Working with Nature for Sustainable Profits

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Executive Summary

For more than a decade it has been challenging to achieve profitability in the Northern Beef Industry, and when there is no profit, there is no sustainability.

This report investigates different strategies for “working with nature” to simultaneously improve profitability and sustainability. These strategies are summarised below.

One of the key profit drivers in the Northern Beef Industry is herd fertility. Adapted, fertile cattle perform well with limited inputs, which is good for business and the environment. Developing a herd of such cattle means selecting for traits such as maintaining good body condition, moderate frame size and early sexual maturity. Identifying these natural, "outstanding achievers" and multiplying their effects in the total herd represents a modified version of Darwin's "survival of the fittest."

Another known profit driver is managing pasture and the manner by which that pasture is harvested. There is general agreement that the stocking rate of cattle should not exceed the carrying capacity of the pasture available and that incorporating some form of rest period, to allow recovery of plants, is important. There is wide variation in the intensity of grazing management systems undertaken and this is discussed.

With the ever-increasing scrutiny of animal husbandry practices, in particular the practice of dehorning, there is a growing trend in Australia for selection of polledness, that is cattle born naturally without horns. Increasing the proportion of polled cattle in the herd can be achieved through crossbreeding with a polled breed or selecting within the breed. This process has been made easier with the development of the poll genomic test, based on a tail hair sample.

Diversification is an effective way to spread risk in a business and prevent “leakage” of underutilise resources from the business. On-farm diversification tends to either be in intensifying production vertically or branching out into new but complementary enterprises.

Finally, the report highlights the importance of looking at the “whole” (environment, economics and people), rather than the isolated “parts,” when making decisions for a family and grazing business.

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Foreword

My wife, Michelle, and I manage our family's 23,200 ha Wambiana Station located 70km SW of Charters Towers in North Queensland. We operate a range of enterprises, from breeding and selling bulls, growing out steers and trading cattle to hosting coachloads of primary and secondary school and university students from Australia and overseas for educational camps.

Our family have owned Wambiana since 1912, so we have been the custodians of this land for over a century. It is a responsibility we take seriously and hence we believe it is important for our business to be both economically profitable and ecologically sustainable.

Achieving profitability in the northern beef industry, in which we operate, has been challenging for many producers. I have been very interested to look for ways to better utilise our resources to improve profitability for northern producers. As the Chairman of the North Queensland Beef Research Committee, I have been aware of the drivers of profitability and where current research dollars are being spent. I was keen to look at what other people, from similar environments around the world, were doing to work with nature for profitable futures.

This opportunity to study on a Nuffield Scholarship has been a wonderful experience and I hope that the ideas in this report will assist northern producers. I travelled through New Zealand, Mexico, Brazil, Argentina, Chile, the United States of America, the United Kingdom and the United Arab Emirates. The highlight for me was meeting progressive graziers and farmers who so generously shared their knowledge and hospitality.

My family and I have for a long time, had a good rapport with my investor, Meat and Livestock Australia (MLA). I have been very appreciative of their support of me through this scholarship and I enjoyed meeting with and discussing red meat issues with the MLA Regional Managers for North American and Africa and the Middle East.

Acknowledgments

The efforts of numerous people have allowed me the opportunity to undertake this Nuffield Scholarship whom I would like to acknowledge.

Firstly, I thank my family for giving me the freedom to travel and research these topics of great interest to me. In particular I thank my wife Michelle who was very supportive of this journey even though it greatly increased her responsibilities and workload in both our business and family during my absence. Thank you also to our children Thomas, Connor, Sophia and Hugh who stepped up to assist with the running of the property and hosting groups in my absence. It has been great to see how much you have grown (in capability, not just height!) and I am very proud of you all.

Thank you equally to my parents John and Ronda Lyons who have always encouraged me to learn about agriculture, given me the freedom to implement innovations and in this case, stepped in to manage Wambiana while I was travelling. You are inspirational role models to Michelle and I.

