WHAT ARE YOUR HEIFER REPLACEMENT GOALS?

Mark Engstrom
Hoffmann-La Roche, Inc.
Eden Prairie, MN

INTRODUCTION

Several factors are increasing dairy producer interest in heifer replacement programs. These factors include:

- better awareness of costs (provides impetus for measurement and change),
- research advances (what can be done to improve things; how can we remove bottlenecks?),
- young, expanding herds (refines quality requirements for replacements, increases number of replacements needed and pressure for change), and
- changing industry structure (i.e. contract heifer raising: further defines costs, requirements, bottlenecks, fosters communication).

As a result, many producers have detailed knowledge of their heifer production costs. Despite this, most dairy producers feel that contracting with heifer growers at $1.30 a day is too expensive, and many heifer growers feel that they won't stay in business at rates below $1.40 a day, or that they won't be able to produce a quality heifer at lower prices (Hoffman et al., 1996; Moen, 1996).

Most authors (Barmore, 1995; Grummer et al., 1995; Hoffman, 1996; Hoffman and Funk, 1992; Heinrichs, 1993; Price et al., 1994) agree that the following standards are achievable and desirable for Holstein heifers at first calving:

- 1350 lb bodyweight prepartum
- 22-24 months of age at first calving (**AFC**)
- 54-56 inches at withers
- Body condition score (**BCS**) = 3.5

Although the above standards are often detailed in the trade press and in university publications (and recited by producers), most youngstock programs have just one defined milestone: breeding (and thus, AFC). The use of intermediate stature and weight goals is very limited in the dairy industry--producers usually change the current program when AFC is determined to be *too old*, or heifers are too fat or too small. Furthermore, the goal of increased average daily gain (**ADG**) is in conflict with the perception that heifers may get too fat, or that the mammary system will be compromised when heifers are grown too fast (Sejrsen et al., 1982; Swanson, 1960).

GOALS AND COSTS

Accurate and complete accounting of heifer raising costs is relatively easy to obtain. Table 1 reports the cost ranges encountered by a contract heifer grower (capacity = 700 head) in Mora, Minnesota. The average cost reported was $1.35/hd/day, or $.78/lb in cost-of-gain terms. In a 1993 survey of western New York dairies, total heifer raising costs averaged $1.47/hd/day (Karszes, 1994). At total heifer production costs ranging from $600 to $1300 per heifer, Smith (1993) calculated that a heifer doesn't return her investment costs until nearly the second lactation (the $600 heifer) to as late as the third lactation (the $1300 heifer). In any case, heifer replacements are very expensive--second only to lactation feed costs on a dairy farm.

Others (Veldman and Cady, 1995; Karszes, 1994; Skidmore, 1995) have reported similar costs, with some regional variation. Although heifer contracts vary widely in content, many contain weight-for-height, maximum ADG, and AFC details to protect the producer's interests. Other defined responsibilities often include: age at arrival, right of refusal, vaccinations, nutrition program, AI program, and insurance details.

Suppose a dairy producer has an accurate idea of youngstock costs, and wishes to use some early breeding date goals to shorten AFC by 30 days. How worthy a goal would this be? As pointed out by Cady and Willett (1996), increased AFC costs the producer in three ways: 1) increased days of

Table 1. Heifer raising expenses: 10 weeks to springer (500 hd)[1].

Item	$ Cost/hd/day
Protein/mineral supplement	.12- .15
Corn/grain	.10- .15
Hay/haylage	.24- .34
Corn silage	.24- .34
Fuel	.02- .03
Bedding	.02- .04
Repair/misc.	.04- .06
Trucking	.02- .04
Veterinary	.05- .07
Rent/yardage	.10- .15
Insurance	.01- .02
Breeding	.01- .02
Utilities	.02- .04
Interest	.04- .12
Labor	.25- .35
Death loss	.01- .03
Principal	.00- .11
Totals	**$1.29 - $2.07 (avg $1.35)**

[1]Adapted from Moen, 1996.

rearing, 2) increased number of (slower-growing) replacements needed on the farm, and 3) lost lifetime milk production potential. Using the following assumptions, Table 2 shows the economic impacts of shortening AFC by 30 days:

- Production cost = $44/mo
- Heifer cost = $1200
- Herd size = 100 lactating cows
- Current AFC = 26 months
- Cull rate = 28%/yr (67 heifers on-hand)
- 1 lb @ calving = 6 lb additional milk in first lactation (Keown and Everett, 1986)
- Milk margin = $3/cwt

Other goals to consider in a youngstock program are prepartum bodyweight (milk yield in the first lactation maxes out at 1350 lb), BCS [scores above 3.5 raised dystocia index by several points in the Hoffman et al. (1995) study], and stature (more accurate than BCS, and as useful in determining body composition if combined with weight measurement). As these effectors are further refined by research, producers will press for more efficient youngstock programs, and will look for biological and economic limits to production.

