Developing Replacement Heifers: Birth to Breeding

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Introduction

About 30 percent of the heifer calves produced in North Dakota are retained and developed for cow herd replacements. Costs associated with heifer development represent a significant up-front investment. Furthermore, management of the heifer during the development period can significantly affect her lifetime productivity.

Research indicates that heifers that calve early in their first calving season continue to calve early in subsequent calving seasons and wean heavier calves throughout their lifetime compared to heifers that calve later in their first calving season. Therefore, it is very important that heifers are managed to control costs and enhance productivity.

The period from the time the heifer calf is weaned to the time she is bred is critically important in replacement heifer development. As a producer, your goals should include getting heifers bred early, minimizing calving difficulties, weaning acceptable calves, and having the heifer stay in the herd for a long, productive life.

Preweaning Management

During the preweaning time period, the replacement heifer is largely dependent on the dam to provide nourishment and care. However, there are some management practices which can impact the future productivity of heifers during this period. If possible, heifers should be individually identified to allow producers to base selection upon actual records of birth weight and weaning weight.

Implanting

The following guidelines should be followed when implanting replacement heifers:

- Heifers should not be implanted at birth or within the first month of birth.
- Implanting at two to three months of age appears to have very little adverse effect on subsequent reproductive performance.
- Use of multiple implants (once at two to three months of age and again at weaning) appears to have some negative impact on subsequent reproductive performance.
- If replacement heifers can be identified early (two to three months of age) it is probably best not to implant them. If they cannot be identified at this time, implanting once will have little effect on subsequent reproductive performance.

Creep feeding

Data regarding creep feeding replacement heifers is controversial. In some instances, creep feeding replacement heifers can result in reduced performance when those heifers enter the cow herd. The problem is more prevalent when the cows are good milkers and creep feed is consumed at a rate of 3 to 6 pounds per day. Apparently, excess fat can be deposited in the mammary tissue, resulting in lower milk production potential and lower productivity when heifers enter the cow herd.

In contrast, an extensive survey conducted by the American Simmental Association and Montana State University indicated no reduction in subsequent performance when creep fed heifers were compared to non-creep fed heifers.

Selection

Traditionally, the biggest heifers at weaning have been retained for replacements. This method is simple and straightforward. This selection method is not necessarily bad, since older heifers from earlier calving, heavier milking dams with good growth potential would be selected. However, there are problems with this method. Some of the heaviest heifers may be overly fat, leading to reduced milk production, or may have some endocrine imbalance leading to reduced fertility. This method may also result in the gradual increase in mature cow size, which at some point leads to herd production inefficiencies.

A rigorous selection process should be developed to select replacement heifers. This process should use available weight and performance records as well as visual appraisal. Select heifers from sires that transmit desired milk production and mature size and have demonstrated early sexual maturity. From this pool keep those heifers of desired body type and frame size which are most likely to breed early, calve without difficulty, and remain sound with minimal inputs.

Age at puberty

In order for a heifer to calve at 22 to 24 months of age, she must reach puberty by 12 to 14 months of age. Table 1 shows the breed group averages for age and weight at puberty based on data from the US Meat Animal Research Center.

Table 1. Breed group averages for age and weight at puberty.[1]

Breed Group	Weight at Puberty (lbs)	Age at Puberty (days)
Jersey-x	518	308
Hereford-Angus-x	622	357
Red Poll-x	580	337
South Devon-x	639	350
Tarentaise-x	622	349
Pinzgauer-x	611	334
Saihwal-x	642	414
Brahman-x	712	429
Brown Swiss-x	615	332
Gelbvieh-x	626	326
Simmental-x	666	358
Maine-Anjou-x	672	357
Limousin-x	679	384
Charolais-x	703	384
Chianina-x	699	384

1 From Beef Research Report No. 2: Roman L. Hruska, U.S. Meat Animal Research Center and University of Nebraska College of Agriculture.

