Why Heifer Maturity Matters?

Gavin Staley,
DVM Diamond V

Introduction

How does one know when to breed virgin heifers? On many dairies the decision is entirely subjective. The heifers look "big" enough, or reach a certain age or the pen is getting crowded and they need to move on. But the critical question should be when are they mature? The following discussion will show that breeding immature heifers has a profoundly negative impact on the entire herd's future productivity. Heifer maturity, in this discussion, is the phenotypic characteristics (such as body weight) that allow full expression of milk production during subsequent lactations.

In recent years the potential financial benefits of calving heifers earlier were recognized and promoted, resulting in an industry wide trend to breed heifers earlier. Unfortunately, the necessary management changes to achieve the required maturity goals with earlier calving have been widely ignored. This has been due, in large part, to limited use of objective growth data to evaluate heifer raising.

The evaluation of DC305 dairy records from a large number of herds, primarily in the western US, resulted in the identification of significant patterns associated with heifer maturity, and the following observations were made.

Observation 1

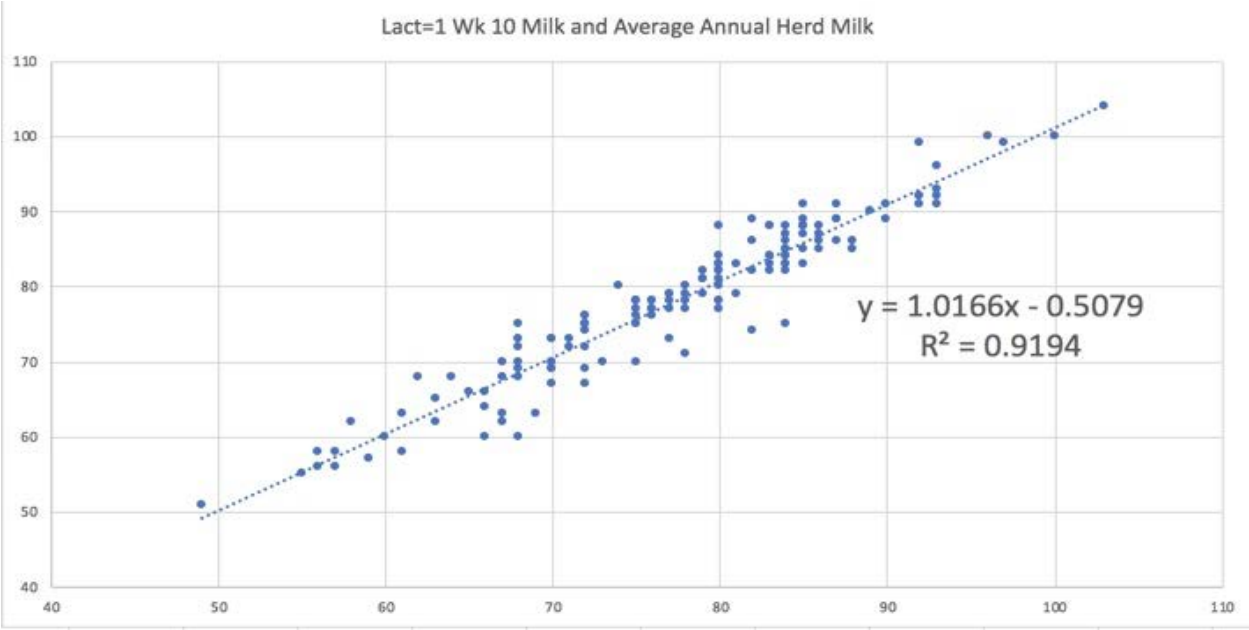
The average annual milk production of a dairy approximates to the 10-week milk production of Lactation=1 animals (see Graph's 1 and 2 below). The percentage of Lactation=1 animals in the herd can influence this association. For example, at 38% Lactation=1 these numbers are very close. At lower % lactation=1 (e.g. 34%) the annual milk is 1-2 lbs higher than 10-week milk and at higher % Lactation=1 (e.g. 42%) the annual milk is 1-2 lbs lower, typically.

Graph 1: Lactation curves for Lactation Groups 1-3
Milk production (WMLK1) and DIM (Weekly Weights)

In the above 3X Holstein herd the average annual milk production (as recorded in Econ\ID, Reports) was 92 lbs. The 10-week milk of Lactation=1 is approx. 92 lbs. The above observation is important because it strongly suggests that the heifer milk production sets the "ceiling" for the entire herd. A herd cannot overcome the restrictions placed on it by under-performing heifers. It also goes without saying that high producing herds have high producing heifers.