Thank you to Nuffield for backing me with this scholarship. The structure of the program and the people involved have made the journey enlightening and has given me greater confidence. On my Global Focus Program, I travelled with a great group of people who began as strangers and finished as very good friends – thank you for the amazing experience.

To all the people around the world who, often on short notice, offered their time, their insight and opened their homes to allow me to partake in this experience – your generosity in knowledge and hospitality is greatly appreciated.

Throughout my life I have had many "teachers" – from people I have had a deep conversation with to my university lecturers, from other graziers to previous employers. Many have shared knowledge with me and encouraged me to seek "a better way", and for that I am sincerely grateful.

Abbreviations

EBV - Estimated Breeding Value

IVF – In Vitro Fertilisation

MLA – Meat and Livestock Australia

NABRC – North Australian Beef Research Committee

Objectives

This report presents options for improving profitability and sustainability by working with nature. In particular, it looks at options in two of the key profit drivers being:

1. Selection of fertile, adapted cattle; and
2. Optimal grazing management.

It also looks at two emerging trends, which work in a complementary manner with nature for sustainable profits. These are:

3. Polled Cattle (born naturally without horns); and
4. Complementary enterprises.

This report highlights the importance of looking at the "whole" (environment, economics and people), rather than the isolated "parts," when making decisions for a family and grazing business.

Introduction

The Northern Beef industry has generally not been profitable…
The "*Northern Beef Report: 2013 Situation Analysis*" commissioned by Meat & Livestock Australia found that the majority of northern beef producers are not economically sustainable as they are not generating sufficient profits to fund current and future liabilities (McLean, Holmes, & Counsell, 2014). This is not a recent phenomenon, with profits before interest, on average, largely unchanged for 12 years. More concerning is that profits after interest are trending down due to increased debt servicing costs.

Where there is no profit, there is no sustainability…
The concern, when there is a lack of profitability in the industry, is that maintenance is not carried out and we see a mining of physical and social resources. The land and pastures are over-utilised and the people in the business work longer hours leading to physical, mental and emotional stress on families. This is not sustainable.

Given that reality, where do these businesses focus to improve profitability?
The Grazing for Profit School, facilitated by Terry McCosker of Resource Consulting Services based in Yeppoon, refers to three "secrets" of improving profitability (McCosker T. , 1998):

- **Decrease Overheads** – the operating costs that do not increase with increasing numbers of stock e.g. rates, repairs and maintenance.
- **Increase Gross Margins** – can be achieved by increasing price received, improving productivity or decreasing direct costs (e.g. animal health, freight and feed costs).
- **Increase Turnover** – turnover refers to the number of units sold. If the enterprise has a positive gross margin, then increasing turnover will increase profitability.

What research themes are important to investigate?
In 2012, the North Australian Beef Research Committee (NABRC) released a Prospectus which aims to guide investment in Research, Development and Extension (RD&E) in the Northern Australia beef industry.

Six themes were short-listed by NABRC as priorities for planning of RD&E priorities:

1. Reproduction.
2. Grazing land management.
3. Nutrition and growth.
4. Human capacity and enabling change.
5. Animal welfare.
6. Information technology and Precision Livestock Management.

What this report will cover…
Using a combination of these resources (Northern Beef Report, Three Secrets to Improving Profitability and NABRC Prospectus) and the author's experience managing a diversified grazing business in northern Australia, it was decided to research the following:

1. Selection of fertile, adapted cattle.
2. Optimising grazing management.
3. Breeding polled cattle (naturally without horns).
4. Complementary enterprises.

This report will summarise the author's findings in these areas with reference to how they contribute to "*working with nature for sustainable profits*".

Chapter 1: Selection of Fertile, Adapted Cattle

Background

Most sales in the beef industry are made on a $/kg basis, so the heavier the animal, the more money you earn. The simple extrapolation of this assumption is that the bigger the animals you produce, the more money you will make. This has led to many producers in the beef industry becoming fixated on productivity rather than profitability, based primarily on weight gains. However, there is an inverse relationship between production per animal and profit per hectare. In terms of cattle breeding, "survival of the fittest" has given way to "survival of the prettiest" (Zietsman, 2014).