Breeds vary with respect to age at puberty. In addition, sire selection within a breed also plays a role in determining age and weight at puberty. Age and weight at puberty are moderately to highly heritable traits. This means that producers can use selection to improve these traits within a given herd.

An easy method of selection for age at puberty in replacement heifers is to select daughters of bulls with large scrotal circumference. In general, bulls with larger scrotal circumferences have daughters that reach puberty earlier.

Impact of bull exposure on age at puberty

University of Nebraska research indicates that exposing heifers (from weaning to breeding) to surgically altered (gomer) bulls can reduce age at puberty by 40 days and increase the number of heifers bred during the first 21 days of the breeding season.

Impact of ionophores and anthelmintics on age at puberty

Research also indicates that the addition of an ionophore or a combination of an ionophore and an anthelmintic wormer can reduce age and weight at puberty. Ionophores generally improve gain and feed efficiency by 10 to 15 percent in forage based growing rations.

Use of MGA and other progestins

Melengestrol acetate (MGA) is a feed additive commonly used by the feedlot industry to suppress estrus in heifers being fed for slaughter. It can also be used to induce cyclicity in some pre-puberal heifers that are close to, but have not reached, sexual maturity (possibly due to insufficient weight or age). MGA can also be used as part of an estrous synchronization program. Synchromate B implants are another progestin which can be used to synchronize estrous.

Target Breeding Weights

Heifers that breed and calve early their first year have been shown to have an advantage in lifetime production. For early breeding to occur, heifers must be cycling at the start of the breeding season. Furthermore, conception is greatly improved by breeding after several heat cycles compared to the first puberal estrus. Therefore, heifers should be cycling 60 days prior to breeding or by about 12 months of age.

The level of nutrition the heifer receives the first winter following weaning will influence her rate of development, weight gain, and the age and weight at which she reaches puberty. Heifers fed for a higher rate of gain will be heavier and younger at puberty. Low rates of gain will delay puberty, but heifers will reach puberty at a lower weight. The fact that weight has such an important impact on sexual development allows use of a simple nutritional management concept known as target weight. A heifer's target weight is the minimum weight she should achieve by the time she is exposed for breeding.

Current target weight recommendations call for heifers to weigh 65 percent of their estimated mature weight at the time of breeding. Mature weight of heifers can be estimated from frame scores determined by measuring height at the hip or from weights of similar cows in the herd. Average mature weight in a particular cow herd can also be estimated based on weight of cows culled from the herd and sold through an auction barn.

Once target weight has been determined for heifers, an appropriate rate of gain can be targeted by dividing the total pounds of gain needed to reach target weight by days in the feeding period until breeding. Table 2 provides an example worksheet for calculating required weight gains for heifer development. Where there is wide variation in weights and target gains, it is good management to sort light and heavy heifers in groups so they can be fed according to their different needs.

Table 2. Example worksheet for calculating required heifer gains.

	NDSU Example	Your Herd
Mature cow size	1300 pounds	_____
Target weight at breeding (65% of mature weight)	845 pounds	_____
Current weight	550 pounds	_____
Current date	October 15	_____
Start of breeding season	June 1	_____
Feeding period	225 days	_____
Total gain needed	295 pounds	_____
ADG needed	1.3 lbs/day	_____

In addition to greater feed costs, overfeeding heifers may also contribute to decreased productivity. The period from about three to nine months of age is critical to mammary growth in heifers. Both inadequate nutrition and overfeeding in this period have been shown to result in reduced milk production.

Target gains will vary depending on weaning weights, frame size, breed type, and length of the backgrounding feeding period. Typical gain targets from weaning to breeding are 1.25 to 1.5 lbs per day for British breed type heifers and 1.5 to 1.75 lbs per day for Continental breed types.

Research suggests that the rate of gain in the development period does not need to be constant as long as the target weight is reached. In fact, some NDSU research identifies advantages to developing heifers in stages of reduced energy and gain followed by periods of compensatory growth. A slight reduction in feed expenses has been shown for heifers developed at fairly slow rates of gain early followed by a period of accelerated growth just prior to breeding.

