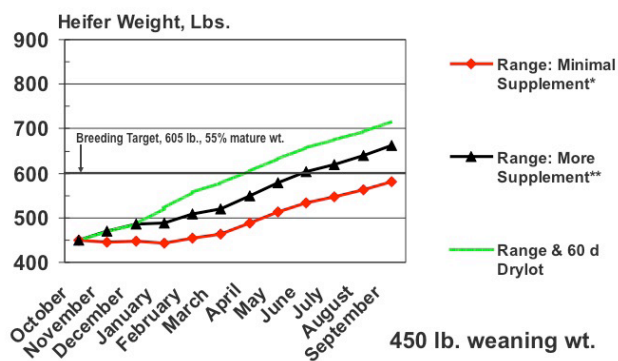
Strategy

Achieving acceptable weight gains on winter range in order to reach target 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 at 55% mature weight is 605 lbs., then heifers need to gain from 0.47 to 0.69 lbs. per day. If possible, gain which allows heifers to have at least one heat cycle before the breeding season starts will enhance fertility. By feeding bypass protein, one can improve conception at these lighter weights. If breeding earlier than June, amounts of protein supplement fed will need to be increased.

Based upon computer modeling, published research, and diet quality data from near infrared spectroscopy fecal analysis available for Arizona rangelands, expected weight gains were projected for replacement heifers using the following TDN values from October to September of the following year: 59.56, 60.03, 60.04, 58.60, 60.17, 61.50, 62.00, 61.00, 59.00, 61.00, 62.00, and 62.00 respectively. These projections are displayed in *Figures 4 and 5*.

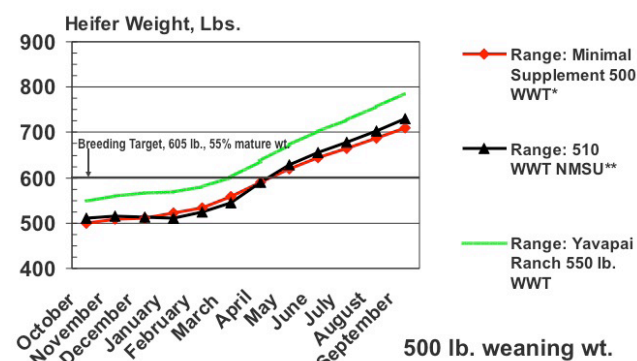
Unless heifers weigh at least 450 lbs. at weaning, it is not possible to develop heifers on rangeland for late spring breeding without some time being spent in a dry lot with an improved ration. If a 450 lb. heifer is fed minimum supplement over the winter following the New Mexico example, she would not achieve the target breeding rate until late summer or early fall (*Figure 4*). By feeding 180 lbs. more supplement over the winter, the 450 lb. heifer could achieve the targeted breeding weight by June.

Figure 4. Heifer Development, 1100 lb. Mature Wt.



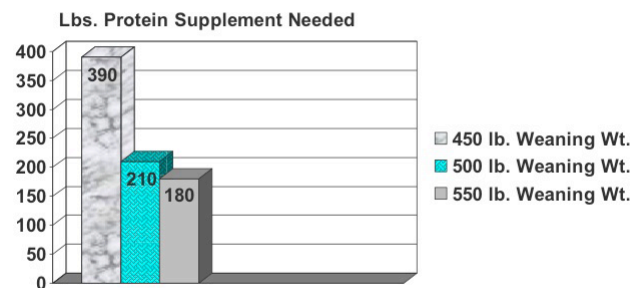
*0.5 lbs. suppl./d for 60 d then 2 lbs. suppl./d for 90 d
 **2 lbs. suppl./d for 30 d then 3 lbs. suppl./d for 90 d then 2 lbs. suppl./d for 30 d
 Range/Drylot has 2 lbs. suppl./d for 30 d then 3 lbs. suppl./d for 30 d then 60 d drylot then 2 lbs. suppl./d for 30 d

Figure 5. Heifer Development, 1100 lb. Mature Wt.