In many cases, cattle with the greatest productivity do not suit their environment and so require more inputs. Bigger cows have bigger maintenance requirements and so further inputs are required for these cattle to grow and reproduce.

How do fertile adapted cattle increase profitability and work with nature?

Working with nature to determine the cattle that are fertile and well-adapted to their environment can lead to lowers cost of production. Fertile cattle yield higher outputs with relatively lower input costs. The "*Northern Beef Report: 2013 Situation Analysis*" and other benchmarking projects in northern Australia have indicated that low cost of production is correlated to higher profitability (McLean, Holmes, & Counsell, 2014).

Strategies for selecting fertile adapted cattle

To achieve optimum production, graziers must produce fertile cattle that fit their environment instead of artificially changing the environment to suit their cows. The latter becomes very expensive and is unsustainable. The producers listed below are examples of cattle breeders who have successfully demonstrated breeding of cattle adapted to their environment.

Johann Zietsman - Zimbabwe

Zietsman's approach is that there is no universally superior genotype and that the *environment* should dictate the most profitable genotype, not *man* (Zietsman, Man, Cattle and Veld, 2014).

He seeks profitable production by selecting for:

- Cow efficiency.
- Calf maturity.
- Six-month maturity.
- Grass conversion efficiency.
- Body condition.
- Yearling maturity.

A cow's reproductive performance depends on hormonal balance and body condition. Both hormonal balance and body condition are the result of interaction between inheritance (genetics) and the environment. The relative importance of genes in determining the optimum hormonal balance and body condition is dependent on genotype and environment.

Zietsman also likes the following "easy care" traits:

- Calving ease.
- Tick resistance.
- Resistance to internal parasites.
- Mothering ability.
- Temperament.
- Polled cattle.

Figure 1: Johann Zietsman with easy care Mashona cattle (photo courtesy of Heather Dugmore)

Kit Pharo – USA

Kit Pharo, the Principal of Pharo Cattle Company, manages their herd so that cows graze on short, native grass year-round, with very little feed supplement. Nature sorts out the "good ones" with no exceptions made for non-pregnant, late or dry cows. They must produce and wean a calf every year or they are culled (Pharo, Pharo Philosophies, 2015).

Here is what he looks for in a cow:

- Moderate size – frame score of 2 to 4 with a mature weight of 1,000 to 1,250 pounds, and the ability to wean a calf that is a high percentage of her own body weight.
- Easy-fleshing – a low-maintenance animal with the ability to maintain good body condition, even on limited feed resources.
- Volume & capacity - Large fermentation vat (rumen) with the ability to efficiently convert low quality forages into meat and milk.
- Structurally sound - Good feet, legs, teeth, muzzle, eyes, udder, hair coat, fly resistance, etc.

Figure 2: Kit Pharo selecting bulls to be catalogued for sale in Colorado, USA

Jacarezinho – Brazil

Ian Hill, General Manager of Jacarezinho, breeds Nelore cattle which originated in India and are by population, the largest beef breed in Brazil. Ian uses the following selection criteria to identify fertile, adapted animals (Hill, 2014):

- Days to reach 160kg from birth.
- Days to reach 400kg.
- Conformation as a weaner and a yearling.
- Precocity (sexual maturity) as a weaner and a yearling.
- Muscling as a weaner and a yearling.
- Scrotal circumference, adjusted for age and weight.
- Age at first calving.
- Birth weight.