Feeding and Nutrition

It is relatively easy to feed heifers from weaning to breeding to accomplish targeted moderate rates of gain with fairly simple rations. Table 3 provides minimum nutrient requirements which serve as a guide in formulating rations. Replacement heifers have nutrient requirements which differ from the rest of the cow herd; consequently, they should be fed and managed separately.

Table 3. Nutrient requirements for medium and large frame heifer calves.
Adapted from NRC (1984).

Heifer Weight	Nutrient Requirements (per animal per day)				Ration Specifications (dry matter basis)				Estimated Minimum Daily Dry Matter Feed Intake
	ADG	TDN	Protein	Ca	P	TDN	Protein	Ca	Phos.	
(lbs)	(%)	(lbs)	(g)	(g)	(%)	(%)	(%)	(%)	(lbs)
MEDIUM FRAME									
400									
	1.0	6.1	1.01	16	9	62.0	10.2	0.36	0.20	9.9
	1.5	7.0	1.17	21	11	68.5	11.4	0.45	0.24	10.2
	2.0	7.7	1.29	26	13	77.0	12.9	0.57	0.29	10.0
500									
	1.0	7.3	1.11	16	11	62.0	9.4	0.30	0.21	11.8
	1.5	8.3	1.25	21	12	68.5	10.3	0.38	0.22	12.1
	2.0	9.1	1.35	24	13	77.0	11.4	0.45	0.24	11.8
600									
	1.0	8.4	1.19	17	12	62.0	8.8	0.28	0.20	13.5
	1.5	9.5	1.32	20	13	68.5	9.5	0.32	0.21	13.8
	2.0	10.4	1.41	23	14	77.0	10.4	0.38	0.23	13.5
700									
	1.0	9.4	1.28	17	13	62.0	8.4	0.25	0.19	15.1

1.5	10.6	1.39	20	14	68.5	9.0	0.28	0.20	15.5
2.0	11.7	1.46	22	15	77.0	9.6	0.32	0.22	15.2
800									
1.0	10.4	1.36	17	14	62.0	8.1	0.22	0.18	16.7
1.5	11.8	1.46	19	15	68.5	8.5	0.24	0.19	17.2
2.0	12.9	1.51	21	15	77.0	9.0	0.28	0.20	16.8
LARGE FRAME									
500									
1.0	7.3	1.17	17	11	59.0	9.4	0.30	0.20	12.4
1.5	8.3	1.33	22	12	64.0	10.3	0.38	0.20	12.9
2.0	9.1	1.47	26	14	69.5	11.2	0.44	0.24	13.1
600									
1.0	8.3	1.25	18	12	59.0	8.9	0.28	0.19	14.1
1.5	9.5	1.42	22	13	64.0	9.6	0.33	0.19	14.8
2.0	10.4	1.55	26	15	69.5	10.3	0.38	0.22	15.0
700									
1.0	9.4	1.35	18	13	59.0	8.5	0.25	0.18	15.9
1.5	10.6	1.49	22	14	64.0	9.0	0.29	0.19	16.6
2.0	11.7	1.61	25	15	69.5	9.6	0.33	0.20	16.8
800									
1.0	10.4	1.44	19	14	59.0	8.2	0.24	0.18	17.6
1.5	11.7	1.57	21	15	64.0	8.6	0.25	0.18	18.3
2.0	12.9	1.67	24	16	69.5	9.0	0.28	0.19	18.6
900									
1.0	11.3	1.52	19	16	59.0	7.9	0.22	0.18	19.2
1.5	12.8	1.64	21	16	64.0	8.2	0.23	0.18	20.0
2.0	14.1	1.74	24	17	69.5	8.6	0.26	0.18	20.3

Energy Requirement - Listed requirements are for cattle under thermoneutral conditions. Increasing listed requirement for TDN by 1% for each 1 degree drop below 10°F for cattle in winter hair should be sufficient in adjusting for cold temperatures. Under dry cold conditions to -10°F intake may increase to compensate.

