As published in

DairyAdvisor™

Tech Topic

Managing heifer reproduction for improved first lactation

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How heifers are managed at first breeding (1st breeding) represents a significant economic opportunity on many dairies. DairyComp305 records from four free-stall Holstein dairies in the Central Valley of California show how first breeding selection criteria impact first lactation (1st lactation) and subsequent reproductive performance.

Our California Dairies 1, 2, 3, and 4 illustrate how the best overall performance results from criteria for first breeding that include:

- Optimal heifer size at the desired age;
- A narrow breeding window, which keeps feed costs down; and
- Weekly or bi-weekly breeding eligibility, rather than monthly or longer.

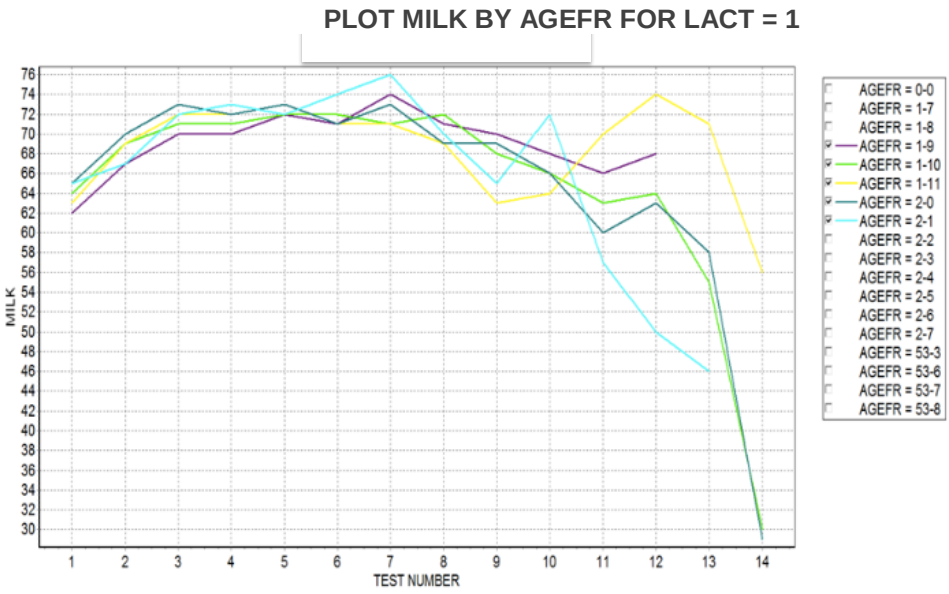
AGEFB criteria: Height and age

If the appropriate physical selection criteria for breeding heifers – such as height at the withers – is consistent across age at first breeding (AGEFB), then it is reasonable to expect that these animals will perform similarly in the first lactation.

Dairy 1 demonstrates this outcome as shown in Graph 1 (all graphs generated using DairyComp305 from Valley Ag Software).