Figure 3: Ian Hill and Michael Lyons admiring high fertility Nelore cattle in Brazil

Accelerating natural selection for adapted cattle

Faster progress for selecting adapted cattle can be achieved by limiting the number of traits under selection. Therefore, it is critical to ignore the unimportant traits and concentrate on the important traits. To this end, Zietsman focusses on:

- Grass conversion efficiency – the ability to convert grass into growth and good body condition.
- Hormonal balance - high levels of testosterone in bulls and oestrogen in heifers at a young age resulting in early sexual maturity.
- Optimum milk – a balance of producing enough milk to grow her calf to approximately 50% of her weight but not so much milk that it impacts her ability to fall pregnant again
- Easy-care – cattle that can efficiently convert grass into meat with minimum inputs

Cow size

The over-riding principle in achieving optimum cow size is that "*the smaller and heavier the cow, the better.*" There is a relationship between size, growth, grass intake, maturity rate, body condition and efficiency of feed conversion that is essential to understand. The faster an individual animal grows, the greater the feed conversion efficiency. If two animals are growing at the same rate, then it stands to reason that the smaller one is doing so more efficiently.

Everything else being equal, the animal that is capable of the highest grass intake, relative to its size, will be in the best body condition, resulting in the highest fertility and most efficient grass conversion (Zietsman, Man, Cattle and Veld, 2014).

Selection indices

While selection for an individual trait will lead to rapid progress in that trait, it will most likely also lead to regression in other traits. For example, too much focus on growth will often lead to lower fertility. To avoid this, application of a selection index is a very good way to ensure genetic progress across a balance of traits. In Australia, Breedplan is the most commonly used system of recording selection indices.

1. Breedplan

Breedplan is a modern genetic evaluation system for beef cattle. Using Best Linear Unbiased Prediction (BLUP) technology, Breedplan produces Estimated Breeding Values (EBVs) for cattle for a range of important production traits (Agricultural Business Research Institute, 2015).

In the Brahman breed, Breedplan has a range of EBVs for fertility such as "Scrotal Size" and "Days to Calving", growth such as "200, 400, & 600 Day Wts" and carcass traits such as "Carcass Weight" and "Shear Force" (a measure of tenderness). Each trait has an accuracy figure produced which provides an indication of the amount of information that has been used in the calculation of that EBV (Figure 4). The higher the accuracy, the more likely the EBV is to predict the animal's true breeding value and the lower the likelihood of change in the animal's EBV as more information is analysed for that animal, its progeny or its relatives.

Development of a Selection Index allows selection across a balance of EBV's. A weighting can be given to each of the EBVs to develop a selection index. The selection index value for an animal is effectively an EBV of the animal's profitability in that particular commercial production scenario and market. Ranking seedstock animals on their selection index value sorts them based on their progeny's expected profitability for the targeted production system. Selection indexes are expressed as "*net profit per cow mated*".

For example, if we compare a bull with an Index of +$60 with a bull that has an Index of +$30, we can estimate that the difference in net profit from the progeny of the bulls would be: = 0.5 x difference in Index that is 0.5 x (60-30) = $15 per cow mated. Note that the difference in net profit is multiplied by 0.5 because half the progeny's genes come from the sire. If the two bulls were joined to 200 cows during their breeding life, this would equate to a difference of (200 x $15) = $3,000. It is important to note that this difference includes profit across the entire production chain from joining to slaughter and also considers the long-term profit generated by a sire's daughters, if it is a self-replacing selection index. (Agricultural Business Research Institute, 2015).

November 2016 Brahman GROUP BREEDPLAN

	Birth Wt. (kg)	200 Day Wt. (kg)	400 Day Wt. (kg)	600 Day Wt. (kg)	Mat. Cow Wt. (kg)	Milk (kg)	Scrotal Size (cm)	Days to Calving (days)	Carcase Wt. (kg)	Eye Muscle Area (sq.cm)	Rib Fat (mm)	Rump Fat (mm)	Retail Beef Yield (%)	Flight Time (secs)	Shear Force (kgs)
EBV	+0.9	+17	+28	+42	+31	-2	+3.5	-5.5	+21	+1.4	+0.3	+0.9	+0.6	+0.17	-0.10
Acc	77%	82%	85%	87%	80%	47%	82%	37%	69%	37%	36%	37%	34%	38%	36%
Breed Avg. EBVs for 2014 Born Calves Click for Percentiles															
EBV	+2.5	+18	+24	+34	+39	-2	+0.6	-0.6	+20	+2.1	-0.3	-0.5	+0.5	+0.01	+0.02