*0.5 lbs. suppl./d for 60 d then 2 lbs. suppl./d for 90 d for a total of 210 lbs. suppl. fed
 **0.5 lbs. suppl./d for 90 d then 2 lbs. suppl./d for 120 d for a total of 285 lbs. suppl. fed
 Yavapai Ranch has 0.5 lbs. suppl./d for 60 d then 1 lbs. suppl./d for 90 d then 2 lbs. suppl./d for 30 d total of 180 lb

Figure 6. Heifer Development on Rangeland



1100 lb. Mature Weight, Breeding at 55% of Mature Weight
450 lb. weaning wt at breeding weight in June, 500 lb. in May, 550 lb. in April

It is easier to achieve the targeted breeding weight for heifers weighing 500 lbs. or more at weaning. *Figure 5* presents expected performance for the Yavapai Ranch heifers weaned at 550 lbs., the NMSU heifers weaned at 510 lbs., and a heifer modeled for Arizona conditions weaned at 500 lbs. Supplementation for the Arizona heifer was halted in mid March with 75 lbs. less supplement being fed than with the NMSU example. More supplement was modeled for feeding during early winter for the Arizona heifer. Both the NMSU and the Arizona heifers achieved the targeted breeding weight by May while the Yavapai Ranch heifer achieved breeding weight by April.

Figure 6 presents the amount of supplement needed to develop heifers on rangeland varying in weaning weight from 450 to 550 lbs. Costs increase substantially as weaning weights decline to 450 lbs. As mentioned previously, it is not likely that heifers weighing 400 lbs. or less at weaning can be developed in a timely fashion for spring or early summer breeding without some time spent in a dry-lot.

The following strategy is proposed for developing 450 to 500 lb. *Bos taurus* heifers on rangeland {BCS = Body Condition Score (1-9)}:

I. 500 lb Weaning Weight

- Feed 0.5 lb supplement for 60 d and evaluate
- Feed 2.0 lb bypass protein for 30 d and evaluate
- If BCS good, continue 2.0 lb bypass protein for 30 d & evaluate
- If BCS not good, feed 3.0 lb bypass protein for 30 d & evaluate
- Middle February, evaluate BCS and winter conditions
 - If good, feed 2 lb. bypass protein for 30 more d
 - If poor, feed 3 lb. bypass protein for 30 more d
- Middle March, evaluate BCS and feed availability
 - If poor, feed 2 lb. bypass protein for additional 30 d

II. 450 lb Weaning Weight

- Feed 2.0 lb supplement for 30 d

- Feed 3.0 lb bypass protein for 60 d and evaluate
- If BCS good and feed good, continue 3.0 lb bypass protein for 30 d and evaluate
- If BCS not good, bring heifers into dry-lot for 60 d
- Middle February, evaluate winter conditions
 - If good conditions, feed 2 lb bypass protein for 30 more d
 - If poor conditions, feed 3 lb. bypass protein for 30 more d
 - If BCS and winter conditions both poor, bring heifers into dry-lot
- Middle March, evaluate BCS and feed availability
 - If poor, feed 2 to 3 lb bypass protein for additional 30 d

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 protein supplement. In a 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

It is worth your while to do a financial analysis regarding heifer development on your ranch. Computer spreadsheets are available online (Whittier and Miller, 2009) for this purpose or you may contact the authors of this paper. We also have spreadsheets available for calculating daily gain on rangeland with varying amounts of supplement and differing forage quality.

When replacement heifers are selected at weaning, weigh the heifers and then determine how much weight heifers will need to gain by breeding time. 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. However, you will want to avoid selecting larger framed heifers that increase the mature cow size. You can avoid this by establishing some frame score thresholds according to Beef Improvement Federation guidelines (BIF, 2002).

With recent advances in genetic progress, it is possible to develop *Bos taurus* heifers on rangeland to a lower percentage (55%) of mature weight and still achieve acceptable conception rates. Brahman cross cattle and heifers weighing less than 450 lbs. at weaning will most likely require some feeding time in a dry-lot in order to achieve acceptable conception rates. If developing heifers in the dry-lot, 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 (try not to exceed 2 lbs. ADG in the feedlot), 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.

When developing heifers on rangeland, feeding bypass protein should be considered to enhance puberty and reproduction. Keep the total amount of bypass protein to no more than around 0.5 lbs./day (3 lbs. of a 36% crude protein ration with 50% bypass protein). 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.

