Is your herd of cows picture perfect or profitable to milk?

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While evaluating a dairy in central California recently, I observed that they were making an easy 80lb of milk and the body condition score was good. The herd's reproduction and culling were going extremely well, but I just could not get over how much smaller their Holsteins were than most herds.

The cows at this farm were noticeably smaller than most Holstein dairies I visit, but their milk production was above average reaching about 82lb on twice a day milking with no rBST and a higher forage ration than most dairies. This is not an isolated phenomenon. There are Holstein dairies scattered across the countryside with smaller framed cows getting as good or better milk production compared with their neighbour's larger framed cattle.

Genetic selection for smaller framed Holsteins is a trend gaining serious momentum as dairies have been hard-pressed to maximise feed efficiency with several consecutive years of high feed prices and certainly more high feed prices to come.

The old adage is big strong cows make more milk and last longer. However, research on the relationship between type traits and production traits is variable at best. If you were to look at bulls with high reliability for PTA Type and PTA Milk you would find the correlation between those traits is low (< 0.02), meaning bulls with high PTAT do not necessarily have daughters that produce a lot of milk. Conversely, bulls with high PTA Milk will not necessarily have daughters with a high final score.

Feed efficiency and weight

What we know for certain is a larger framed cow needs to consume more feed to make the same amount of milk as her smaller framed herd mate. When milk production is the same, regardless of body size, there is a clear negative correlation between feed efficiency and body weight (Fig. 1).

This point was emphasised in research on Jersey cattle published in the January 2012 issue of the Journal of Dairy Science.

The researchers found Jerseys are not only more feed efficient than Holsteins but also require less water, produce less waste and have a lower carbon footprint.

All of these facts would hold true for small-framed Holsteins compared to large-framed Holsteins too.

Highlighted in Table 1 you can see that a 1,400lb cow producing 80lb of milk has the same feed efficiency as her 1,600lb counterpart making 90lb of milk.

At this level you can make an argument as to which cow is truly more profitable in the herd. While feed costs make up the bulk of any dairy's operating costs, that extra 10lb of milk produced by the second cow may indeed make her more profitable than the first.

However, in the case that both cows are making the same amount of milk it is obvious the smaller cow is more profitable.

Furthermore, body weight gain is not free. It takes extra energy for a first lactation cow to grow to full body size or for a cow to increase in body condition score.

The energy required for the 1,600lb cow to reach mature body weight was unquestionably more than that of the 1,400lb cow. Now consider during their first lactation the 1,600lb mature cow was already less feed efficient than the 1,400lb mature cow. Then you add on the extra energy that was needed to obtain mature body weight while the cows were lactating.

An example of five dairies (Table 2) randomised for body weight and milk production demonstrates the most efficient cows in the herd are smaller framed cows that produce large amounts of milk. In all five simulated farms the average feed efficiency of the cows weighing less than 1,450lb is 0.06 or 0.07 greater than the feed efficiency of the cows weighing more than 1,650lb (compare the far right two columns).

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Fig. 1. Feed efficiency of different sized cows that are not growing, producing 80lb of 3.5% fat corrected milk, and walking 1.25km per day.

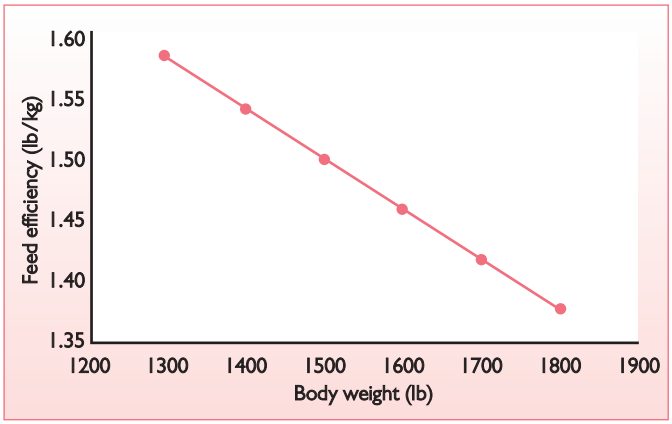

Table 1. The matrix below clearly demonstrates the feed efficiency of cattle based on their body weight and milk production.

