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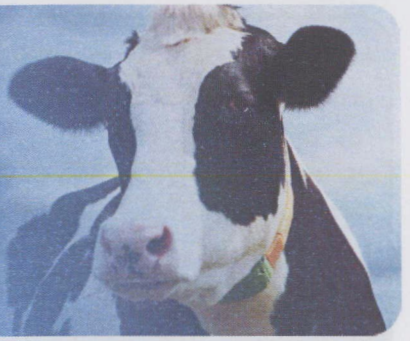

Investing in Your Heifers

By Pedro Nogueira

Heifers are the future of the dairy operation. The goal of feeding and the environmental management of dairy replacement heifers is to produce high quality heifers at a low cost. Based on data compiled from 110 dairy farms in Ontario, OMAFRA (2003) estimated the cost of raising a heifer to be $1900.00. Based on this information, in order to reduce costs it would make sense to have heifers calving sooner better than later. There are two aspects involved in this reasoning:

1. It is calculated that for each month calving is delayed heifer rearing costs increase $50 to $60, so the sooner the heifers reach the milking herd, the sooner they can make a profit on your dairy;
2. The second aspect is that older calving ages result in the need for more heifers for herd replacement, as indicated in Table 1 (The Real Cost of Raising Heifers. OMAFRA 2003). This has economic implications.

Table 1: Heifer inventory required to supply replacements for 100-cow herd*

	Age at first calving (months)			
Annual Milking Herd Turnover %	24	26	28	30
25	58	62	67	72
29	67	72	78	83
33	76	82	89	95
37	85	92	99	106
41	94	102	110	118

*15% allowance for culling, non-breeders and death loss.

Early calving – Questions involved

The first point above, having heifers calving earlier, is the subject of intense debate. First it is important to define what we mean by early calving: it is calving before 24 months of age. Research shows that there is no biological or economical justification to have heifers calving after 24 months (in Canada the average age at first calving (AFC) is 27.7 months), so this discussion will be for

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early calving (<24 months). In theory, as soon as a heifer reaches puberty and has the appropriate body weight and height, she can be bred, allowing her to enter the milking herd sooner. According to Patrick Hoffman, a researcher from the U. of Wisconsin who has been working on this subject, there are two flaws in this type of economic analysis. First, economics of first lactation or lifetime milk yield are not considered. Second, herd culling rate is assumed to be equal across all calving ages. According to him this assumption is false. There are numerous factors in early calving replacement heifer management programs that could increase first lactation culling rate, thereby increasing herd culling rate.

The main aspects involved are body size, body composition and breeding efficiency. To have early calving of replacement heifers it is not enough just to breed them earlier. Growth rate of heifers must be accelerated to ensure heifers are of adequate body size at calving otherwise we will have decreased milk yield and increased dystocia. Height at the withers is also very important. Height is correlated with frame size and dry matter intake and should be evaluated in addition to weight. Table 2 indicates optimum body size criteria of Holstein replacement heifers at first calving (Patrick C. Hoffman, U. Wisconsin).

Table 2. Optimum body size criteria of Holstein replacement heifers at first calving.

	Genetic Range		
Criteria	Average	Lower	Upper
Body weight, lb (14 d prepartum)	1366	1312	1422
Body weight, lb (7 d postpartum)	1231	1182	1280
Body weight, lb (30 d postpartum)	1148	1102	1193
Wither height, in	54.9	54.2	55.5
Body length1, in	67.3	66.5	68.0
Pelvic area, cm2	> 260	> 260	> 260
Body condition score	3.5	3.5	3.5

1 Measured from the point of shoulder to the ischium.

Because there is such a big variation in the mature body weight in the Holstein breed, the NRC 2001 publication target weights for breeding and calving not at a specific absolute weight, but rather based on percentages of mature size. Heifers should be pregnant by 55% of mature size and calve at 82% of mature size. Table 3 (from NRC 2001) indicates target weights for dairy animals of different mature size. According to this publication it is considered that cows entering 3rd lactation have reached approximately 100% of their mature size. Only mid-lactation animals or those scoring a body condition of 3 (on a scale of 1 to 5) should be included in the estimate of the herd mature weight.

Table 3. Target weights for dairy animals of differing mature size.

Mature body weight, lb	1000	1400	1800
First bred, 55% mature weight, lb	550	770	990
Post-calving target body weight, lb			
1st calving, 82% mature weight	820	1150	1475
2nd calving, 92% mature weight	920	1290	1655
3rd calving, 100% mature weight	1000	1400	1800

Body Composition

To achieve the same body weight at a younger age a diet higher in energy/protein must be fed. This increases body protein and frame growth, but deposition of fat will be proportionately higher. Research has shown that high average daily gains, (more than 2.0 lb/d (0.907 kg)), before puberty can decrease mammary development

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and decrease subsequent milk yield. According to Mike VandeHaar, from Michigan University, the number of milk-secreting cells is determined by genetics and by the physiological environment during mammary development, especially during the rapid mammary growth phase that occurs before puberty between 3 and 10 months of age. Mammary cell numbers increase dramatically from 3 months of age until the second or third oestrous cycle of the heifer. Mammary growth during this period is the foundation for future milk production, and if impaired has the potential to limit future milk yields. Increasing heifer body growth rate before puberty allows heifers to reach puberty and breeding size earlier. However, the earlier onset of oestrous cycles shortens the duration of the period of rapid mammary proliferation, meaning fewer secretory cells might be produced and this would lower future milk production.

This is what Patrick Hoffman calls a paradox. According to him the complete logic is as follows:

- To achieve optimum body weight at an earlier age, growth must be accelerated.
- Accelerated growth yields a heifer with a higher proportion of body fat.
- Excessive fat increases dystocia, fat mobilization, ketosis, and displaced abomasums, and decreases dry matter intake.
- Dystocia, ketosis, displaced abomasums, etc., increase herd culling rates.

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Breeding Efficiency

This is another important aspect of early calving age. Accelerated growth coupled with poor breeding efficiency can have negative consequences. If we feed heifers to calve at 22 months of age (breeding at 13 months) and they do not conceive until 15 or 16 months this delay can result in obese heifers. These heifers are more prone to calving and metabolic problems, which can increase culling rates.

Conclusions

It is difficult to come up with straightforward conclusions. The only thing that seems to be common to all the authors is to breed heifers based on size and forget age. As to AFC there are different opinions. There seems to be a tendency to push for calvings at younger ages (as young as 20 months). I, however, think the opinion of Patrick Hoffman seems to be wiser. He says that based on current research information, calving ages of 22 to 23 months are biologically feasible and should enhance profitability under good management. Calving ages less than 21 months may be feasible, but the risk of increasing herd culling rate rises and must be weighed in the decision making process. Calving ages greater than 24 months are economically unsound and biologically unjustified.

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