Protein Requirements - Listed requirements should be adequate in 50% of cases. Increasing listed requirement by 15% should be sufficient in 85% of cases. Increasing listed requirement by 30% should be sufficient in 100% of cases.

Mineral Requirements - In addition to listed calcium and phosphorous requirements, the following are suggested minimum requirements for trace minerals: sodium chloride .08%, potassium .65%, magnesium .10%, sulfur .10%, cobalt 10 ppm, iodine .5 ppm, iron 50 ppm, manganese 40 ppm, selenium .20 ppm, zinc 30 ppm.

Vitamin Requirements - Suggested requirements for growing heifers per pound of dry ration are 1000 IU/Vit A, 125 IU/Vit D, and 5-25 IU/Vit E.

Heifers are commonly developed most economically on high forage rations supplemented with grains and grain by-products, protein concentrates, and minerals as needed to meet their needs and gain target. Modest levels of gain can be achieved solely on high quality roughage fed to appetite. Table 4 gives example rations based on varying forage quality, heifer weight, and gain target.

Table 4. Example rations for developing replacement heifers.

	Hay Quality		
Heifer Weight	**Low**	**Average**	**High**
MEDIUM FRAME - 1.5 TARGET ADG			
400 lbs			
Hay, lbs	9.0	11.0	12.5
Grain, lbs	5.0	3.5	2.0
Protein supplement, lbs	.5	.1	—
Mineral supplement, lbs	.2	.1	—
600 lbs			
Hay, lbs	13.0	15.0	18.0

Grain, lbs	7.0	5.0	2.0
Mineral supplement, lbs	.1	—	—
800 lbs			
Hay, lbs	16.0	18.5	21.5
Grains, lbs	8.5	6.0	3.0
LARGE FRAME - 1.75 TARGET ADG			
500 lbs			
Hay, lbs	10.5	13.0	15.0
Grain, lbs	6.5	4.5	2.5
Protein supplement, lbs	.5	.1	—
Mineral supplement, lbs	.3	.1	—
700 lbs			
Hay, lbs	13.5	16.5	20.0
Grain, lbs	8.5	6.0	2.5
Mineral supplement, lbs	.2	—	—
900 lbs			
Hay, lbs	17.0	19.5	23.5
Grains, lbs	10.0	7.5	3.5
Mineral supplement, lbs	.2	—	—

Low quality hay = 52% TDN, 7% CP;
average quality hay = 56% TDN, 9.5% CP;
high quality hay = 60% TDN, 12% CP.

Grain = 84% TDN, 13% CP (barley);
mineral = 12% P, 12% Ca, 12% salt.

In addition, it is important to understand the composition and quality of feeds to be fed. Forages, in particular, vary considerably in level of protein and energy and should be analyzed in order to accurately balance rations. High quality hays are those with over 12 percent crude protein and 58 percent TDN. Hays with crude protein values between 8 and 11 percent and TDN in the mid 50s would be considered average quality hays. Hay with less than 8 percent crude protein and 52 percent TDN would be considered low quality forage.

Insufficient energy intake which results in poor growth can have devastating effects on breeding performance of heifers as yearlings and on their subsequent performance in the cowherd. Table 5 shows the results of research which examined the effect of winter nutrition level on heifer development, reproductive performance and calf production.

Table 5. Effect of winter nutrition level during heifer development on subsequent performance of replacement heifers.[1]

	Pounds of Grain per Head per Day		
	0	**2.7**	**5.4**
Number of heifers	112	113	112
Initial weight (lbs)	496	502	493
ADG, wintering period, lbs	0.07	0.50	0.80
Breeding weight (lbs)	506	577	613
% bred as yearlings (60 days)	69.2	73.9	83.5
Subsequent Production			
% rebred after first calf	67.3	75.4	87.1
Weaning weight of first calf (lbs)	405	433	443

[1]Adapted from Lemenager et al., 1980.