Traits Observed: BWT,200WT,400WT,600WT,SS
Statistics: Number of Herds: **1**, Progeny Analysed: **21**,

SELECTION INDEX VALUES		
Market Target	**Index Value**	**Breed Average**
Jap Ox Index ($)	+$ 44	+$ 24
Live Export Index ($)	+$ 41	+$ 22

Figure 4 Example of Breedplan data and selection indexes showing the results of a high performing Brahman bull, DDRF15910, compared to the breed average

A point of controversy

Timing of mating

There is general agreement that timing of mating is very important for profitability and working with nature. Cows need to calve in Body Condition Score (BCS) 3 or higher (on a scale of 1 being thin to 5 being fat) to have the best chance of conceiving with a calf at foot. Allowing nature to put that condition on cows through availability of good feed is an efficient and low-cost method of maximising the cow's chances of conceiving within a short time frame. However, there are conflicting opinions as to when that timing should be. The three main opinions are summarised below:

Group One believes that calving should occur during the dry season. In northern Australia, this means an optimal calving period in August/September. The rationale behind this is to select the cows that have:

- The ability to reconceive with the least inputs.
- Produced a calf that can ruminate and eat grass during its first wet season.
- The ability to regain body condition during the wet season, ready to calve in very good condition the following year.

Proponents of this calving period include Alf Collins Snr from Australia (Collins, 2016). The Collins family want to put their herd under sufficient pressure to show the animals with superior genetics for adaptation and speed of reproduction.

Group Two believes calving should occur six weeks before the onset of the wet season. In northern Australia, this means an optimal calving period in November/December. The reasoning behind this is that the cows draw down on their own energy reserves after calving and as the calf demands more milk, the wet season should provide a rising plane of nutrition for the cow to reconceive. Proponents of this calving period include Terry McCosker from Australia (McCosker, 2014) and Kit Pharo from USA (Pharo, 2014).

Group Three believes calving should occur late in the wet season. In northern Australia, this means an optimal calving period in January/February. The reasoning behind this is to allow the cow to fatten during the wet season prior to calving. This body fat would allow the cow to make milk to keep the calf growing and re-join as the pastures deteriorated. Proponents of this calving period include Johann Zietsman from Zimbabwe (Zietsman, Man, Cattle and Veld, 2014).

Each of these systems has practitioners who are operating successfully. This success will be in part because you achieve what you select for.

Further information

Johann Zietsman's book "Man, Cattle and Veld" is a very comprehensive reference for breeding cattle that are profitable and adapted to their environment (Zietsman, Man, Cattle and Veld, 2014).

Chapter 2: Optimal Grazing Management

How does optimal grazing management increase profitability and work with nature?

The highest value resource a grazier manages is the land. By strategically grazing the pasture, the manager can grow animals and improve the land. This has the potential to increase beef production per hectare thus improving gross margins and turnover.

Background

Then northern beef industry has traditionally been operated under extensive conditions and continuous grazing, where cattle are set stocked in paddocks all year round. The effect of this is that pastures do not get any relief from grazing animals. Patch grazing occurs where the more palatable species are severely overgrazed and the less palatable species are left ungrazed. This is referred to as having overgrazed and under-utilised pasture plants in the same paddock.

Strategies to optimise grazing management

While there is never going to be a one-size-fits-all grazing system, the following strategies are useful for guiding management:

a. Match Stocking Rate to Carrying Capacity

There seems to be universal agreement that this is the key criteria in managing pastures. This strategy refers to reducing or increasing the number of cattle grazing to match the amount of grass available. In northern Australia, where there are definite growth and non-growth periods, it is important to assess the quantity of pasture at the end of the growth period (e.g. March-April) also known as doing a pasture budget. Working forwards from that quantity and the number of days until the next growth period, you can calculate the number of animals that can be grazed.