OPTIMUM GROWTH RATES

To make progress toward earlier AFC, we need to grow our youngstock faster, yet with appropriate body condition. A common producer question is: "How fast can we push them without compromising udder development and first lactation performance?" Several recent research trials were designed to help answer this question. The first report, from Van Amburgh et al. (1994), investigated accelerated pre-pubertal growth rates and their effect on first lactation milk yield. Groups of heifers were targeted to grow at 1.32, 1.86 and 2.2 lb ADG.

In the Van Amburgh study, milk yield and prepartum bodyweight were numerically reduced in the accelerated heifers, indicating that a prepubertal growth rate of 2.1 lb ADG may be near the limit for modern Holsteins.

In another study, Hoffman et al. (1995) fed control (62.5% TDN in ration) or accelerated (68.5% TDN) heifers to be bred at 14 or 10 months of age. Treatments were begun at 10 months, and depending on breeding efficiency, heifers were then divided into target or delayed groups for analysis.

Table 2. Economic values of increased ADG pre- and post-puberty.

Item	Value ($/heifer)
30 less days to breeding/AFC	$ 44
3 less replacements needed (3/67 = 4.4%)	$ 53
38 lb more wt at calving	$ 7
Total	**$104**

Table 3. Effect of pre-pubertal growth rate in Holstein heifers on first lactation milk yield.[1]

Item	Group 1	Group 2	Group 3
Prepubertal ADG, lb	1.57	1.86	2.1
Age fresh, mo	24.2	22.0	21.0
Calving BW, lb	1186	1161	1126

[1]Van Amburgh et al., 1994

Several researchers have investigated the effects of additional protein (Van Amburgh et al., 1994) or undegradable intake protein (Steen et al., 1992) in protecting against excessive BCS gain in fast-growing heifers. Park and others (1987) have conducted a series of studies in which heifer growth rates are matched to a *stair-stepped* energy supply to maximize ADG after critical udder development has occurred. These studies may help to define optimal or maximal ADG's or BCS's for heifers grown on accelerated programs and calving at 22 months or earlier.

NUTRIENT INFLUENCERS

Once the baseline ADG and nutrition programs have been established for a set of heifers, how does one adjust for any management or environmental factors which might be encountered? Several researchers have attempted to characterize the effects of housing, weather, etc. on heifer performance and nutritional requirements.

Table 4. Effect of early calving on development and lactation performance of Holstein replacement heifers.[1]

Item	Treatment			
	Accelerated		Control	
	Target	Delayed	Target	Delayed
Calving age, mo	20.6	22.7	23.6	25.6
ADG, lb/d	2.1	1.9	1.7	1.7
Prepartum BW, lb	1371	1462	1407	1464
Postpartum BW, lb	1215	1294	1279	1327
BCS	3.5	3.7	3.4	3.6
Pelvic area, cm^2	259	274	269	291
Dystocia index	2.7	4.2	2.8	3.4
Milk yield, lb/d	55.1	57.3	60.0	58.6

[1]Adapted from Hoffman, et al. 1995

Table 5. Effects of deworming, mud, wind, cold, and ionophores on heifer energy requirements.[1]

	energy adjustment: lb corn/900 lb heifer/day	
Ite	Hoffman	CNCPS
Mud	+2/3	+0 to 2
Deworming	-2/3	NA
Cold/Wind	+1/2	+2.5
Ionophore	-1/2	-1/2 to 1

[1]Adapted from Hoffman, 1994; Fox et al., 1993.

MONITORING HEIFER GROWTH--THE MISSING LINK?

As pointed out by Hoffman (1996), measurement programs for replacement heifers "almost always fail at the farm level due to the time commitment involved." Simple schemes of heart girth, wither height, and BCS measurement at breeding/calving or at a single time for all replacements on-hand (Galligan and Ferguson, 1995) have been proposed as useful tools for goal integration.

CONCLUSIONS

Several recent research reports have helped to define the biological and economic limits to heifer performance. These can be useful for fine-tuning youngstock programs for today's dairy producers. Modern Holsteins necessitate a new set of stature and weight goals, and the economic pressure is increasing to produce acceptable heifers at younger AFC's. The emerging industry segment of contract or custom heifer raising has also increased the awareness of these limits.

However, the use of defined goals is limited--producers are better at reciting expected goals than at measuring performance toward those goals.

