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Age at first calving affects performance at commercial dairy

By AL KERTZ

While there have been retrospective studies done on the effect of age at first calving (AFC) and individual studies done and reported, field data have been limited. This dearth of field data was addressed in a recent study from the Tulare Medicine Teaching and Research Center, University of California-Davis (Ettema and Santos, 2004).

The objective was to "examine milk production, health and economic performance among Holstein heifers during first lactation on three commercial dairy farms in California." In this column, only portions of the total study will be addressed.

Experiment setup

Holstein heifers (n = 1,933) were moved into a breeding group at two-week intervals as they reached 360-390 days of age, or 12-13 months old. Then, after these heifers calved, they were assigned retrospectively for data analysis to one of three groups based on AFC. The heifers were then housed separately from older cows in free-stall barns for the entire 310-day lactation at all three sites. All herds averaged at least 25,000 lb. of 3.5% fat-corrected milk (FCM).

Heifers at each site were fed one total mixed ration (TMR) between weaning and 12 months of age to gain 1.54-1.76 lb. daily and a second TMR between breeding and 252-258 days pregnant to gain 1.76-1.98 lb. daily. A third TMR was fed from after this point until calving. All TMRs met 2001 National Research Council (NRC) requirements for metabolizable protein and energy.

After calving, all first-calf heifers were

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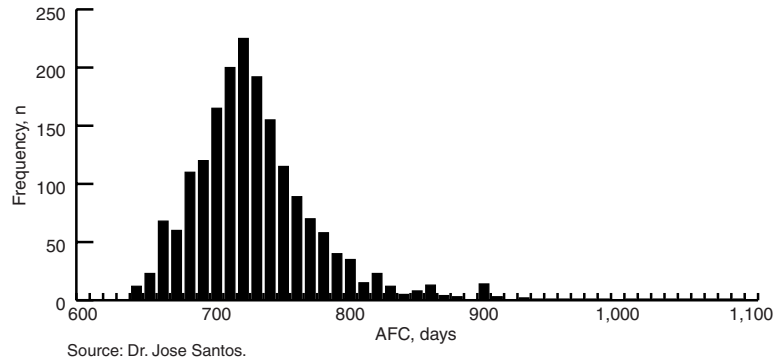
TABLE

Averages for various parameters by low, medium and high AFC

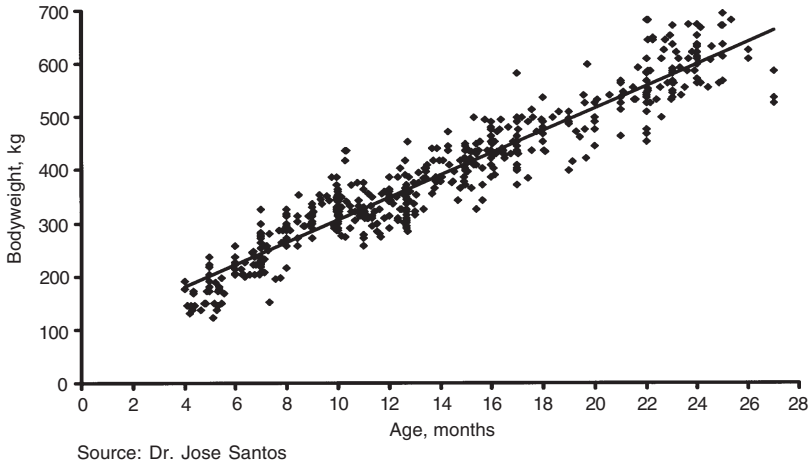
	Low	Medium	High
Age, months	22.4	23.8	26.0
Weight, lb.	1,257	1,328	1,432
Height, in.	53.2	53.6	54.0
First AI conception rate, %	76.9	64.4	44.9
Calving difficulty	1.94	1.84	1.66
Stillbirths, %	16.1	19.8	13.5
Daily lactation, lb.	73.5	75.7	76.4
Additional rearing cost, $	—	40.34	107.89
Adjusted 310-day income, $	3,085	3,224	3,125

FIGURE



1. Histogram of frequency of AFC in days for all heifers in the study. Ages at calving were grouped as: low = fewer than 700 days (n = 514, mean = 679.8 ± 0.7 days, median = 682 days), medium = 701-750 days (n = 917, mean = 724.2 ± 0.4 days, median = 723 days) and high = more than 750 days (n = 474, mean = 791.4 ± 2.2 days, median = 781 days).

FIGURE



2. Regression analysis of bodyweight (kg) and age (months) for 566 heifers between the ages of 4 and 27 months. Bodyweight (kg) = 95.9016 + 21.0186x, where x = age in months. Adjusted r^2 = 90.9% (P < 0.0001).

housed separately in one group at each dairy throughout the entire lactation and fed the same TMR formulated to 2001 NRC requirements. Cows were milked twice daily at two dairies, three times daily at the third dairy and received recombinant bovine somatotropin according to label at one dairy.

Milk production was monitored monthly by the Dairy Herd Improvement Assn. and analyzed monthly for fat, true protein and somatic cell count content.

Because of the large number of heifers involved, subsets of 120-200 heifers from 4 to 27 months of age at each site were measured for wither height and heart girth during both 2000 and 2001. Heart girth was used to estimate bodyweight.