Using low birth weight EPD bulls is an integral part of heifer development on rangeland. Having heifers in good body condition for breeding and selecting for adequate pelvic area are also good management practices to follow. Allowing heifers access to high quality winter pastures separate from the cowherd can aid in achieving desired weight gains. The **bottom line** is to achieve target breeding weights and ages in replacement heifers at breeding time. Combined with genetic selection for puberty, applying good management practices, and using bypass protein, heifer development on rangelands can be cost effective. Optimum conception rates on rangeland (rather than maximum conception rates in the feedlot) can bring more profitability into the herd, saving \$40 to \$50 per head in heifer development costs. An additional advantage to low input heifer development is that offspring from heifers and cows fed for reduced winter feed (as opposed to maximal inputs) appear to be programmed *in utero* for reduced maintenance and may actually be retained longer in the herd (Roberts et al., 2008).

Literature Cited

- BIF. 2002. Guidelines for Uniform Beef Improvement Programa. 8th Edition. Beef Improvement Federation, University of Georgia, Athens, GA. Available at: <http://www.beefimprovement.org/library/06guidelines.pdf> Accessed December 10, 2010.
- Creighton, K., M. Ullerich, and T. J. Klopfenstein. 2001. Undegradable intake protein supplementation of compensating grazing steers. 2001 Nebraska Beef Report pp 34-36. Available at <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1290&context=animalscinbcr> Accessed March 5, 2010.
- Ferrell, C. L. 1988. Energy metabolism. In: D. C. Church (Ed.) The Ruminant Animal: Digestive Physiology and Nutrition. pp 250-268. Prentice-Hall, Englewood Cliffs, NJ.
- Funston, R. N. and G. H. Deutscher. 2004. Comparison of target breeding weight and breeding date for replacement beef heifers and effects on subsequent reproduction and calf performance. J. Anim. Sci. 82:3094-3099.
- Funston, R., J. Martin, and A. Roberts. 2007. Heifer development – then and now. Proc. Range Beef Cow Symposium XXI. 7 pp. December 1-3, 2009, Casper WY. Available at: <http://digitalcommons.unl.edu/rangebeefcowsymp/13/>. Accessed March 20, 2010.
- Funston, R., J. Martin, and A. Roberts. 2009. Extensive heifer development systems. Proc. Range Beef Cow Symposium XXI. pp. 22-27. December 1-3, 2009, Casper WY.
- Havstad, K.M., and D. E. Doornbos. 1987. Effect of biological type on grazing behavior and energy intake. In: M. K. Judkins, D. C. Clanton, M. K. Petersen, and J. D. Wallace (Ed.) Proc. Grazing Livest. Nutr. Conf. pp 9-15. Univ. of Wyoming, Laramie.
- Hawkins, D. E., M. K. Petersen, M. G. Thomas, J. E. Sawyer, and R. C. Waterman. 2000. Can beef heifers and young postpartum cows be physiologically and nutritionally manipulated to optimize reproductive efficiency? Proc. Am. Soc. Anim. Sci., 1999. Available at: <http://www.asas.org/symposia/9899proc/0928.pdf>. Accessed March 2, 2010.
- Hawkins, D. E., K. K. Kane, S. Cox, and M. K. Petersen. 2008. Low versus high input development of replacement heifers. Proceedings Corona Range and Livestock Research Center Field Day. Available at: <http://coronasc.nmsu.edu/documents/hhawkins-hieifer-input-crlrc-08.pdf>. Accessed March 20, 2010.
- Huntington, G. B. 1996. Grazing ruminant response to ionophores affected by management, environment. Feedstuffs. October 21, 1996.
- Kane, K. K., D. E. Hawkins, G. D. Pulsipher, D. J. Denniston, C. R. Krehbiel, M. G. Thomas, M. K. Petersen, D. M. Hallford, M. d. Remmenga, A. J. Roberts, and D. H. Keisler. 2004. Effect of increasing levels of undegradable intake protein on metabolic and endocrine factors in estrous cycling beef heifers. J. Anim. Sci. 83:283-291.
- Klopfenstein, T. J., D. J. Jordon, I. G. Rush, and T. Milton. 1999. Predicting amount of compensatory gain. 1999 Nebraska Beef Report pp 26-28. Available at: <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1411&context=animalscinbcr>. Accessed March 5, 2010.
- Kronberg, S. L., K. M. Havstad, E. L. Ayers, and D. E. Doornbos. 1986. Influence of breed on forage intake of range beef cows. J. Range Manage. 39:421-423.
- Lalman, D. L., M. K. Petersen, R. P. Ansotegui, M. W. Tess, C. K. Clark, and J. S. Wiley. 1993. The effects of ruminally undegradeable protein, propionic acid, and monensin on puberty and pregnancy in beef heifers. J. Anim. Sci. 71:2843-2852.
- Larson, D. M., A. S. Cupp, and R. N. Funston. 2009. Extending grazing in heifer development systems decreases cost without compromising production. Proc. West. Sec. Amer. Soc. Anim. Sci. 60:67-71.
- LeFever, D. G. and K. G. Odde. 1986. Predicting reproductive performance in beef heifers by reproductive tract evaluation

