COWS & SYSTEMS
Victorian Dairy Conference 2006
MATCHING THE COW TO THE SYSTEM

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Take home messages

- When defining your dairy system, you should ask two key questions
- Is it possible that your cow's genetic potential could exceed the economic parameters of your business?
- Genetically am I increasing or decreasing my ability to be profitable at low milk price?
- To answer these questions we need first to look at our business system, then at the existing herd to try and find the cow that will maximise profit within our system.
- This paper describes my approach to matching my cows to my system
- But remember, this is my system! You need to clearly define your system, understand what drives it and its economics. Then design and breed the cow, which will give you the best economic outcome within your system, not the guy down the road's system.

Table 1. My 2004/5 figures at a glance

Herd	188 cows, seasonal calving
Breed	Cross bred Aussie/Swedish Red Breed x Holstein & Jersey
Production	591 kg MS/cow or 111,156 kg MS for herd
Pastures	49 ha perennial pastures
Consumed	17.7 t DM/ha or 4.6 t DM/cow
Utilised	70% of total DM consumed
Milk	$4.18/kg MS return, $2.43/kg MS to produce
Operating surplus	$1230/cow or $231,271 for herd
EBIT	$756/cow or $142,148 for herd *
Return on Capital	9.7% *
Return on equity	11.1% *

*after $75,000 operator allowance

Cows and systems

Should you build your system around the cow, or the cow around your system? It's a great question for possibly a controversial topic! I've always had a strong belief that you need to define and understand your system and the economics within it, and then design a cow to match your system that will give you the best economic outcome.
As I define my business system and then attempt to design a cow to match it, I need to continually ask myself two basic questions as I go through the process.

- Profitability at low milk price; can my system handle it, and genetically am I increasing or decreasing my ability to be profitable at low milk price?
- Is it possible that a cow's genetic potential could be exceeding the economic parameters of my business?

To answer these questions we need first to look at our business system, then at the existing herd to try and find the cow that will maximise profit within our system.

Business system

- Flexible, must be able to maximise high milk price, but still be profitable at low milk price
- .Pasture based, low to medium risk, feeding 1.5 -1.8 t supplements/cow
- Seasonal calving
- Dry off for 4 -5 weeks (if it doesn't get in calf, sell it!) Holidays!!
- Single labour unit (using the KISS principle. Keep it simple, stupid)

The basis of my system is to maximise profit at around a 70%-30% pasture to supplement ratio, and work on the principle of buying my maintenance and growing my production.

Table 2. My farm system

Pasture 70% $82/t DM 0.75cents/mj me Production MJ of ME	zone	Supplements 30% $251t 2.0c/MJ of ME Maintenance

Matching the cows to my system

The challenge is to match the cow to my system that will give me maximum profit for the least input and effort. To find the cow that best suits my system, I need to research my existing herd to find my most profitable cows within it, and then put a breeding plan in place based on what works best for me in my system.

The cow I am looking for will not necessarily be the highest producing cow or the cow with the highest margin over feed costs (MOFC), but will be the cow that gives me the highest margin/ ME (MegaJoule of Metabolic Energy) that I invest in her over her lifetime. This is where I need to differentiate myself from working in production and make sure I am working in profit!

Margin/ ME, what is it and why do I use it?

The margin over all feed costs divided by total ME required, is not the full picture of profit but it guides me to the cows that are the most efficient converters of feed within my system. I find it is a particularly valuable tool to use in mixed or crossbred herds for the reason demonstrated below.

Table 3. Example of my Margin/ ME

Cow	**PI**	**Live weight (kg)**	**Milk solids (kg)**	**MOFC**	**Total ME required**	**Margin/ ME (cents)**	**% difference + or -**
300	104	680	667	$1912	77441	0.0246	
346	89	420	631	$1847	66029	0.028	+13%

We find that the cow with the lower production index (PI) in fact is returning our business 13% more margin/ME than the cow with the PI of 104, even though she has lower production and a lower margin over her feed costs.

It is important to remember that I am in the business of converting energy into profit; it's the return per ME that I need to focus on, not production or MOFC.

There are two main areas that determine profit within my system, namely efficiency of production and longevity.

Efficiency of production (or Feed conversion efficiency)
This is the ratio of feed proportioned to maintenance and production or the ability to extract a higher return from a given amount of feed.
To achieve this, I need a cow that can consume a high proportion of pasture in relation to her bodyweight within my system.