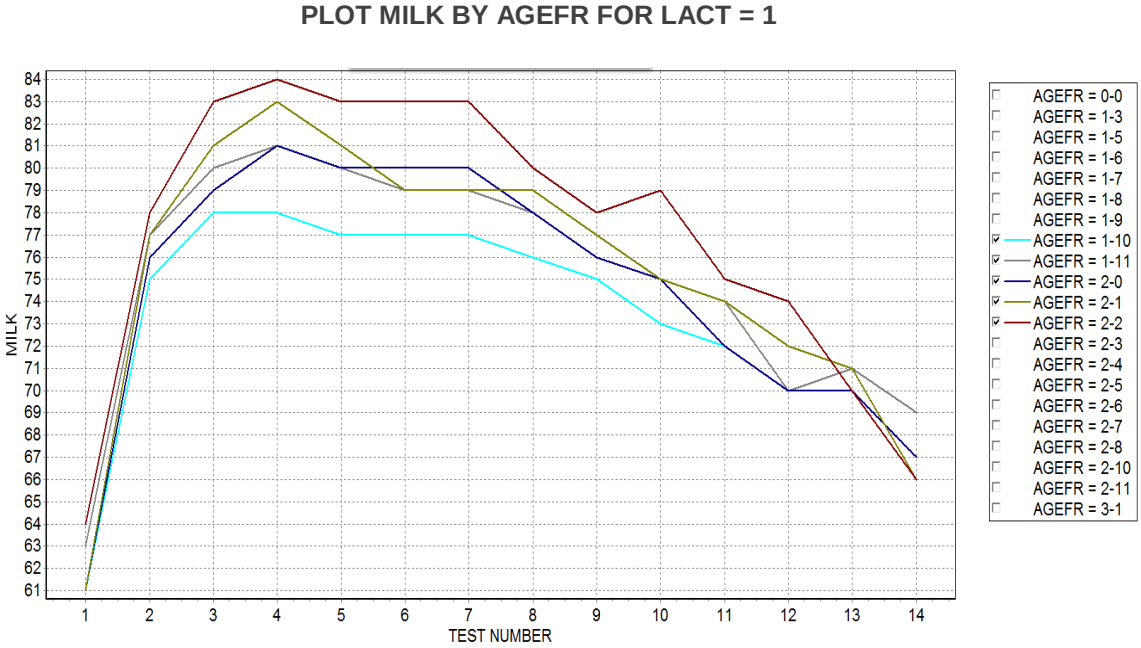
There is very similar milk production across AGEFR for the majority of test dates (Graph 1). This herd is a 2X-milked, non-rBST-supplemented herd. Note that as first lactation heifers are culled during the lactation, the number of animals in the cohort decreases and the variability of production increases.

Graph 1— Dairy1
Test day milk production by age at freshening (AGEFR)
for first lactation (Lact=1)



However, if heifers are bred primarily on **age** rather than **height**, then the resultant first lactation milk production is likely to reflect the immaturity of the heifers that were bred early, which is what we see on Dairy 2 (Graph 2).

Graph 2 – Dairy 2
Test day milk production by AGEFR for Lact=1



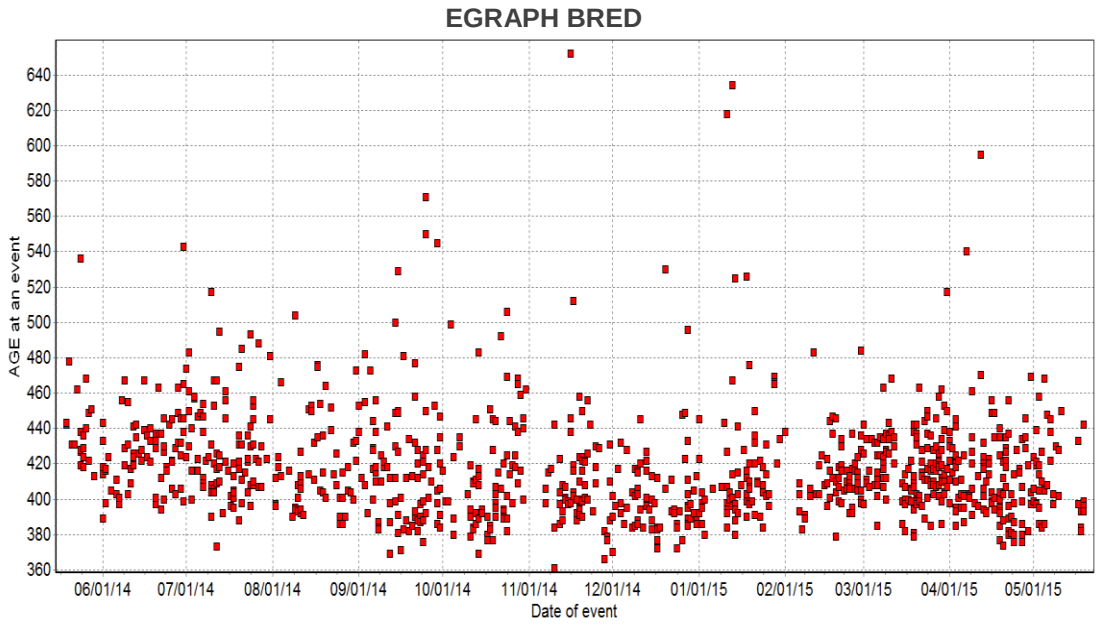
For Dairy 1, there is a 2 lb. milk difference at Test 4 between the earliest (21 months) and latest (25 months) AGEFR (Graph 1). Like Dairy 1, Dairy 2 does not supplement with rBST; however, it is a 3X-milked herd (Graph 2). Dairy 2 has a 6 lb. milk difference at Test 4 between the earliest (22 months) and latest (26 months) AGEFR. Note that the difference in test day milk production is apparent from even the earliest test date production.