If large groups of heifers will be developed, producers should consider splitting the heifers into two or more feeding groups (based on weight). This will allow more precise feeding of each group based on necessary target breeding weights and daily gains.

Consequences of nutritional mismanagement

- increased age at puberty
- Lower conception rates
- Greater degree of calving difficulty
- Increased calf morbidity and mortality
- Calves born later in the calving season
- Lighter weaning weights
- First calf heifers with poor reproductive performance during rebreeding
- Later rebreeding of first calf heifers
- Reductions in lifetime productivity
- Increased rate of culling

Alternative Feeds

Weaning and first appearance of the heifer into the growing lot is a critical period. Calves which have not been creep fed must be trained to eat harvested forage and grain from a bunk. It is important that first feeds are highly palatable, safe, and high in nutrients. Complete commercial starter feeds are convenient choices in instances where starting calves in the lot has been a problem.

Forages harvested as silage or haylage can be very good feeds for growing heifers. Properly harvested and stored small grain silage is generally a high quality forage. Corn silage typically is higher in energy than most forages but only moderate in protein and will produce adequate heifer growing gains with little or no grain feeding if protein levels are balanced.

There is limited opportunity for use of crop residues such as straw or corn stover in the growing heifer's diet, since these products are generally low in energy, protein, vitamins, and minerals. Gains of about 1 to 1.5 pounds per day might be anticipated by heifer calves grazing corn stalks in late fall and early winter when supplemented with protein, vitamins, and minerals. Small grain straw and chaff are generally too low in nutrients to be used to any great extent in heifer rations. However, ammoniation can be used to increase crude protein and digestibility to acceptable levels.

Increasingly in North Dakota, byproducts of the grain milling and oil seed processing industries are available to cattle producers. These feeds are generally moderate to high in energy and protein. Byproducts and remnants from grain milling make useful feeds for growing rations, typically having energy values intermediate to common feed grains and forages with fairly high concentrations of protein and minerals. In many instances, they can be economically fed as a replacement for grain and protein supplements. Oilseed meals remaining after solvent or expeller crushing of oilseeds are generally good sources of protein. These oilseed meals are useful as a ration ingredient for supplementing low protein forages.

At times, some minor alternative crops become priced competitively for consideration as feed stuffs. In particular, field peas are high in protein and TDN and make an excellent concentrate feed for use in high roughage growing rations.

Health

As in all calf growing programs, sickness and death loss risks are of concern in the growing of heifers for replacement purposes. The health status of heifers is enhanced by minimizing stress, providing adequate nutrition, and by a proper vaccination program. Please refer to NDSU Extension Circulars AS-1154, "Respiratory Illnesses," or AS-1160, "Preconditioning Programs: Vaccination, Nutrition, and Management," for more information regarding health programs.

Economics

A four year study of heifer development and associated costs at the Dickinson Research Extension Center documents the greatest single cost in developing heifers from weaning to entering the cowherd as bred heifers the following fall is for feed in the growing/backgrounding period. Drylot feed costs averaged $113 per heifer for heifers developed at a rate of 1.67 pounds per day gain and represented over 40 percent of total costs over the year period. The second greatest expense was yardage at $36 per heifer during this drylot period to cover costs associated with labor, equipment, facilities, utilities, fuel, repairs, and management.

Custom Heifer Development Services

A growing number of companies or individuals will develop replacement heifers for individual producers. The biggest advantage these services offer is that a professional who develops heifers for a living will be managing your heifers and may be able to devote more management expertise to your heifers than you could. Additional advantages may include not needing additional facilities, feed, and labor required to develop heifers on your ranch or farm. Most commercial development facilities will also offer synchronization and artificial insemination programs for your heifers as well. Disadvantages may include increased costs associated with fees for yardage, breeding, and other expenses which may not be cash expenses in your operation.