Table 4. Example of efficiency or margin over feed costs for 1000 t DM

Cow	**Live weight (kg)**	**Milk Solids (kg)**	**Efficiency, Kg M S / Kg LW**	**%Margin/ ME + or -**	**MOFC For 1000 t DM**
510	470	745	1.58	+ 14%	$342,000
Herd	520	591	1.14	av	$300,000
307	685	659	0.96	- 13%	$261,000

There is nothing magical about cow 510, she simply has the ability to eat an extremely high amount of grass in proportion to her body weight, her intake averages around 4.6% of body weight/day in her lactation. Cow 307 on the other hand, is genetically OK, but she just physically cannot consume enough in my system to reach her genetic potential.

For efficiency of production, I am obviously looking for a smaller cow that is capable of high production in relation to her body weight. Unfortunately this is where the economics for my seasonal calving system can come unstuck when it comes to fertility and longevity.

Fertility and longevity
For my seasonal calving system, fertility has the biggest impact on longevity, followed by health & mastitis, efficient production, milking speed, temperament and calving ability.

Genetically there is a strong negative correlation between production and fertility (-0.35)*, while live weight (-0.08)*, type (sharpness) and rump width also have negative correlations to fertility.

So if I select heavily for three main traits, production, larger body size and type (sharpness), genetically fertility within my herd will decrease. If I selected for big wide rumps as well I would be even worse off!

We obviously want both production and fertility and to get both, I have two choices. Firstly, I can do as the industry suggests and improve management and feed better. This option in my system results in increasing my cost per unit ME and will decrease my margin per unit ME, resulting in decreased profitability at low milk price.

The second option is to try to get the gains in fertility genetically, which of course is free and if successful, will increase my profitability at low milk price.

To tackle the genetic approach there are two basic things I need to know about genetics and heritability.

Firstly, genetic traits range from low to high heritability. Two examples are:

- High – Production, milking speed.
- Low – Health traits, fertility.

Secondly, heritability has two forms.
Heritability in the "narrow sense" and heritability in the "broad sense".

To quote Professor Les Hansen, Geneticist, University of Minnesota "One is heritability "in the narrow sense", which is the one almost always used and referred to. It measures the percentage of all differences for a trait (for cows for us) that are due to the effects of INDIVIDUAL genes (good genes versus bad genes). These effects are the ones expressed in estimated breeding values (EBV) or predicted transmitting abilities (PTA), which are the same thing, except EBV is twice PTA.

The other is heritability "in the broad sense", This measures the percentage of all differences for a trait that are due to ALL genetic effects, which include the effects of individual genes (which is included in heritability in the narrow sense) plus INTERACTIONS among individual genes (such as when a dominant gene masks a recessive gene at the same location on the chromosome). This is what hybrid vigour is all about! Therefore, heritability in the broad sense includes within-breed genetic effects as well as the potential bonus from crossbreeding (hybrid vigour) and the potential depression from inbreeding.

This is why I refute the claims that dairy producers can make just as much progress by selecting for fertility within breed as they can by crossbreeding. The percentage of differences for fertility from effects of individual genes is much smaller than the percentage of differences for fertility from interaction of genes (when you have genes from two different breeds at every location on the chromosomes).

My guesstimate (based on past studies) is that heritability for fertility of dairy cows is 3% in the narrow sense and 15% in the broad sense. For survival, my guesstimate is that heritability is 10% in the narrow sense, but 30% in the broad sense. People always say that there isn't much genetic control of fertility and survival, but this is thinking only in terms of individual gene effects (heritability in the narrow sense) and not all genetic effects (heritability in the broad sense).

Of course, these days, people marketing Holstein semen wish to comment only on heritability in the narrow sense. However, heritability in the broad sense will become more of a concern within the Holstein breed because of the rapidly increasing potential for inbreeding within the breed.

Heritability in the broad sense only comes into play when you have hybrid vigour (or inbreeding). Normal selection programs within breed make use of only heritability in the narrow sense." (End quote 15/04/06 personal email)

By crossbreeding and working in the "broad sense" I should theoretically get genetic gains by effectively moving the heritability of traits like fertility and survival from low towards high heritability.

In an attempt to get further gains in fertility and longevity, I need to look for systems and selection processes that better suit the economic needs of my business.

This would include Sweden introducing fertility into their total merit index (TMI) in 1972 and other health traits in 1978, effectively giving them a 30 year head start over us in health and fertility.

So we need to look at the Nordic TMI, the system now used by Sweden, Denmark and Finland, and compare it to our APR (Australian profit ranking), to see if it's possible for me to get fertility and longevity gains by using bulls proven in their TMI or by using bulls that are proven in Australia but have close genetic links to the Nordic TMI system, Aussie Red (ARB) bulls.