Despite the difference in milking frequency, both Dairy 1 and Dairy 2 show a similar pattern of milk production and AGEFR, with younger animals producing less milk in the first lactation. However, in Dairy 2 the spread across the milk production graphs by AGEFR is very broad. It is possible that the 3X milking frequency accentuates the underlying immaturity of younger animals.

If this difference in milk production is extrapolated over the entire lactation, the potential economic opportunity is obvious.

Also, we can compare the artificial insemination (AI) patterns at first breeding for Dairy 1 (Graph 3) and Dairy 2 (Graph 4). Note that Dairy 1 has a wide "window" of age at first breeding (380-450 days of age). This wide range of age means that heifers are fed and managed for an extended time period before being bred even once.

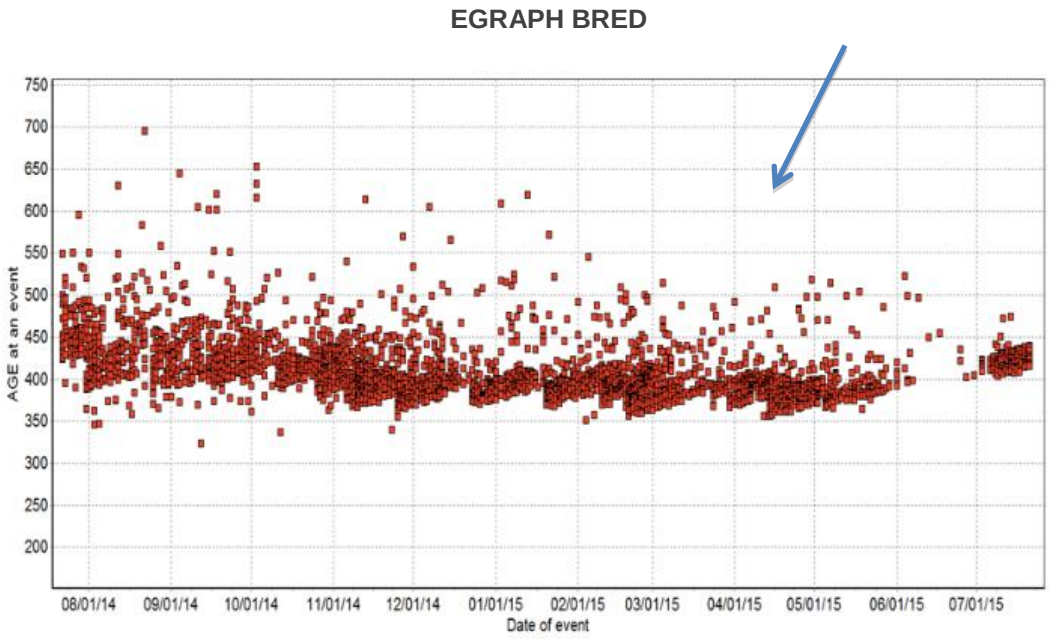
Graph 3 – Dairy 1
AGEFB by Calendar Month



Under normal circumstances, heifer raising costs are likely to be higher on this dairy. However, based on first lactation performance, the Dairy 1 heifers are being selected consistently for breeding on appropriate physical criteria.

