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What is the Best Cow to Buy?

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Summary

The value of a cow is greatly affected by her

- PW
- Age
- Liveweight

It is affected to a lesser extent by her

- Calving date
- BW
- Condition score

Individual cows may be affected by

- Disease – e.g. mastitis
- Poor rearing
- Poor conformation

These effects can be valued, and the purchase price for a cow can be adjusted to account for differences

A simple system to incorporate these adjustments is outlined

A similar system to value herds according to their characteristics is outlined

Introduction

Sharemilkers and others buying a herd for the first time are faced with some very difficult spending decisions which often involve the greatest expenditure that a young couple have made to date in their financial careers.

The stakes are high and there is debate about which cow is the best “bang for your buck”. One school of thought says you should buy the best. By this I mean high genetic merit cows with resulting high PW. These cows always outperform lower PW/BW herds, all other things being equal.

There is an equally strong school of thought at the other end of the spectrum that says “any cow will produce milk if well fed, so why commit to a very high capital entry cost when you could have a herd that produces adequately at a fraction of the cost”.

Both of these approaches have merit and more than a grain of truth. But they can't both be entirely right.

Logic suggests something in the middle. There must be a point at which “the best” is simply too expensive and a point at which “the cheapest” has just too many things wrong to produce milk efficiently and sustainably.

If we can identify the factors that contribute to a cow’s ability to survive and produce over her lifetime, then these factors can be valued, added up and a purchase price arrived at. Then a decision can be made about which herd or which cow represents value for money.

Nice theory, but it is actually quite complex in practice.

My approach has been to look at the value of a nominal “average cow” and calculate the values of other individual cows as deviations from this value.

What is the “Average Cow” Worth?

This simple question does not have a simple answer. Often herd valuations are influenced not only by the future income that an investor hopes to get from the herd but also a whole range of other market factors such as availability of herds (supply and demand) – influenced by

- Numbers of replacements reared in the industry over recent years
- Numbers of new farm businesses being set up versus numbers exiting (over recent years many more starting than exiting)
- Export markets for dairy livestock
- Cull values of cows
- Retention of “budget cows” and carry-overs in the industry
- Profitability and liquidity of the dairy industry

A rough rule of thumb over many years is that a buyer should expect to pay around the gross income a cow would be expected to generate in a year. For the purposes of this paper we will use the production of the nominal “average cow” in NZ to calculate the value of the cow.

LIC stats for the last 5 years (excluding season just finished) have average per cow production at 318 kg/cow (it has ranged from 307 in last years drought to 325). Using a predicted payout of \$5.50 (your guess is as good as mine!).

Today’s value = $318 \times \$5.50 = \sim \1750

This is a value averaged across all breeds and all districts, top herds and ordinary, hard farms and easy.

This value is above sales being reported at the moment, but well below what herds were selling for last season. This bears out that the market overvalues cows in good times and undervalues them in harder times.

The purpose of this paper is not to determine the average value, but to think through how value varies for different cows, and we need a base to work from. Irrespective of the base value chosen, the method should work.

Valuing Different Cows

The three biggest factors affecting value are

- Age (or age structure of a herd)
- Production Worth
- Liveweight

Age of Cow or Herd

- Age is not a straight line calculation.
- Young cows have not yet reached their peak production, but have high value due to likely longer life than old cows.
- Old cows may be producing very well, but have very much higher risk of not surviving for long
- Immediate production prospects and likely longevity are both important

For example LIC stats show that age group production for crossbred cows are as follows:

Table1:

Age	2	3	4	5	6	7	8	9	10+
Kg MS	261	305	332	343	346	340	328	315	294
Likelihood of survival to next season	.85	.87	.87	.83	.80	.75	.65	.50	.30
Value relative to "average cow"	-350	+200	+200	+200	+200	-150	-500	-850	-1200

Looking at production on this table, a rising 6 year old has the prospect of earning around \$450 more dollars than a rising 2 year old but will need to be replaced somewhere in the next 2-4 years rather than the likely survival of 6-8 for the rising 2 year old. The nine or ten year old budget cow needs to be priced at not much more than works value.