Table 5. Weightings (% contributions) of traits to the APR & Nordic TMI

Trait	APR	Nordic TMI Swedish Red	Nordic TMI Swedish Holstein
Production	68%	34%	29%
Fertility	5%	15%	15%
Cell Count	6%	15%	14%
Calving ability	-	7%	17%
Other Diseases	-	2%	2%
Udder	-	14%	9%
Legs	-	7%	9%
Longevity-survival	9%	5%	5%
Live weight	4%	-	-
Temperament	4%	-	-
Milking Speed	3%	-	-

Looking at the weightings of each system, it is obvious that the TMI favours bulls that are strong in health, fertility and calving ability. Running lower weightings for production doesn't seem to have an effect on production itself within our herd.

Table 6. 305 day production details for 2nd lactation cows (2004/05)

Breed	Cows	Protein (kg)	Protein (%)	Fat (kg)	Fat (%)	Milk (L)
SRB-ARB XB	10	273	3.59	328	4.31	7610
> 75% Fr	8	281	3.49	320	3.97	8061
Fr x J	18	263	3.86	319	4.68	6816

Table 7. 305 day production details for 3rd lactation cows (2004/05)

Breed	Cows	Protein (kg)	Protein (%)	Fat (kg)	Fat (%)	Milk (L)
SRB-ARB XB	11	298	3.57	353	4.23	8337
> 62% Fr	8	299	3.52	362	4.27	8486
Fr x J	10	279	3.55	355	4.52	7853

The theory is that by crossbreeding and moving heritability from the "narrow sense" to the "broad sense", I should be able to increase the heritability of fertility from 3% to at least 15% and increase survival from 10% to 30%; and then get an extra bit by using bulls linked to the Nordic TMI. If we look at tables below for fertility and longevity in our herd we see that the theory is actually working!!

Fertility

Table 8. 2005 pregnancy test results for 188 cows

Breed	Cows	6 week in calf	9 week in calf	13 week in calf
SRB & ARB XB	50	44 = 88%	49 = 98%	50 = 100%
Fr X J	68	52 = 77%	61 = 91%	66 = 97%
>75% Fr	49	27 = 55%	36 = 74%	44 = 90%

Longevity

Table 9. Cows born in the year 2000 and milking in their 4th lactation.

Breed	Cows born	4th lactation
SRB & ARB XB	18	11= 61%
Fr X J	23	11 = 52%
> 75% Fr	16	5 = 31%

Table 10. Cows born in the year 1999 and milking in their 5th lactation.

Breed	Cows born	5th lactation
SRB & ARB XB	9	6 = 67%
Fr X J	14	9 = 64%
> 75% Fr	15	5 = 30%

The economic benefits of longevity are numerous, examples include

- Less replacements required, do a better job of rearing less
- Costs more to rear a heifer than I receive for a cull

A simplistic way of looking at the economics of both efficiency and longevity could be the different amount of DM required for two self-replacing herds, both producing 111,000 kg MS, one with an efficiency of 1.14 kg MS/ kg LW and 60% go into 4th lactation, the other has an efficiency of 0.95 kg MS/ kg LW and 30% go into 4th lactation.

Table 11. Extra tonnes DM required to get the same production for self replacing herds

Production	Kg MS/ kg LW	% in 4th lactation	Extra t DM needed
111,000 kg MS	1.14	60%	0
111,000 kg MS	0.95	30%	+ 224 t

A simplistic view will not give the true picture of profit. We need to split the cows from the herd into breed groups, and then calculate each breeds income and costs to identify the breed group that is most profitable at low milk price and can also make good use of high milk price.

The assumptions in Table 12 are; each herd is producing 111,000 kg MS (fat and protein adjusted) and self-replacing herds at % of cows going into 4th lactation for each breed group within current herd. Full income, milk, culls, calves and full expenses per breed group.

Table 12. Operating surplus, in $ per herd and $ per cow, for 188 cow self-replacing herds of different genetic makeup, each producing 111,000 kg MS (fat & protein adjusted)

Price ($/ kg MS)	**Current OS ($ herd/ $cow)**	**Holstein ($ herd/ $cow)**	**SRB-ARB XB ($ herd/ $cow)**	**Fr X J ($ herd/ $cow)**
$4.30	$244610 / $1301	$225685 / $1200	$260313 / $1385	$255202 / $1347
$3.84	$193478 / $1029	$174625 / $929	$209253 / $1113	$202142 / $1075
$3.50	$155685 / $828	$136885 / $728	$171513 / $912	$164402 / $874
$3.25	$127896 / $680	$109135 / $581	$143763 / $765	$136652 / $727
Break even	$3.22	$3.39	$3.08	$3.15
Prod. costs	$2.43	$2.67	$2.29	$2.28

Table 12 clearly identifies the breeds that perform best in our system. The two crossbred groups are clearly more profitable than the straight-bred Friesians in our system. This now allows me to set my breeding goals and design my breeding plan.