Figure 5: Dr Peter O'Reagain demonstrating pasture budgeting to university students

b. Overgrazing Vs Undergrazing

There are two ways to damage pastures – overgrazing and under-grazing (O'Reagain, 2014). Often, there are examples of individual plants in both of these states within the same paddock. The overgrazing that occurs is actually a function of how long the cattle have access to the pasture rather than the number of stock grazing in the paddock (Savory & Butterfield, 1999).

c. Time Control Grazing

This term is used to cover all grazing systems that work on providing adequate rest for pastures to recover from grazing before grazing again. These systems vary in their intensity and capital requirements. However, all have the following commonalities:

- Give paddocks adequate rest before grazing again.
- Keep grazed periods short to restrict plants from being grazed twice during the grazing period.
- Use high stock density to eat the pasture or knock it down so that it can protect the soil surface and be recycled into the soil.

Figure 6: Before and after photos of Ultra High Density Grazing in Chihuahua, Mexico (photo courtesy of Jim Elizondo)

d. Number of Paddocks

Assuming some form of time control grazing is beneficial for incorporating rest into the grazing system, how many paddocks are required to achieve ecological change without compromising animal performance? David Pratt of Ranch Management Consultants in the USA has the following rule of thumb (Pratt, 2013):

- 8-10 paddocks per mob stops overgrazing.
- 14-16 paddocks per mob supports good animal performance.
- >25 paddocks per mob are required for rapid range improvement.

The greater the number of paddocks, the shorter the grazing period and the longer the recovery period. A large number of cattle grazing an area for a short time allows them to

utilise the available pasture and knock down the remaining pasture, thus improving contact with the soil surface and encouraging biological breakdown, mineral and energy cycling.

e. Beware of Rotational Grazing

It is easy to assume that, because animals move to new paddocks, that the pastures are getting healthier and there is some economic benefit. However, unless the moves are based on the rest period of the pasture, it may actually be rotationally overgrazing i.e. re-grazing the pastures before they have had a chance to recover.

Point of controversy

There continues to be a disparity between research personnel and graziers when it comes to more intensive rotational grazing systems. This is despite many of the major awards for conservation and best practice management being awarded to graziers utilizing some form of time control/multi paddock grazing systems (Carbon Farmers of Australia, 2011).

In the 1998 McClymont Lecture, Ben Norton suggested the following three reasons why most research trials have concluded that continuous grazing is either better, or no worse than rotational grazing in terms of livestock production (Norton, 1998). These are:

1. The paradigm underlying studies of rotational grazing, namely, that rotational grazing can control frequency of defoliation, is flawed.
2. Continuous grazing in large paddocks causes patch grazing and localised pasture degradation, but this aspect of continuous grazing has not been addressed in trials comparing grazing systems.
3. Continuous grazing in large paddocks creates a very uneven distribution of livestock, but research trials have usually assumed spatial homogeneity in forage availability and utilisation.

Richard Teague and colleagues describe the differences between the interpretation of results of grazing systems research reported in the scientific literature and the results reported by successful grazing managers. They highlight the shortcomings of most of the previously conducted grazing systems research for providing information relevant for rangeland managers who aim to achieve desired environmental and economic goals as (Teague, Provenza, Kreuter, Steffens, & Barnes, 2013):

1. Varying focus, implementation and scale of previous research mean many grazing experiments are unique inflections in time and space of biophysical processes that link soils, plants, herbivores and people, not generalisations that can be extrapolated across management systems and landscapes.
2. Underestimating the impact of selective grazing. Small scale research has limitations reflecting animal's ability to selectively graze and makes interpreting on a whole property scale difficult and increases opportunity for error.
3. Treatment lags and parameter measurements. Most management changes have effects that are delayed in time and vary over the landscape.
4. Taking soil differences into account. The scale of rangelands soils and the mosaic effect of varying soil types make comparisons between grazing regimes difficult.