A herd that has a normal age structure (i.e. 23-25% rising 2 year olds dropping evenly down to <5% very old cows) is much more valuable than a herd where large numbers of old cows will need to be replaced in the near future. There is an immediate risk of reduced production from old cows, and when they are replaced, there will be lower production from a large crop of heifers, or high cost to purchase 3-5 year old cows.

Looking at income for each age group, heifers have a lower cash income, but a long future. In reality the heifer group is unproven, can have a high attrition rate and has low salvage value, so the heifer price is discounted. To model this accurately would require some actuarial calculation, but this is a rough approximation.

The price of heifers should be discounted by around 20% compared to the base level is justified ($\$1750 - \$350 = \$1400$). 3-5 years should around \$200 above value of the nominal average cow, ($\$1750 + 200 = \1950). From 7 years to 10 years, a discount of around \$350 from peak value per year is would be realistic. (See table)

<p>Cows from 3- 6 years old are the most valuable Cow values should be heavily discounted from around 7 years old. Heifers should be discounted by around 20%</p>
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Production Worth

PW is our informed guess at the future production of a cow over her lifetime, relative to her herd-mates.

PW incorporates genetic merit and is a good indication of how cows from different sources should produce relative to each other when combined in one herd.

Bill Montgomerie (pers.com) calculated for one higher input farm that the difference between the top 20% of first calvers and the bottom 20% was 174 PW units.

Calculating the Net Present Value (NPV) of this difference at a \$5.50 payout and a 5.5% discount rate, there was a difference of \$1310.

In other words, the farmer could afford to pay \$1310 more for the high PW group than the low PW group at the end of their first lactation

In a herd purchase situation PW is not as valuable as this because of the older age structure of a mixed age herd (less years of life left on average) and the lower production of the average herd in NZ

In the example quoted we can approximate the value using the income stream from an average age of 4 years on. In this instance \$701 over a range of 174 PW units

PW has a NPV of \$4.00 per PW point in a mixed age herd
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First calving heifers should also be valued according to their PW rather than BW.

Heifers will have a PW even before they are tested because there are some non-genetic factors we can value, even before the heifer is tested.

An example of this is the crossbreeding effect. A crossbred animal is likely to produce at a level higher than the average of her two parents. This hybrid vigour (heterosis) is not a genetic effect, and is not included in BW because it can't be passed on to future generations. It does have a significant effect on PW.

When the heifer has her first tests, a lot of weight goes onto her production, and much less onto her ancestry.

PW is an important factor in valuing rising 2 year olds
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Liveweight

A good big cow will beat a good little one. If you choose Jersey cows rather than Friesians, the lower intake of the smaller cows will mean you will need to purchase more of them to utilise your feed resource.

The effect of this is that around 20- 22% more Jerseys are required to give an equivalent stocking rate. This needs to be reflected in the purchase price of the livestock.

If the average nominal value of \$1750 applies to a 460 kg Fr Cross cow, then a 400 kg Jersey needs to be adjusted down to $(400/460) \times \$1750 = \1522

Differences between breed are largely a liveweight effect, but there are some small milk composition effects too.

These milk composition effects are accounted for in PW – PW is useful for comparing cows of different breeds.

Adjust cow value in proportion to her liveweight Big cows have a higher value than little cows of equal PW

Value of BW

BW has often been a selling point for herds. It is an appropriate measure for making breeding decisions, but the best predictor of the stream of income from a herd is PW, which has an element of breeding included.

To include the BW of an animal as a separate predictor of the cows own ability to produce would double count, since it is already included in PW.

There is a small component of value not include in PW, and that is the cows ability to produce progeny of high genetic merit.

The first year that the BW of a herd will make any difference at all to your income is the year the first progeny come into milk. This will affect 20-25% of the herd in year 3, with a smaller percentage added each year as the original herd is replaced.

The genetics of any first generation progeny are 50% diluted by the sires used, and so 50% of the effect of BW can be achieved by wise choice of sires.

When discounting is applied to these future streams of income, they will have a NPV significantly less than that of the PW. However it is *not* zero. It affects the PW of progeny for the whole of their lifetime.

The difference in value of progeny of high BW or low BW probably peaks towards the end of the first generation of progeny somewhere around 6-8 years after purchase and will decline as the dilution effect of sires used becomes prominent in the second and subsequent generations.

