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Heifer growth rate requirements should be closely defined, evaluated

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There is controversy over whether accelerated growth of dairy heifers is a beneficial practice for dairy producers. A basic component of this issue is lack of agreement as to what accelerated growth rates are and an inconsistency in the published literature in what is defined as accelerated growth.

Another component is: When does the accelerated growth occur? Is it prepubertal or after breeding?

Consider one of the earlier studies (Sejrsen et al., 1982) that had a control average daily gain (ADG) of 1.34 lb. with a treatment ADG of 2.66 lb. We now consider the control ADG as being too low and the accelerated ADG, twice the control, as too high. Unfortunately, there were no intermediate ADG treatments. Also, 20 years of genetic change has since occurred.

Additionally, some dietary treatments may have been too low in protein, too high in energy or both.

A comparison (Table 1) among the last three National Research Council (NRC) *Nutrient Requirements of Dairy Cattle* publications shows real disparity among the various parameters depicted, including:

• In 1978, ADG above 1.6 lb. was not even addressed beyond bodyweights of 700 lb. Why a higher ADG before puberty or breeding was allowed but not afterward is puzzling. A factorial approach was used, resulting in low percent crude protein (CP) for 400 lb. bodyweight heifers and very low percent CP for 1,000 lb. bodyweight heifers. The negative effects of these low dietary CP levels on dry matter intake (DMI) and digestibility were apparently not considered or were judged not to be significant.

• In 1989, only ADGs from 1.3 to 1.7 lb. were depicted, and beyond 1,100 lb. bodyweight, the ADG of 1.7 lb. was not allowed. DMI was lower than 1978 for 400 lb. bodyweight but somewhat higher for 1,000 lb. bodyweight. A fixed lower CP of 16% for 400 lb. bodyweight and 12% for 1,000 lb. bodyweight kept protein levels from being as low as in the 1978 factorial approach. Metabolizable energy (ME) requirements were lower for 400 lb. bodyweights but similar for 1,000 lb. bodyweights.

• In 2001, ADG were depicted from 1.1 to 2.4 lb. at 0.22 lb. intervals. Thus, even 400 lb. heifers at mid-puberty would be allowed to gain up to 2.4 lb. daily, equivalent to that of 1,000 lb. and larger heifers. DMI was most similar to 1978 at 400 lb. bodyweight but higher than either 1978 or 1989 for 1,000 lb. bodyweights. Percent CP increased with increasing ADG and DMI, as did ME. ME values were similar between 2001 and 1989 at 400 lb. but higher at 1,000 lb.

The emphasis on reducing age at first calving (AFC) is driven by attempting to reduce total costs by that first calving. Since AFC is older than 26 months nationally (*Feedstuffs,* Sept. 10, 2001), near consensus has been that 24 months AFC was an appropriate goal. Then, why not reduce costs even further by reducing AFC to 22 months, 20 months or even lower with increasing ADG to reach those goals?

However, this presupposes that there would be no negative effects in accelerating ADG and that this can be done for the whole population of heifers to average reaching that goal.

Dr. Mike VandeHaar of Michigan State University addressed this and related issues at the 5th Western Dairy Management Conference (VandeHaar, 2001). Key points were:

• About 1,250 lb. bodyweight *after* first calving appears to optimize milk production in the first lactation (Keown and Everett, 1986; Heinrichs and Hargrove, 1987; Van Amburgh et al., 1998). This means about 1,350-1,400 lb. bodyweight *prior* to first calving.

• To calve at 1,400 lb. bodyweight and 24 months of age requires an ADG of 1.8 lb. This could be as high as 2 lb. to offset slower growth rates prior to weaning or during other periods. If AFC was pushed down to 20 months, then ADG would need to average nearly 2.4 lb.

• Decreases in first lactation milk production have occurred in nearly all studies in which heifers exceeded ADG of 2.0 lb. However, the variability of this decrease ranged from 5 to 50%, indicating other factors were also involved.

There is a biological limit to bone growth and protein deposition during growth. If growth is accelerated beyond that point, increased fat deposition will likely occur. This is particularly problematic during the prepubertal period of 3-10 months of age when mammary growth is allometric — more than three times faster than other major body tissues. Hence, the mammary gland fat pad growth can be excessive, which impinges on the later development of milk secretory cells. This is the classic problem associated with accelerated growth rates prepubertal: later reduction in first lactation milk production.

