BREEDING STRATEGY – REFINING YOUR SEMEN

David Chin
LIC

What are the core principles behind a successful breeding plan? What do the best herds in the country do to accelerate their genetic gain? If I wasn't constrained by reproductive performance or economics how would I run my mating program? As a dairy farmer engaged in breeding your own replacements you will have inevitably asked yourself these sorts of questions at one time or another.

The answers to these questions are important to understand especially as the dairy industry comes off 20 years of continuous growth in both cow population and production growth and enters a period of relative stability and consolidation. Six years ago when I visited dairy farms the conversation was all about generating *more* replacements as farmers wanted to increase cow numbers or take advantage of a market where AB heifers and in milk cows were highly sort after. Now the conversation is changing and farmers are focusing on generating more *high quality* replacements.

This paper looks to explain a core principle behind all good breeding strategies and how you could implement this on your farm.

Breeding strategies

To understand the impact of breeding strategy on genetic gain let's take 3 scenarios:

- **Scenario 1**: Mate your herd to the top 15 bulls on the RAS list.
- **Scenario 2**: Mate your *top* 10% of cows in the herd to the Top 5 bulls on the RAS list and mate the rest of your herd to the top 15 bulls on the RAS list.
- **Scenario 3**: Mate your *bottom* 10% of cows to beef/SGL bulls and mate the rest of the herd to the top 15 bulls on the RAS list.

Notes:

If you weren't constrained by time, reproductive performance or economics, which scenario would you choose to accelerate your genetic gain?

How should we test this?

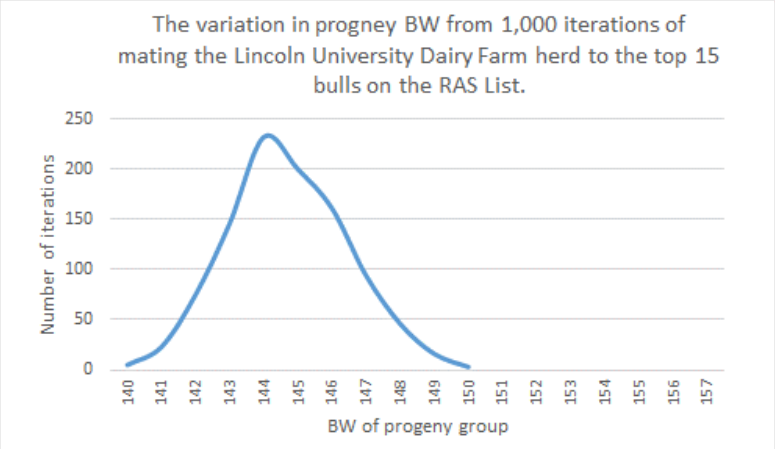
To find the answer to the above question we have developed a model. It uses the Lincoln University Dairy farm. The controls in the model are:

- Every cow has an equal chance of generating an AB heifer replacement.
- Every cow has an equal chance of being mated to the top bull on the RAS list (and the bottom bull).
- Replacement rates are 25%.
- In all cases when mating elite cows to elite bulls the top 5 bulls will be used.
- BW will be used as the 'trait' we are breeding for.

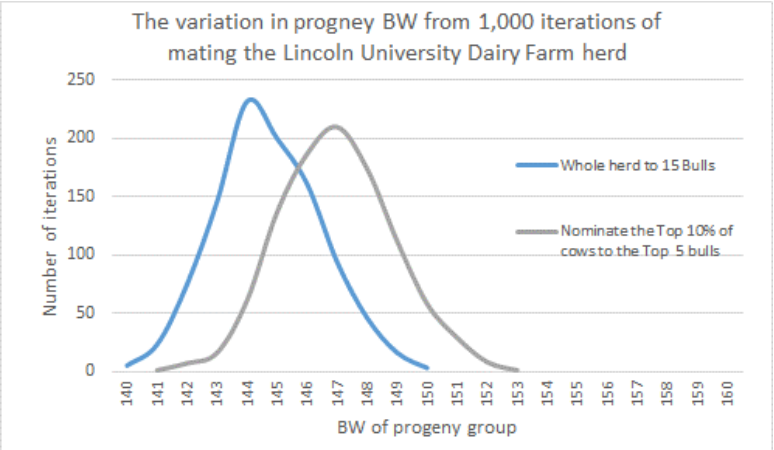
In real life, not every cow gets pregnant, and not every cow has an AB heifer calf. In some seasons, a high percentage of your best cows may have bull calves, in other seasons they may have a higher percentage of heifer calves. All this impacts on the final BW of the progeny group. The model that we have developed takes all this into account. How it works is that it randomly mates cows to different bulls in the bull team. It then randomly selects 25% of cows to have an AB heifer calf. This process is repeated 1,000 times to try and cover all eventualities – it basically simulates 1,000 years of spring mating, randomly matching bulls to cows and randomly selecting 25% cows to generate a AB heifer replacement.

The graph below is the output of Scenario 1 where the Lincoln University herd was mated to the top 15 bulls on the RAS list. The BW of the calves is depicted by the bell curve line. In some years the best cows had AB replacements to the top bulls, in other years the poorer cows had AB replacements to the lower ranked bulls.

The output of 1,000 iterations of randomly mating the same team of 15 bulls over the same herd results in a line of calves with an average BW of 145.