The value of the BW point is about \$1 per point per year. Halving this to account for the dilution effect of sires, and multiplying by replacement rate (25%), we get \$0.12 in year 3, somewhere about \$0.22 in year 4 as the next age group of replacements calves and so on. Some rough calculation on this suggests an NPV of \$1.25 per BW unit after these income streams are discounted.

From extremely low BW to extremely high may justify a difference in price of \$125 per cow (say BW = 40 compared to BW = 140)

It is important to note that high BW is related to high PW, and this value is in addition to the value attached to PW. In reality a high BW herd is likely to also be a high PW herd.

BW has a NPV of \$1.25 per unit due to higher production of high BW progeny
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Expected Calving Date

Cows calving between a month and two months before balance date (or magic day when feed supply = feed demand) for a farm are ideal.

Earlier than this, the value may be reduced as there may be a cost to adequately feeding very early calving cows up to the balance date

Later calving cows have a long term cost due to lost opportunity for days in milk and production, and this may carry forward into subsequent years as it is usually takes years to significantly tighten a calving pattern.

Research from DRC in the 1980s suggested that every extra day in milk before balance date represented another day's production at very close to peak production This may represent say 1.8 kg MS at \$5.50 = \$9.90 a day. There is usually some cost in achieving this production.

If the cow is 3 weeks late this is \$200 of immediate production. If the late cows are able to be brought forward by 10 days per season, there will effectively still be a cost of \$100 next season which may be discounted to say \$95 due to the time value of money.

So a group of cows that average three weeks late may effectively have a value of \$300 less than early calving herd-mates.

For cows calving later than 2 weeks before balance date, every day later reduces the value of the cow by \$15

Cow Condition

Cow condition is effectively a temporary effect and can be completely corrected in a few weeks of fully feeding. Hence the reduction of value due to poor condition is only the cost of feed to correct it. The cost of a condition score is around 200 kg of additional feed – at current cost of feed this would be around \$50 However if cows are purchased in poor condition too close to calving, or there is no opportunity to correct the condition, the cost of one condition score is around \$100 per cow per condition score. This is mostly an immediate production effect in the first lactation, but there is a carryover effect on 6 week in-calf rate and empty rate as well.

Cow condition is worth \$50 per BCS if you have time and resources to correct it before calving, and \$100 per BCS if you haven't

Animal Health Status

Some animal health effects are long term, while some are much more transient. Effects such as mastitis or eczema can have permanent and significant costs on production and reduce the longevity of the herd'

This would need to be costed on a case by case basis. The main effects are cost of treatment, reduction in short or long term production, and reduced longevity of the animal.

For instance every additional 100,000 BMSCC above 150,000 will reduce production by 1.5%, apart from the costs of treatment, discarded milk, management time and risk

of inhibitory substance penalties. Assuming this takes several years to correct, this will reduce the value of the cow/ herd by perhaps 3%

Every 100,000 increase in BMSCC above a threshold of 150,000 reduces production by 1.5 % and value of the herd by \$53

Heifer Rearing

Runts or poorly reared animals have severely reduced long term prospects. Given good feeding levels, some animals may compensate by growing out over their first few lactations. They will do this at the cost of production. This is a large effect, and poorly grown animals should be severely discounted.

Conformation

LIC statistics show no relationship at all between conformation and production. Ugly cows can still produce milk. There is a relationship between farmer opinion of the animal and her production. This shows that farmers have a good idea of the flaws in livestock that make them costly to keep, likely to be culled or unlikely to produce well. So while overall conformation is not important, there is a minimum standard for feet and legs, constitution, capacity, udder support etc. Be sensible when buying and avoid buying a problem.