To validate this observation DC305 data from 149 herds representing 401k cows was collated and the relationship determined (see Graph 2 below)

Graph 2: Average Annual Milk production and week 10 milk production of Lactation=1 (401k cows in 149 herds; no rBST supplemented herds included)

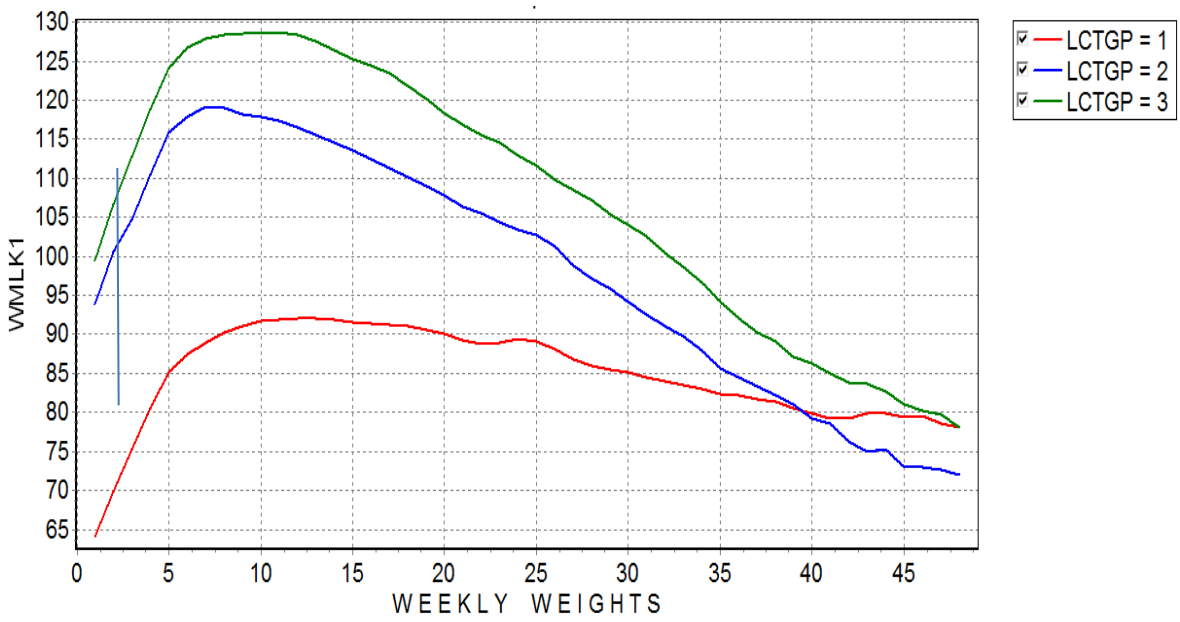


In the above graph average annual milk production is on the y-axis and week 10 milk for Lactation=1 is on the x-axis. The above graph shows the strong correlation (R squared=92%) between these two variables. Furthermore, the slope of the equation indicates that as 10-week milk increases by 1 unit (lb) so does the average annual milk (lb). An improvement of a pound of milk at 10 weeks of Lactation=1 will translate to an additional pound of milk for every cow, every day, as these Lactation=1 animals move on up into later lactations.

Observation 2

The production difference between Lactation=1 and 2 at 5 weeks of lactation is 30 lbs (13.6 kg) (Holstein)(Graph 3). Five-week milk production was chosen as a comparative time period to accommodate for the difference in peaks between lactation groups. This observation is consistent in "stable" herds. Stable herds in this discussion are herds where there is very little fluctuation in average annual milk production year to year and little intentional change to the heifer program over time. In other words, all animals in the herd have had a similar heifer raising experience. This observation is independent of milk production level.

Graph 3: Milk production by LCTGP (Holstein) (annual production)