On Dairy 2 (Graph 4) there is a similar wide breeding "window" (380-460 days of age). However, the difference in first lactation production suggests that Dairy 2 heifers are not bred consistently based on appropriate physical criteria. Heifers are likely being bred too soon, resulting in relative under performance by AGEFR (Graph 2) and eligibility for breeding criteria on this dairy may favor age more than height.

Graph 4 – Dairy 2
AGEFB by Calendar Month



Note: Blue arrow identifies most recent change in breeding management.

Dairy 2, therefore, has a wide breeding window suggesting high heifer raising costs and also the largest opportunity to improve first lactation performance.

Also, note that Dairy 2 has attempted to address the situation, which can be seen in the most recent breeding window being considerably "tighter" (blue arrow, Graph 4). However, this intervention can be advantageous **only** if these animals are also of suitable height at the new earlier breeding age.

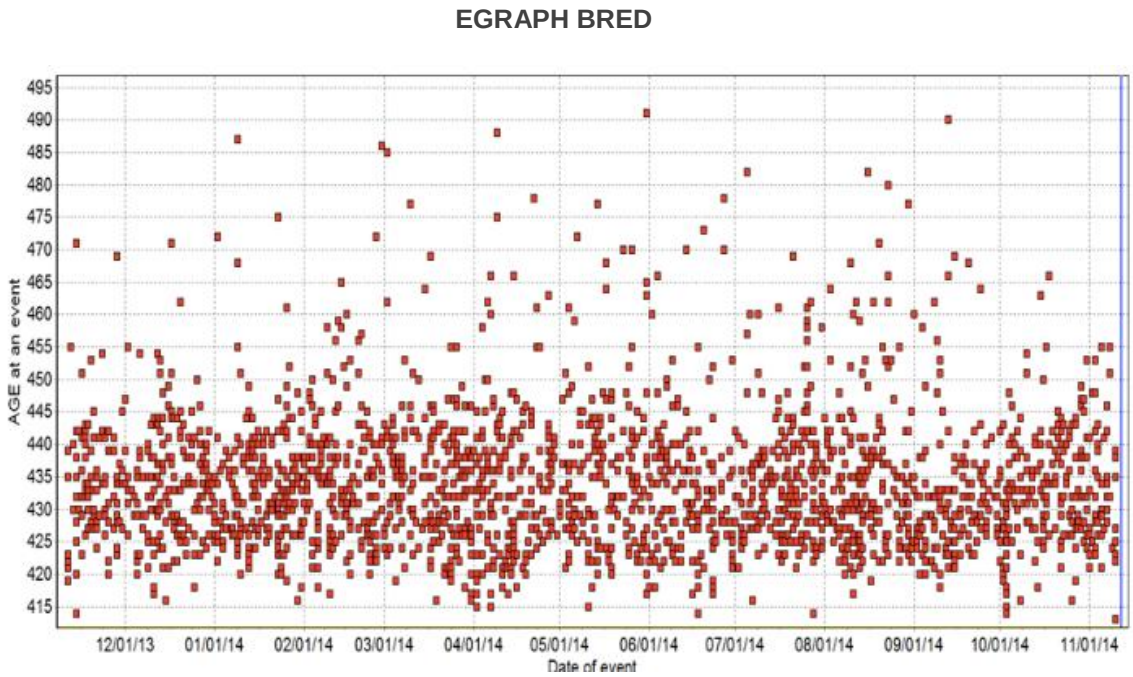
Paradoxically, creating a narrow or "tight" breeding window without maintaining appropriate physical attributes for breeding is going to exacerbate the disparity in performance, not improve it.

AGEFB and Consistent Lactation Performance

So is it possible to have a "narrow" breeding window and also consistent first lactation performance?