- before breeding. pp 13-15. CSU Beef Program Report, Colorado State University, Fort Collins.
- NRC. 2000. Nutrient Requirements of Beef Cattle. (7th Ed.). National Academy Press, Washington, DC.
- Patterson, D. J., L. R. Corah, G. H. Kiracofe, J. S. Stevenson, and J. R. Brethour. 1989. Conception rate in *Bos Taurus* and *Bos indicus* crossbred heifers after postweaning energy manipulation and synchronization of estrus with melengestrol acetate and fenprostalene. *J. Anim. Sci.* 67:1138-1147.
- Patterson, D. J., L. R. Corah, J. R. Brethour, M. F. Spire, J. J. Higgins, G. H. Kiracofe, J. S. Stevenson, and D. D. Simms. 1991. Evaluation of reproductive traits in *Bos Taurus* and *Bos indicus* crossbred heifers: Effects of postweaning energy manipulation. *J. Anim. Sci.* 69:2349-2361.
- Patterson, D. J., R. C. Perry, G. H. Kiracofe, R. A. Bellows, R. B. Staigmiller, and L. R. Corah. 1992. Management considerations in heifer development and puberty. *J. Anim. Sci.* 70:4018-4035.
- Petersen, M. K. 2006. Strategic low cost supplementation. *Proc. West. Sec. Amer. Soc. Anim. Sci.* 57:3-6.
- Roberts, A. J., E. E. Grings, M. D. MacNeil, R. C. Waterman, L. Alexander, and T. W. Geary. 2008. Implications of going against the dogma of feed them to breed them. *Proc. West. Sec. Amer. Soc. Anim. Sci.* 60:85-88.
- Roberts, A. J., T. W. Geary, E. E. Grings, R. C. Waterman, and M. D. MacNeil. 2009. Reproductive performance of heifers offered ad libitum or restricted access to feed for a one hundred forty-four day period after weaning. *J. Anim. Sci.* 87:3043-3052.
- Sprinkle, J. E. 1992. Fecal output of different biological types of beef cattle on native range throughout a production year. M. S. Thesis. Montana State University, Bozeman.
- Wagner, M. W., K. M. Havstad, D. E. Doornbos, and E. L. Ayers. 1986. Forage intake or rangeland beef cows with varying degrees of crossbred influence. *J. Anim. Sci.* 63:1484-1490.
- Whittier, J. C. 2009. Profitable cow and heifer pregnancy rates. *Proc. Range Beef Cow Symposium XXI*. 7 pp. December 1-3, 2009, Casper WY. Available at: <http://www.rangebeefcow.com/2009/documents/Whittier2009RBCSproceed.pdf> . Accessed March 20, 2010.
- Whittier, J. C. and K. Miller. 2009. Comparing purchasing -vs- raising beef replacement females Excel spreadsheet. Available at: <http://www.csubeef.com/content/view/70/71/> . Accessed March 19, 2010.
- Willett, G. S., and D. D. Nelson. 1992. Raise or buy replacements? Washington State Cooperative Extension Bulletin No. 1710., Department of Agricultural Economics, Hulbert Hall, Washington State University, Pullman, WA 99164-6210.



THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE AND LIFE SCIENCES
TUCSON, ARIZONA 85721

JIM SPRINKLE

Gila County Extension Director and Area Agent, Animal Sciences

DOUG TOLLESON

Assistant Extension Specialist, Range Management, School of Natural Resources & the Environment, University of Arizona

CONTACT:

JIM SPRINKLE
sprinkle@cals.arizona.edu

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