Putting it All Together

- Purchase value of a **cow** should include all of the above
- Purchase value of a **herd** should also include all of the above

Adding all the plusses and minuses can be done as follows:

Cow Value = (Average value +BW + PW + age + calving date + cow condition + liveweight + breed + health status + conformation)

Example 1 – Valuing an Individual Cow

Base value of cow - \$1750

Table2:

Characteristic	PW	BW	Age	Exp CD	BCS	SCC	Breed/LW
Individual Cow	100	85	8	10/8	4.5	180	520
Average/Threshold	90	78			5.0	150	460
Difference	10	7		0	0.5	30	+13%
\$ per unit	4.03	1.25		15	60	53	
\$ total	+40	+8	-500	0	-30	-16	+288

Value of cow = 1750 +40+8-500-30-16+288 = \$1480

Note the overwhelming effect of age on what otherwise is a very good cow

Example 2 – Valuing a Herd

Base value of cow - \$1750

	PW	BW
Individual Cow	120	110
Average/	90	78
Difference	30	32
\$ per unit	4.03	1.25
Net Value	+\$121	+\$40

Age Structure of Herd

Age	R2yr	R3yr – R6yr	R7	R8	R9	R10+	Net Value
% of Herd	25%	50%	9%	6%	5%	5%	
Value adjustment	-\$200	+\$200	-\$150	-\$500	-\$850	-\$1200	
Net Value	-\$50	+\$100	-\$14	-\$30	-\$43	-\$60	-\$23

Late Calvers

Late calvers	15%
Average days late	20
Average days per cow over herd	3
Cost per day	\$15
Net Value	-\$45

Condition Score

Cows less than BCS 5	90%
Average BCS of these cows	4.5
Target BCS	5.0
Value per BCS unit	\$50
Net Value	-\$23

Somatic Cell Count

Average BMSCC	250,000
Acceptable level BMSCC	200,000
Difference	50,000
Value \$/'000 SCC	\$0.53
Net Value	-\$26

Liveweight

Liveweight of this herd	400
Liveweight of average herd	460
% of average herd	86%

$$\text{Cow Value} = \$1750 + 121 + 40 - 23 - 45 - 23 - 26 = \$1815 \times 86\% = \$1561$$

Average value for this herd - \$1561

Note the big items here are the high PW and the low liveweight of jersey cows
Age structure is reasonably normal and does not affect herd value greatly.

Conclusions

- Cow values vary based on their likely future production and that of their progeny
- A realistic purchase price could be calculated based on the future stream of income from a cow or a herd using financial discounting tools such as net present value (NPV).
- In practise this is extremely complex and would require very sophisticated modelling to calculate accurately.
- Cows and herds vary from average in PW, BW, age, breed, predicted calving date, health, condition, liveweight, each of which impacts on value.
- The stream of income is much more influenced by long term payout than the spikes or troughs in payout in any one year. Thus cows tend to be overvalued in good years and undervalued in bad ones
- Age structure of a herd has a major impact on subsequent replacement policy and is one of the greatest determinants of herd value. A very old cow may be worth little more than salvage value, while a young cow may be worth more than three times as much or more.
- The difference in NPV between very low PW heifers and very high ones may be as high as \$1300. This difference lessens as the cow gets older, and has fewer years left.
- Large cows are worth more than small cows of similar PW. Breed dictates potential liveweight. It will also dictate milk volume and composition, salvage value of the cow and potential markets for non replacement progeny – bobbies or rearers. Breed as it relates to profitability is largely a function of liveweight. A Jersey cow for example should be discounted in proportion to her liveweight compared to a Friesian cow of the same PW, calving date etc.
- BW is a secondary consideration in herd purchase, as differences in BW will be significantly diluted in the progeny by the genetic contribution of bulls used
- The value of cow condition will be realised over the first season, and has minor impact on value.
- Late calving in general is regarded as a negative influence on a cow's value. Subsequent calving dates are to a large extent dictated by previous calving date, thus reduced per cow production tends to carry forward into subsequent years, unless interventions like induced calving are employed. This has a minor effect on value.
- Rearing and prior feeding will have an effect on liveweight of cows, particularly at younger ages, and may also have effects on fertility and longevity within the herd. The economic value of this is difficult to determine. Very poorly reared animals should be heavily discounted.
- Conformation may have aesthetic value, but has seldom been shown to have strong correlation with longevity or other economic values.
- Differences between cows tend to be greater in higher producing herds. PW, Calving date, Liveweight become more important, not less
- Farmer intuition appears to be generally quite accurate at ranking the values of herds and individual cows.

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