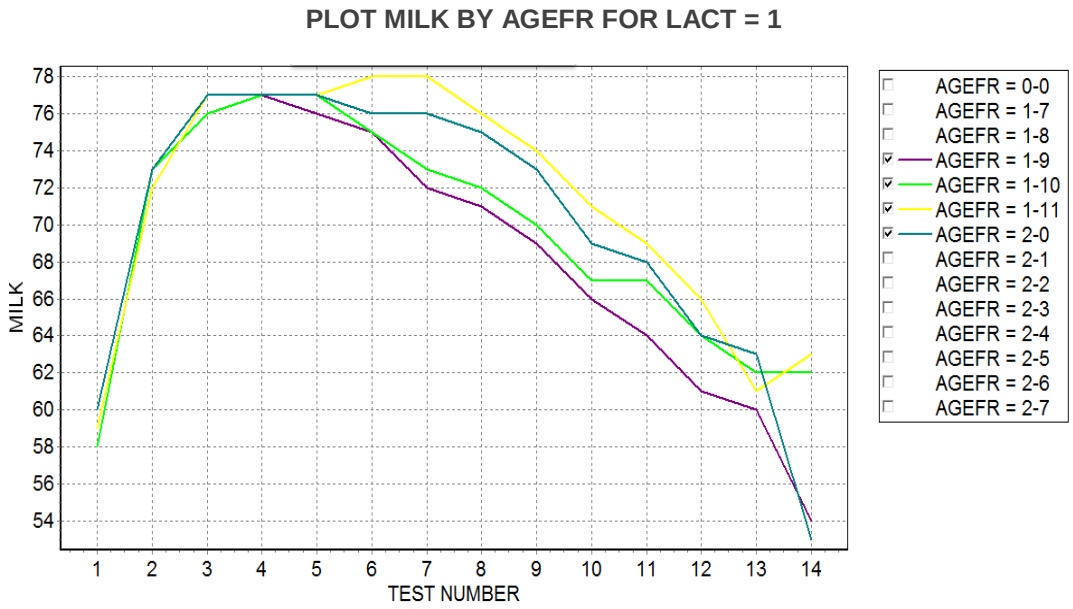
In Dairy 3 we have an example of a dairy that has both a "narrow" breeding window (Graph 5) and very consistent first lactation performance (Graph 6).

Graph 5 – Dairy 3
AGEFB by Calendar Month



In Graph 5, the days of age (y-axis) show that the variability in age at first breeding is very "narrow" (approximately 25 days).

Graph 6 – Dairy 3
Test day milk production by AGEFR for Lact=1



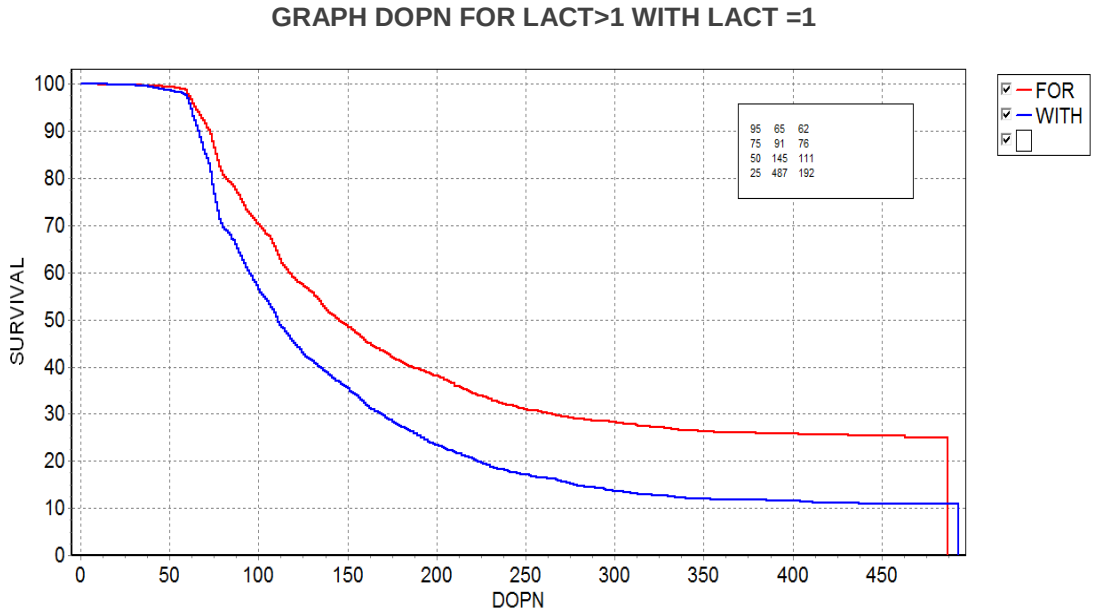
Note that there is also very little difference at Test 4 milk production for animals that freshened at different ages. The lactation curves diverge later in lactation. Notice that there still appears to be some benefit of later AGEFR, as the lactation curves maintain the AGEFR age pattern.