A total of 566 heifers were evaluated at three sites. Since growth rate at these sites followed similar patterns, data were merged and regression analyses done to estimate growth curves for wither height and bodyweight during the first 27 months of age.

Heifers were divided into three age groups based on actual AFC rather than randomly preassigned to be inseminated at differing ages. The average AFC of all 1,933 heifers was 726 ± 50 days (23.9 months) with calving age categorized as low when equal to or less than 700 days, medium from 701 to 750 days and high when equal to or greater than 751 days. This grouping strategy was used since AFC of 23-24 months is generally considered to be optimal economically.

The retrospective differences in grouping by AFC were caused by differences in age at first breeding, which, in turn, was associated with delayed cyclicity, unobserved estrus or delays of failure to conceive at first artificial insemination (AI).

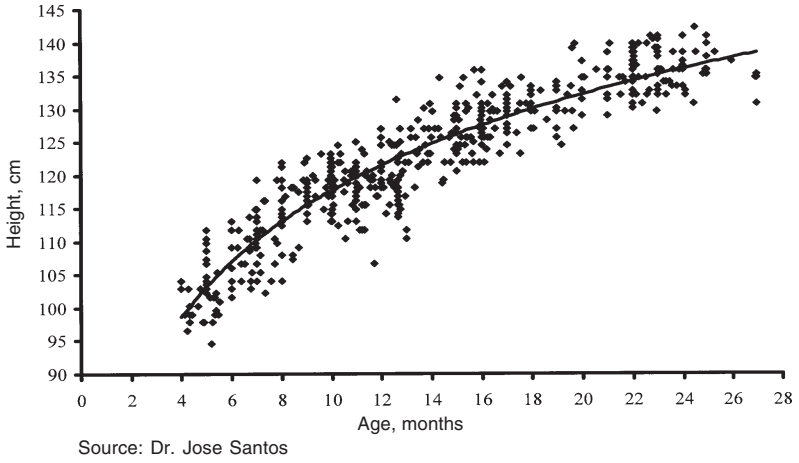
Further details are available in the paper on: reproductive management as heifers and postpartum, abortions, calf gender, twins, calving difficulty, stillbirths, health events and cost analysis of income from first lactation.

Discussion

Interestingly, conception rates at first AI differed ($P < 0.001$) for low, medium and high heifers at 76.9, 64.4 and 44.9%, respectively (Table). Since the time at which heifers became pregnant determined when they calved — and were subsequently grouped into these three categories — this was the primary factor in determining AFC.

It was not clear why older heifers had lower conception rates, but this hearkens back to Hoffman's delineating at least 17 factors affecting heifer performance other than nutrition (Kertz, 2004).

FIGURE



Source: Dr. Jose Santos

3. Regression analysis of height (cm) and age (months) for 566 heifers between the ages of 4 and 27 months. Height (cm) = 89.7973 + 3.26860x - 0.0557941x², where x = age in months. Adjusted r^2 = 86.5 ($P < 0.0001$).

One difficulty in a study of this type in most larger dairies, especially those that increased in size or began with purchased first-calf heifers, is that genetic information on those heifers is limited or unknown. While selection for milk production has progressively increased milk production, this is accompanied by increased dry matter intake and an unspecified or unknown variability in performance parameters.

Furthering this inability to construct genetic history of heifers and their growth, conception and subsequent milk production is the high use rate of natural service bulls on many larger dairies. Consequently, this whole interrelationship is not and cannot be well documented.

An example of the effect this variability can have is documented in a Danish study with 450 heifers (Sejrsen, 2000). In a series of experiments over a period of several years, several bulls were used allowing calculation of genetic variation in growth and subsequent milk yield. Average daily gain 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.

With that being said, now look at the age distribution for first calvings in the California study (Figure 1).

Relationships between age and bodyweight or wither height are shown in Figures 2 and 3, respectively.

The mean standard deviation (SD) of all age groups (categorized by month) was wither height = 3.42 cm or 1.35 in. and bodyweight = 35.2 kg or 77.5 lb. While there was a numerical trend for greater calving difficulty with lower AFC, this was not statistically significant (Table).

However, incidence of stillborn calves was lower for high compared with low and medium AFC heifers ($P < 0.05$). Tyler (Kertz, 2004) indicated that stillbirths averaged 9% of all calf births. The numbers in this California study cover a range that nearly doubles Tyler's average.

Considering that the most recent national study (National Animal Health Monitoring Service, 2002) found that the mortality of calves born alive was up to 10.5%, this category added to the number of stillbirth yields a total calf loss of about 20-30%. This is a staggering loss and is seemingly little acknowledged or addressed in the industry.

Not surprisingly, rearing costs increased as AFC categories increased (Table). The largest increased cost was from high to low ($107.89) versus medium to low ($40.34). This would reflect the greater AFC difference from high or medium to low (3.6 or 1.4 months) and the lower daily increase in milk production from high or medium to low (2.9 or 2.2 lb.), plus the other factors included in the study but not addressed in this column.

The Bottom Line

While the California report found that the highest economic return for dairies studied was when calving occurred at 23.0-24.5 months, corresponding to the most commonly expressed goal, it also showed the multitude of factors that influence that return. Part of that return is a live calf. This factor is often not measured, or is ignored, despite stillbirths being 10-20% of all calf births.

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