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Calf gain may improve later milk production

Bottom Line

with **AL KERTZ***

IN the summer of 2007, I recall visiting with Mike Van Amburgh of Cornell University about a calf trial in progress.

Later in the conversation, I asked him what kind of data were kept on calves in the Cornell research herd that were not used in trials. He said records included birth weight, weaning weights, etc., and the university had been doing this for about 10 years.

Sometime later, retired Cornell dairy cattle geneticist Bob Everett asked Van Amburgh, "Does it make any difference how we raise calves and what kind of cows they become?"

From this question, Everett got involved in a project with Van Amburgh and graduate student Fernando Soberon, who were working on developing the calf data set. The collaboration with Everett allowed them to make use of the Test Day Model Everett had developed years earlier.

The Test Day Model originally had been developed to take a monthly milk sample, adjust it for all sorts of uncontrolled variables and project lactation yield in the Dairy Herd Improvement records program. The model also was the basis for sire proofs and daughter records.

The Soberon/Van Amburgh data set grew to 1,400 calves after an abstract was presented at the 2009 American Dairy Science Assn. meeting in Montreal, Que.

Another element loomed in the picture, though, as Everett contracted cancer. On March 24, 2011, Van Amburgh sent the paper to Everett for review but, unfortunately, he died the next day.

In tribute to the unique contribution of a retired dairy cattle geneticist, here is a synopsis of that recently published paper (Soberon et al., 2012).

Study details

Two databases were used in this paper. The Cornell research herd calf objective was to double birth weight by 60 days of age. Milk replacer was fed at 1.5% of birth weight for the first seven days following birth and then at 2.0-2.5% of birth weight diluted to 15% dry matter for feeding from days 8-42.

Data collected were: birth weight, birth height, weaning weight, weaning height, age at first calving and monthly average ambient temperatures. Milk replacer intake was monitored and recorded.

Over that time period, the primary milk replacer fed (more than 90% of the time) contained 28% protein and 15% fat (Van Amburgh, personal communication, 2010; disclosure, I now work for the company that made that milk replacer). When that milk replacer was not fed, it was replaced with a 28% protein/20% fat milk replacer.

Weaning was done by reducing the milk replacer fed to 50% during a seven-day period prior to weaning at about 49 days of age. A common starter was fed throughout, but no intakes were recorded. Water was available free choice except during winter months, when it was available only for four to five hours each day during freezing weather.

Calves were kept for 7-10 days after weaning in their hutch or barn until moved to group housing.

Growth data were collected starting in 1998, and lactation data were collected through 2008. Lactation data were collected from 2001 to 2008 and comprised 1,244 complete first-lactation records.

A commercial herd in New York also was fed the same 28/15 milk replacer and had data available for birth weights, weaning weights and age at first calving, with preweaning daily gain and daily gain until breeding calculated from those data.

The average daily milk replacer feeding rate was about 2 lb. of powder from day 7 to weaning at about 49 days of age. Dairy Herd Improvement records were accessed for lactation data from 1999 to 2004, with 633 complete first-lactation records.

Results

Birth weight and height (Table) were a bit greater than the 90 lb. and 30 in. described in an older database (Kertz et al., 1997).

Preweaned average daily gain (ADG) was more than enough to double birth weight by 60 days of age in the Cornell herd and in the commercial herd as well, although tabular preweaning ADG in the latter herd appears to be too small based on a postweaning weight of 185.3 lb. There is considerable variation in many values in the Table, especially for ambient temperature, where the standard deviation (SD) is greater than the mean ambient temperature.

Therein lies another dimension to the analysis of preweaning ADG. The range in the Cornell preweaning ADG was 0.22-3.48 lb., somewhat surprisingly wide. Within this range, a 1.0 lb. ADG difference resulted in an astonishing 850 lb. more or less milk in the first lactation.

What accounted for this wide range?

Growth and performance data

Herds	Cornell	SD	Commercial	SD
First-lactation records	1,244	—	623	—
Birth weight, lb.	91.8	11.2	93.7	11.2
Birth height, in.	31.8	2.2	—	—
Average temperature, °F	47.4	48.6	43.9	48.8
ME above maintenance from milk replacer, Mcal	2.81	0.61	—	—
Weaning weight, lb.	180.7	22.6	185.3	23.5
Weaning height, in.	36.4	3.9	—	—
Preweaning ADG, lb.	1.81	0.40	1.45	0.24
Postweaning ADG, lb.	—	—	2.00	0.22
Age at first calving, days	691	54	687	64
First lactation 305-day milk production, lb.	24,000	3,922	29,910	2,830

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If calves had both been treated with antibiotics but still had diarrhea, that reduced ADG by about 0.1 lb., and these calves produced 1,086 lb. less milk in their first lactation.

In a Pennsylvania 10-year database of 795 Holsteins from 795 Holsteins (Heinrichs and Heinrichs, 2011), weaning dry matter intake, days treated for respiratory illness and bodyweight at first calving all affected first-lactation, 305-day mature equivalent milk production.

However, in the Cornell study, seasonality and ambient temperature were the major influencing factors. Calves born during winter months (32°F) consumed about 1.43 Mcal per day less metabolizable energy (ME) above maintenance than calves born during warmer months (67°F). This resulted in 517 lb. more milk in the first lactation and 2,000 lb. over three lactations for summer-born calves.

In the commercial herd, preweaning ADG ranged from 0.70 lb. to 2.80 lb. per day, and within that range, a 1 lb. difference affected the subsequent first-lactation milk yield by 1,114 lb. This was a 31% greater response in milk production compared to the Cornell herd. However, this difference was similar to the 25% difference in the level of first-lactation milk yield between these two herds.

Analyzing records for the second and third lactations found ongoing positive relationships between preweaning ADG and milk production in both herds. Cumulative milk production for three lactations per pound of ADG difference at the end of two months of age was 5,020 lb. in the Cornell herd and 2,832 lb. in the commercial herd.

What could account for these differences in lactation as they related to calf performance during the first two months of life? The researchers cited studies in other species indicating that it could be epigenetics (the impact of nutrition in turning on genes during this stage of life) or lactocrine factors contained in milk or milk replacers.

These data imply that nutritional or metabolic programming occurred during the first two months of life that had a large effect on subsequent milk production.

Now, here's some perspective. The rate of genetic progress is typically put at about 200 lb. of milk per year. Reponses in this study far exceeded that amount, and this system may cost more per calf than a typical calf program, but look at the returns. If it costs $25-50 more per calf to double calf bodyweight by two months of age, that is a pittance compared to the total cost of $1,650 to raise a calf from birth to first calving (Zwald et al., 2007).

The Bottom Line

Evaluation of a large database from the Cornell research herd found that a difference of 1 lb. in ADG at the end of two months of age resulted in 850 lb. more milk in the subsequent first lactation and a total of 5,020 lb. more milk in the first three lactations.

A similar evaluation in a New York commercial herd found a 31% greater response in the first lactation but a lesser response over three lactations.

Colder winter temperatures had a very negative effect on the Cornell data. For every megacalorie of ME above maintenance from the milk replacer alone, calves produced 517 lb. more milk in their first lactation and 1,988 lb. more milk over three lactations.

An objective of doubling calf bodyweight by the end of two months of age is quite achievable and very cost effective considering the subsequent milk response and the total cost to raise a heifer.

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