These results for Dairy 3 suggest that it is possible to breed heifers over a "narrow" breeding window and in a consistent manner based on physical criteria, such that the first lactation production performance is very similar.

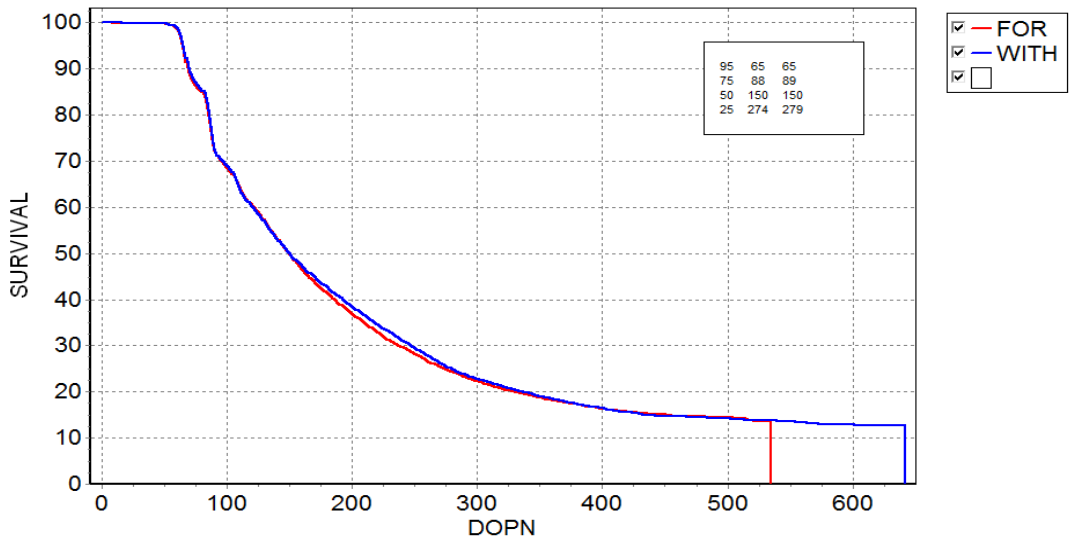
AGEFR and Reproductive Performance
A further consideration is that AGEFR may impact reproductive performance.

The days open (DOPN) survival curves comparing the first lactation (Lact=1) and the subsequent lactation (Lact>1) for Dairy 1 and Dairy 2 show a marked difference.

Graph 7— Dairy 1
Survival graph of DOPN for Lact=1 (blue line) with Lact>1 (red line)



Graph 8 – Dairy 2
Survival graph of DOPN for Lact=1 (blue line) with Lact>1 (red line)



Both dairies have a similar pre-synch timed AI protocol. In Graph 7, we see that the Lact=1 animals are more fertile than Lact>1 animals and the survival curves are clearly separate. Also, the Lact=1 curve of DOPN drops quickly.