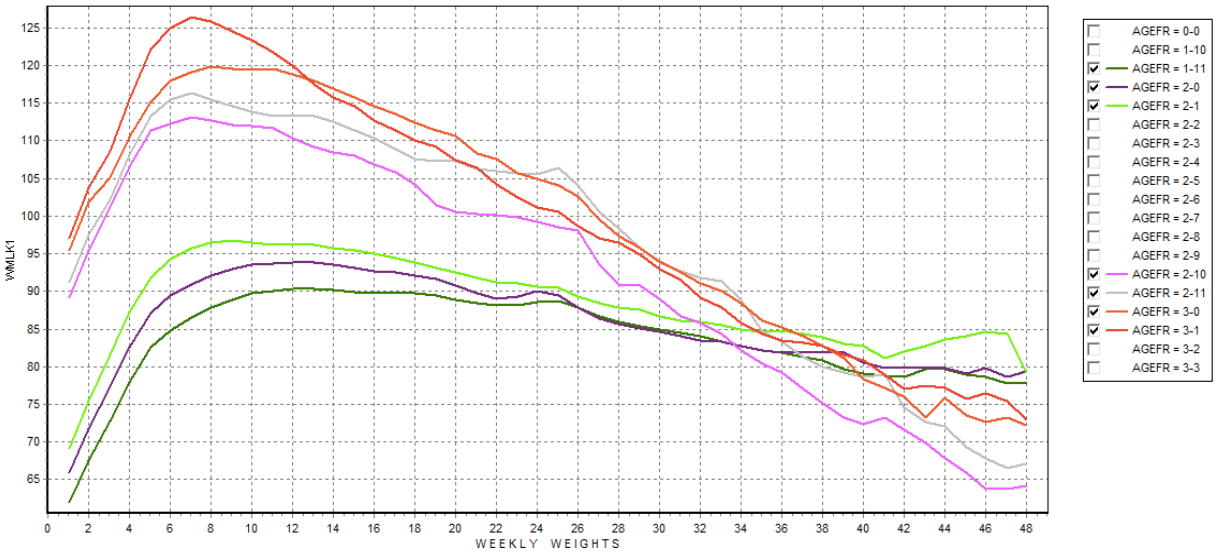


The above observation is important because it clearly demonstrates the predictable change in herd milk production resulting from a change in heifer management. For example, if the difference between Lactation=1 and 2 at 5weeks decreases by say 3lbs (ie is now 27 lbs) we can predict that the following year the difference between Lactation=1 and 2 will increase back to 30lbs and Lactation=2 production will have increased the incremental difference. Similarly a drop in Lactation=1 production will predictably drop milk production. Metaphorically, "all ships rise on a rising tide", suggesting improved heifer performance lifts production of all parities with time.

Observation 3

The age at calving (AGEFR) impacts milk production in both Lactation 1 and 2. This is best visualized in herds that breed by age and not size. In the example herd below, the age at calving is later (23-25 months) and yet a clear impact of age at calving on Lactation=1 production is still demonstrable. The impact of age at calving is especially obvious in herds that calve heifers at 20-21 months (personal observation).

Graph 4: Graph of milk production of Lactation 1 and 2 by age at calving (AGEFR)



In the above graph it is apparent that as heifers mature (ie grow) they produce more milk in lactation=1. This is not surprising. It is noteworthy that all these Lactation=1 animals are subject to the same management, reproductive programs, culling philosophies, transition, nutrition and facilities. The variable is age at calving (AGEFR). Also, the lactation curves reveal that the lactation curves differentiate almost immediately after calving, suggesting that culling of Lactation=1 animals is not a likely or significant reason for any variation in production. Furthermore, culling of virgin heifers is unlikely to influence subsequent Lactation=1 production curves since the two categories representing most culls in virgin heifers, namely deaths and open heifer culls are not represented at all.

At a growth rate (average daily gain) of approx. 2lb/day the breeding heifers will grow 60lbs/month and in this herd that will be approx. 2-3lbs more milk per cow per day for every month increase of AGEFR (from the logic of Observation 1). Since virgin heifers have a high conception rate (55% plus) it also means that in the above lactation=1 production curves there will be more 23m animals than the other two month cohorts. This is significant because it means that most of these Lactation=1 animals will under-perform relative to their cohorts.

Furthermore, the Lactation=2 lactation curves reveal a similar production and AGEFR pattern. Although these are not the same animals, almost all of the Lactation=2 animals that calved at 34 months would have calved at 23 months the year before. It is apparent that if a herd has excellent herd fertility and immature heifers these younger immature animals will be "locked" into lower Lactation=2 production. Since the average lactations of many herds in the US is low, e.g. 2.2 it follows that if immaturity negatively impacts both Lactation's 1 and 2 it will seriously impact the entire herd's production. It is not unreasonable to suggest that these herds effectively never reach full genetic potential. They never "grow up". They are experiencing the "Peter Pan Problem".

Recommendations

It is not good enough to rely on subjective criteria for breeding heifers. Objective criteria, such as body weight, wither or hip height and average daily gain (ADG) can greatly assist in determining the best time and size to breed heifers. While body condition score is not included in this conversation, the assumption is made that over-conditioning must be avoided. A suggested approach is laid out below.

1. Determine the mature body weight (MBW) of the herd. This is not the average of cull cows. This means weighing a cohort of cows in the 3rd and 4th lactation between 80-120 DIM;
2. Weigh either close-up (DCC>260) or fresh cows (DIM<7) to calculate the % of MBW of these animals. Close-ups should approximate 95% of MBW and fresh cows should be close to 85% MBW.
3. Determine the difference between desired and actual weights. This will be the increased body weight that must be made up by either delayed breeding of virgin heifers or increased ADG.
4. Determine the weight and age that virgin heifers need to achieve to be at 55% of MBW;
5. Implement the necessary changes and monitor the response by weighing heifers at convenient time periods to ensure a successful outcome.