What is the limit of growth rate during this period? Probably 2.0 to possibly 2.2 lb. ADG. What dietary parameters may best describe how to minimize this negative effect of accelerated growth? VandeHaar has proposed the ratio of protein to energy, specifically the ratio of CP:ME in grams per megacalorie. His recommendations for growth and feeding Holstein heifers *ad libitum* are in Table 2.

Wither heights at the upper end may be too aggressive, depending on genetics, with a 24-months-of-age range of 54-56 in. appropriate for most Holstein populations. Too often, the focus is simply on bodyweight. It is possible to have heifers achieving bodyweight at or above goals, but if they are not as tall as they should be, they will be too fat. More emphasis should be placed

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TABLE

1. Comparison of three editions of NRC recommendations

	NRC publication year								
	1978			1989			2001		
1978/1989/2001	DMI, lb.	CP, %/lb.	ME, Mcal/lb.	DMI, lb.	CP, %/lb.	ME, Mcal/lb.	DMI, lb.	CP, %/lb.	ME, Mcal/lb.
400 lb. bodyweight ADG									
1.4/1.3/1.3	10.5	12.0/1.26	11.75	8.90	16.0/1.42	10.33	10.44	13.1/1.37	10.34
1.6/1.5/1.8	10.5	12.4/1.30	12.17	9.44	16.0/1.51	10.96	10.66	15.3/1.63	11.07
1.8/1.7/2.2	10.5	12.7/1.33	12.68	9.98	16.0/1.60	11.59	10.66	16.6/1.77	11.84
1,000 lb. bodyweight ADG									
1.4/1.3/1.3	20.2	9.8/1.97	21.39	21.22	12.0/2.55	21.13	23.28	13.3/3.10	23.34
1.6/1.5/1.8	20.2	9.8/1.98	22.16	22.44	12.0/2.69	22.35	23.26	14.2/3.29	24.65
1.8/1.7/2.2	—	—	—	23.68	12.0/2.84	23.59	23.01	15.0/3.46	25.96

on heifer height (not necessarily selecting for more height, but achieving what is presently the genetic ability), a reference point to avoid pitfalls that bodyweight alone will not depict. Too often, heifer diets are either too low in protein or too high in energy. The proposed CP:ME is a good dietary cross-check to help avoid these situations.

The last, but certainly not least, point is that of genetic variability. Unfortunately, especially with the more recent mass movement of heifers around the country to provide for expansion of existing herds or to start up new large herds, the genetics of heifers is often not known or taken into account. Also, it has not been possible with the relatively few heifers used in most growth studies to factor in genetic variability. That is why a relatively recent Danish study (Sejrsen et al., 2000) is of signal importance.

A total of 450 Danish-breed heifers in a series of experiments were fed different energy levels over a period of several years. Since several bulls were used, genetic variation in growth and relationship to subsequent milk yield potential were calculated. ADG varied more than 0.2 lb. due to genetics. The top 10% of heifers gained 0.2 lb. more per day, weighed 165 lb. more at first calving and averaged 14 lb. more milk per day during the entire first lactation than the bottom 10% — when all were fed the same ration.

So, it is most likely that forcing inherently slower-growing heifers to grow faster will cause them to fatten; for example, trying to force 28-month AFC heifers to calve at 24 months or 24-month AFC to calve at 20 months.

TABLE

2. Growth and feeding recommendations for Holstein heifers

Age, months	Bodyweight, lb.	Height, in.	ME, Mcal/lb.	% CP	CP:ME
2	167	34.1	1.33	18.4	63
4	279	37.6	1.27	17.6	63
6	398	40.8	1.18	16.4	63
8	517	43.9	1.12	14.8	60
10	634	46.7	1.12	14.8	60
12	748	48.7	1.08	12.6	53
16	970	51.7	1.08	12.6	53
22	1,290	54.8	1.08	12.6	53
23	1,343	55.2	1.08	13.3	56
24	1,400	55.6	1.20	14.8	56

The Bottom Line

Accelerated growth needs to be closely defined in evaluating its potential benefits. The genetic ability of heifers for growth also needs consideration. Then this must be weighed against potential limitations of an accelerated program that may not be evident for three to five years from the birth of a heifer calf until it has finished its first or later lactations.

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