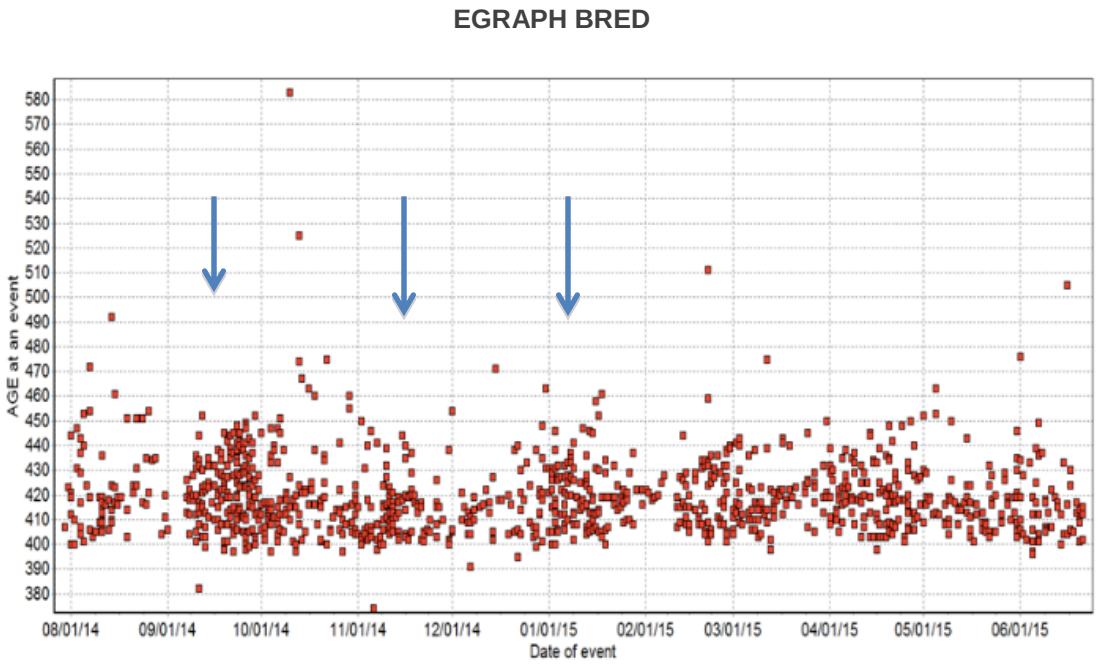
This is not the case in Dairy 2 where there is no difference in fertility across parities. There are other management factors (such as 3X milking) and nutritional factors that can impact differences in parity performance. However, it is reasonable to assume that the differences in managing heifers at breeding may impact both milk production and reproduction efficiency in the subsequent lactation.

Heifer Breeding

Another important factor to consider on all dairies is the frequency at which heifers are made eligible for breeding. Heifers should be managed so that they become eligible for breeding at the earliest opportunity.

Dairy 4 makes heifers available for breeding on a monthly (or even longer) basis (Graph 9). This creates "slugs" of heifers (shown with blue arrows) and delays AGEFR, representing a considerable inefficiency and increase in costs to raise the heifers.

Graph 9 – Dairy 4
AGEFB by Calendar Month



Note: Blue arrows show "slugs" of heifers available for breeding.

In summary, opportunities to improve first lactation performance on dairies would include:

1. Managing heifers such that they reach the appropriate physical size (e.g. 51-52 inches at the withers) at the desired age at first breeding;
2. Basing eligibility to breed on criteria of height, not age;

3. Limiting feed costs by maintaining a narrow ("tight") breeding window, so that animals are bred aggressively soon after becoming eligible, for which prostaglandin programs can be beneficial;
4. Making heifers eligible for breeding as soon as they reach the physical goal; and
5. Achieving weekly or bi-weekly eligibility (based on pen availability), which represents an advantage over monthly or even longer intervals (as shown in Graph 9).

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