Breeding goals

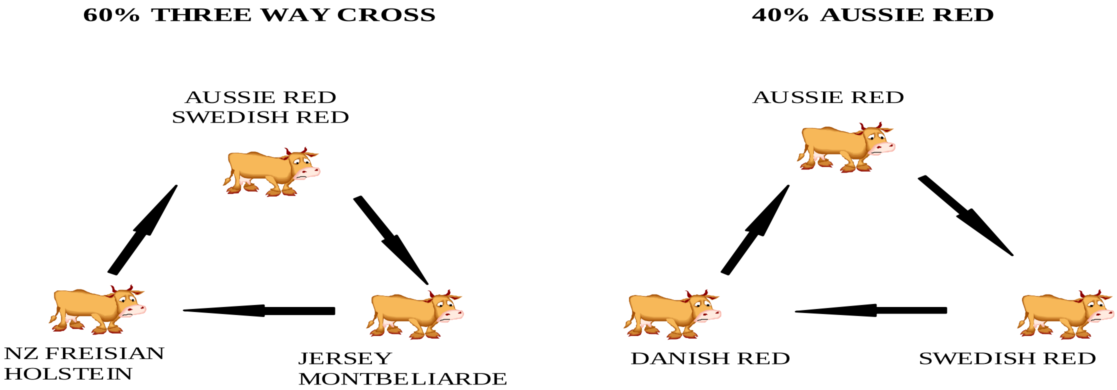
- Select the highest protein bulls from each breed.
- Use three breeds in rotational program to maximise hybrid vigour and heritability in the “broad sense” that **it’s free**
- Aim for smaller cows to increase efficiency of production.
- Aim for functionality, not glitz and glamour.
- Using bulls around the breed average or slightly better for type and udder is fine. However the breed averages are not zero
- Select bulls or bulls that are genetically linked to systems that put more emphasis on health, fertility, efficiency and calving ability.
- Average semen price $14-$16

Breeding plan.

60% of the herd will be run as three way rotational cross, NZ strain Friesian will enter the herd this year in the place of Holstein, I particularly like the NZ breeding objective of extracting a higher return from a given resource, hence my using NZ Friesian.

Montbeliarde will be used this season for the first time in place of Jersey, the aim here being protein production and also the weightings in the French ISU, of 50% production, 12.5% fertility and 12.5% cell count, which match the economic needs of my system better than the current weightings in our APR.

The other 40% of the herd will be run as stud Aussie Red, drawing on any of the red breeds that I think will work in my system. This section of the herd gives me the opportunity to produce bulls for the AI industry; ARBRUNNER is our first bull to be selected for the progeny test.



In summary to answer the questions;

- Is it possible that a cow's genetic potential could exceed the economic parameters of my business?
- Profitability at low milk price, genetically am I increasing or decreasing my ability to be profitable at low milk price?

Definitely yes, if I look at the larger cows in my herd with the lowest production efficiencies, fertility and longevity, I believe genetically they are OK. It's simply that they can not consume enough in my system to reach their genetic potential. Placed in a high input or TMR type system they would possibly reach their potential, as a result I would argue that their genetic potential exceeds the economic parameters of my system.

Profitability at low milk price will depend on my future breeding direction, if I stick to my basic breeding goals, then I should be able to genetically improve my ability to be profitable at low milk price.

Remember, this is my system! You need to clearly define your system, understand what drives it and its economics. Then design and breed the cow, which will give you the best economic outcome within your system, not the guy down the road's system.

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Struth, this is harder than writing this paper! But here is "This is your life" for Steve Snowdon

Well, I left school after completing Form 5 (year 11). The old man said if I passed Form 5, I could leave, so I had a choice, either go to Melbourne and train as a Telecom technician or take a job milking cows for 6 days a week earning $35 a week. It didn't look like a good career move for the family.
I spent three stints share farming; and we owned our own herd, which was mainly registered Holsteins, by the second one. I ended up spending the first 22 years of my working life trying to get a deposit to buy our own farm. I finally got together $118k or 23% equity to buy this farm in 1996.

From a milking area of 49ha we have been able to increase assets to just over $1.5m in the first 9 years of owning our own farm. Last year we were one of the host farms for DPI's "Walking through the seasons" discussion program.

I have a strong belief that dairying is a business, that our primary function is to convert energy into profit. We invest in energy, we then should expect a good marginal return/MJ of ME for our investment. To achieve this, it's extremely important that you define and understand your system and the economics within it. I have always had a strong belief that you need to define your system then design a cow to maximise profit within the system, not let the cow dictate and run the system.