The impact of setting goals is tremendous, due to the costly nature of raising replacements. Research can now characterize the impacts of deworming, shelter, ionophore feeding, and other management techniques so that resources and growth rates can be managed to deliver heifers of acceptable quality. Practical conflicts between high ADG and mammary development, and other biological constraints such as dystocia, poor first lactation performance, and poor reproductive performance are also being characterized. These conflicts make it difficult for dairy producers to make improvements. Today, dairy producers have more tools for self-setting goals which can be measured against and attained--this is how progress will be made in reducing AFC while generating herd replacements of acceptable quality.

ACKNOWLEDGEMENT

The financial support of Hoffman-LaRoche is gratefully acknowledged.

REFERENCES

Barmore, J. 1995. Calf nutrition update and growing heifers. 56th Minnesota Nutrition Conference, pg 137, Bloomington, MN.

Cady, R.A. and G. Willett. 1996. Case study of contract raising. NRAES Conference Proceedings on Calves, Heifers, and Dairy Profitability: Facilities, Nutrition, and Health, Harrisburg, PA.

Fox, D.G., M.C. Barry, T.P. Tylutki, J.D. O'Connor, C.J. Sniffen, and W. Chalupa. 1993. A manual for using the Cornell net carbohydrate and protein system for evaluating cattle diets. Cornell Cooperative Extension, Ithaca, NY.

Galligan, D.T. and J.D. Ferguson. 1995. Regression methods to measure heifer growth. Proc. Madison, WI: Advanced Dairy Nutrition Conf.

Grummer, R.R., Hoffman, P.C., Luck, M.L., and S.J. Bertics. 1995. Effect of prepartum and postpartum dietary energy on growth and lactation of primiparous cows. J. Dairy Sci. 78:172.

Heinrichs, A.J. 1993. Raising dairy replacements to meet the needs of the 21st century. J. Dairy Sci. 76:3179.

Hoffman, P.C. 1994. Effect of nutrition, environment and management on performance of dairy replacement heifers. Professional Dairy Management Seminar: 111.

Hoffman, P.C. 1996. Optimum growth rates for Holstein replacement heifers. Proc. Minnesota Dairy Heifer Raising Seminars, St. Paul.

Hoffman, P.C., and Funk, D.A. 1992. Applied dynamics of dairy replacement growth and management. J. Dairy Sci. 75:2504.

Hoffman, P.C., S. Price, N.M. Brehm, and D.A. Funk. 1995. Effect of accelerated postpuberty growth and early calving on lactation performance of primiparous Holstein cows. J. Dairy Sci. 78(Suppl. 1):236 (Abstr.).

Karszes, J. 1994. Dairy replacement programs: costs & analysis Western New York, 1993. Animal Science Mimeograph Series. Cornell Coop. Ext. 174: 2.

Keown, J.F., and R.W. Everett. 1986. Effect of days carried calf, days dry, and weight of first calf heifers on yield. J. Dairy Sci. 69:1891.

Moen, M. 1996. Heifer raising as a business. Proc. Minnesota Dairy Heifer Raising Seminars, St. Paul.

Park, C.S., G.M. Erickson, Y.J. Choi, and G.D. Mary. 1987. Effect of compensatory growth on regulation of growth and lactation: Response of dairy heifers to a stair-step growth pattern. J. Anim. Sci. 64:1751.

Price, S., P.C. Hoffman, and J. Barmore. 1994. Tailored rations help heifers grow. Hoard's Dairyman, pg 685.

Sejrsen, K., J.T. Huber, H.A.Tucker, and R.M. Akers. 1982. Influence of nutrition on mammary development in pre- and post pubertal heifers. J. Dairy Sci. 65:793.

Skidmore, A.L. 1995. Effect of reproductive efficiency on age-at-first-calving. Compendium on Continuing Education for the Practicing Veterinarian, pg 249, Veterinary Learning Systems.

Smith, T.R. 1993. Dairy replacement economics. Second Biennial Northeast Heifer Management Symposium. Animal Science Mimeograph Series. Cornell Coop. Ext. 165:117.

Steen, T.M., J.D. Quigley, III, R.N. Heitman and J.D. Gresham. 1992. Effects of lasalocid and undegradable protein on growth and body composition of Holstein heifers. J. Dairy Sci. 75:2517.

Swanson, E.W. 1960. Effect of rapid growth with fattening dairy heifers on their lactational ability. J. Dairy Sci. 43:377.

Van Amburgh, M.E., D.M. Galton, D.G. Fox, D.E. Bauman, L.E. Chase, H.N. Erb, and R.W. Everett. 1994. Effect of pre-pubertal growth rate in Holstein heifers on first lactation milk yield. J. Dairy Sci. 77(Suppl. 1):185 (Abstr.).

Veldman, T.M. and R.A. Cady. 1995. Survey of Washington dairy heifer management practices. J. Dairy Sci. 78(Suppl. 1): 162 (Abstr.).