	3.5% fat corrected milk (lb)							
BW (lb)	50	60	70	80	90	100	110	120
1300	1.15	1.28	1.38	1.47	1.55	1.61	1.68	1.73
1400	1.11	1.23	1.34	1.43	1.51	1.57	1.64	1.69
1500	1.08	1.20	1.30	1.39	1.47	1.54	1.60	1.66
1600	1.04	1.16	1.26	1.35	1.43	1.50	1.56	1.62
1700	1.01	1.13	1.23	1.32	1.40	1.47	1.53	1.59
1800	0.98	1.10	1.20	1.29	1.37	1.44	1.50	1.56

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The reason the median feed efficiency is substantially higher than the average feed efficiency in Table 2 is that the less feed efficient cows migrate further from the average than the most feed efficient cows.

For example, an 1,800lb cow making 20lb of milk has a feed efficiency around 0.5 (or 2lb of feed consumed per pound of milk produced) while a 1,300lb cow making 140lb of milk has a feed efficiency of 1.8 (or 0.45lb of feed consumed per pound of milk produced).

We can agree then that a 1,400lb cow producing the same amount of milk as a 1,600lb cow is more profitable.

Now comes the tricky part. To get smaller cows through genetic selection you have to take one of two approaches:

- Select against bigger cows (USDA's Lifetime Net Merit selection index does this with a negative emphasis on body size).
- Remove selection emphasis on traits that lead to larger framed cows (such as stature, PTAT and TPI).

If you use an index (Lifetime Net Merit, Cheese Merit or Fluid Merit) to select bulls, then the first option is a good way to penalise bulls for having larger daughters.

If you do not utilise one of those indexes and instead choose bulls by traits like stature, PTAT and TPI, it may be more beneficial to remove the trait(s) from your selection criteria completely rather than setting a ceiling for it. For example, if your current selection criteria are >1,000 PTA Milk and at least one point on PTAT, Udder Composite and Foot and Leg Composite, you are better off removing PTAT from your criteria altogether than switching it so that you will not take any bulls with more than a point on PTAT.

The reason this proves to be tricky is that people have different ideals. For many the 'showy cow' or the cow that can win at the county fair is perceived as being the ideal cow.

To be frank that cow is ideal, but she is ideal for the show ring not for the milk parlour, feed alley or freestalls.

The ideal cow for a commercial dairy has high feed efficiency, stays out of the hospital pen, conceives easily and produces enough milk over her lifetime to far exceed her raising costs. That smaller cow may likely not do well in the show ring but has an easier time reaching a high level of feed efficiency and thus a higher probability of making a profit for the farm.

I am reminded of conversations that took place on two dairies regarding sire selection criteria. The first producer told me, "Even though I know they are not the best cows for my dairy, I just want a herd of cows that I can feel good looking at."

Not long after another producer told me that he selected for PTAT and TPI above all other traits because "that's what a judge would look for" in cows at a show.

The irony is neither operation even participates in cattle shows yet they were both picking bulls that produced showy daughters. The first producer chose to stick with selection criteria that will lead to larger framed cattle that will have a more difficult time achieving a high feed efficiency ratio. The second producer decided he would begin selecting bulls based on Lifetime Net Merit and combined fat and protein instead of PTAT and TPI.

This brings us to the question you have to ask yourself: Given the choice would you rather have a herd of cows that are picture perfect or profitable to milk? Often those characteristics are not one and the same. ■

	Milk	BW (lb)	FE	<1450 FE	>1650 FE
Herd A					
Average	79.6	1544	1.30	1.36	1.29
Median	79.0	1535	1.37	–	–
Herd B					
Average	79.6	1550	1.30	1.36	1.30
Median	79.0	1547	1.36	–	–
Herd C					
Average	80.5	1557	1.30	1.37	1.31
Median	81.0	1560	1.37	–	–
Herd D					
Average	78.6	1547	1.29	1.35	1.28
Median	79.0	1549	1.36	–	–
Herd E					
Average	80.1	1545	1.30	1.39	1.30
Median	80.0	1539	1.37	–	–

Table 2. Feed efficiency results for five simulated 1,500 cow dairies. Milk ranged from 20-140lb 3.5% fat corrected, body weight ranged from 1,255-1,845lb, and feed efficiency (FE) is a ratio of pounds of milk produced per pound of feed consumed.

References are available from the author on request.