Scenario 2. I want to get more genetic gain – I think I'll buy some straws of the very best bulls and mate them to my top cows



This is a fairly common situation on many farms. When you want to accelerate genetic gain, it's a common option to mate your top cows to a select group of top bulls. This will generate an elite group of calves which will start forming the nucleus of the next generation of replacements.

This is not a silly approach and the logic is good. Mating your top 10% of cows to the top five sires and then mating the rest of the cows to a selection of high BW bulls will generate a line of calves with a higher BW than our baseline scenario. In this case the average BW was 147BW which is 2BW higher than the baseline.

As with the baseline scenario, there is random variation a play here, so it is statistically possible to generate a lower BW line of calves than the average of the baseline (but it's fairly unlikely).

With this mating strategy, you are prepared to pay for more for selecting the top 5 bulls to get a superior line of calves on the ground. Regardless of which genetic company you deal with, the very best bulls are always in short supply, so a premium is charged to secure these bulls.

Scenario 3. What's really holding back my genetic gain?

This may seem counter intuitive for some, but creating an elite group of calves (by mating your top cows to the top bulls) may not yield the best outcome. The issue with this

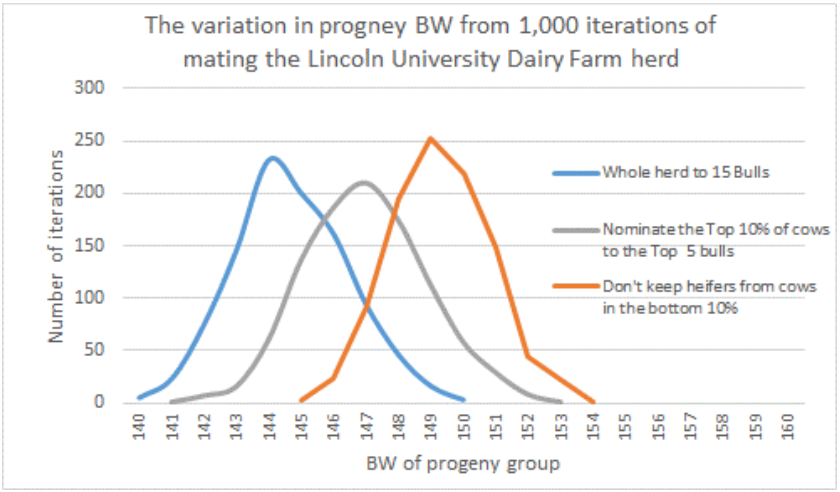
---

Notes:

mating strategy is that you still have the possibility of generating replacement stock from your very worst cows. So while an elite group of calves is generated, so too are a tail end group of calves with considerably lower BWs. These two groups tend to moderate each other and the average of the total line of calves is not as great as you expect. It is these tail end calves that are the handbrake on the herd's genetic gain. By developing a mating strategy which prevents the worst cows from producing tail end calves to enter the milking herd, superior amounts of genetic gain are possible.

There is a 4BW point advantage from mating the whole herd to the top 15 bulls and preventing the bottom 10% of cows generating replacement progeny. This is 2BW MORE than the mating strategy that creates an elite group of calves.

The baseline scenario generated a progeny group that had 145BW. The strategy of not keeping replacements from the bottom 10% of cows generates a progeny group with 149BW. Furthermore, over 1,000 iterations did this strategy generate a line of calves that had a lower BW than the baseline average? The lowest 3iterations were 145BW (which is the average of the baseline scenario). In the 997 other iterations, this strategy generated a superior line of calves.



How do I prevent the bottom 10% of cows generating Ab Heifer replacements?

Depending on the quality of your herd you have one of two options available.

1. If the herd is of high genetic merit, then the calves, if correctly matched to sire and dam, could be sold to other farmers.
2. If the herd is of average genetic merit, beef semen could be used in the bottom 10% of cows. This way you can easily identify the calves and they can be sold as dairy beef. Also, more often than not beef genetics command a lower straw price than dairy genetics so this option can be very attractive.

Management tip

Put a pink button tag into the ears of cows that are in the bottom 10%; this way they can be easily identified by the AB tech at mating time and they can be easily drafted off at other times of the year.

Do I have to alter my mating plan?

YES. The mating plan will have to be extended if 10% of the cows will not produce an AB heifer. For a herd with average reproductive performance (80% 3 week submission rate and 50% conception rate) 4 weeks AB will generate 21% AB replacements. All things being equal the same farm will have to extend AB by 4-5days to generate the same number of replacements from 10% fewer cows. If the mating plan is not extended, the farm will not generate enough replacements.

Good reproductive performance is also required. If there is a concern, then the number of cows going to beef/SGL semen will have to be reduced - 5% or 3% will still be better than doing nothing.

Can you use the same strategy for very high BW herds and very low BW herds?

Yes. The advantage is greatest when the variation of genetic merit within a herd is large and the BW is low, and the advantage diminishes as the variation within the herd decreases (and/or the BW is high). But in both instances, the strategy of not bringing in daughters from the bottom 10% of cows yields higher genetic merit calves than both:

- The baseline mating strategy and
- Mating the top 10% of cows to the top 5 bulls.

implementing both strategies results in the most genetic gain

The most genetic gain is likely be achieved from a combination of:

- Using a smaller number of elite bulls and,

Notes:

- Not keeping daughters from the bottom 10% of cows.

There is also the topic of mating yearling heifers, which would give you even more genetic gain, but that is a topic of a different paper. The fundamental core principle still stands:

The most important thing you should know about your herd is who the worst cows are.