5. Inadequate recovery time in experiments. If inadequate time is allowed for the plant to recover then the rotational approach may not actually be that different to a set-stocked approach.
6. The roles of reductionist and systems approaches. These approaches often fail to find common ground, however simulation offers hope for whole of system analysis.

Further information

It is highly recommended that managers seek training in grazing management, before committing to spending capital on infrastructure. The time and cost of training will be insignificant in assisting them to implement a well-planned system compared to the potential losses and resultant "train wreck" if grazing management is not properly planned.

Chapter 3: Polled Cattle

How do polled cattle increase profitability and work with nature?

Polledness is a naturally occurring mutation leading to cattle that do not develop horns. The genes controlling polledness are dominant and so simple selection strategies allow selection for polledness. A high proportion of polled animals in the herd can lead to increased gross margins through decreased mortalities and bruising. It also improves welfare for the animal and people working with the cattle.

Background

Recent research has indicated complications caused by surgical dehorning contributed to the loss of 2% of dehorned calves a year in northern cattle operations (Meat & Livestock Australia, 2014). Breeding polled cattle eliminates the need to dehorn calves resulting in less pain and stress on the calf and subsequently, a reduction in calf mortalities.

Figure 7: Polled Brahman bull in Louisiana, USA

Polled animals can be either homozygous polled (meaning they have two copies of the poll gene) or heterozygous polled (meaning they have one copy of the poll gene). A homozygous polled parent can be mated with a horned parent and all progeny will be polled whereas a heterozygous parent when mated to a horned parent will achieve approximately 50% polled calves.

Genomic tests that will determine whether an animal is homozygous polled (two copies of poll gene) or heterozygous (one copy of poll gene) are available in Australia from:

- UQ Animal Genetics Laboratory: http://www.uq.edu.au/vetschool/cattle
- Zoetis Animal Genetics: https://genetics.zoetis.com/australia/products/beef/hornpoll.aspx

Figure 8: Pulling a tail sample ready to send to a lab for analysis

Strategies to increase polledness in the herd

Two ways to achieve polledness in the herd are to:

1. Crossbreed with another breed that is polled. The additional benefit of this is hybrid vigour is gained (increased performance as a result of the mixing of two genotypes).
2. Selecting and breeding from polled cattle within the breed. Identifying and selecting homozygous sires will quickly lead to all polled progeny. It is more important in natural mating systems that selection is focussed on homozygous bulls as a bull has the potential to influence 40 calves per year compared to a cow's one calf per year.

It is also important to select for polledness, while retaining a balance of performance traits including temperament, growth rate and fertility.

Point of controversy

Members of the beef industry who are detractors of polled cattle have cited problems, claiming that polled cattle having poor conformation and animal performance or having a higher incidence of preputial prolapse and premature spiral deviation of the penis. Science has shown polledness is not genetically linked to these issues ((Prayaga, 2005); (Norman, Bertram, & McGowan, 2009)). With increasing focus on pain-free rearing of food animals, it is likely that polledness will become increasingly popular. The important consideration will be to select for polledness without compromising fertility, temperament, growth and carcass traits.

Further information

An excellent summary of polled breeding can be found in Kishore Prayaga's MLA Report entitled "*Genetic options to replace dehorning of beef cattle in Australia*" (Prayaga, 2005).

Chapter 4: Complementary Enterprises

How do complementary enterprises increase profitability and work with nature?

By definition, complementary enterprises should improve profitability by complementing the existing enterprises. They often make use of free inputs, for example, the waste of another enterprise within the business (referred to as "leakage") or a resource that is not being utilised, to value add to their business. Turnover should be increased and overheads per unit of income decreased leading to greater profitability.

Background

When looking at their land, many graziers see their pasture as the only resource from which to generate income. However, there are many natural and human resources associated with the land that can be creatively tapped to generate additional income.

Strategies to create complementary enterprises

Intensify or diversify

Businesses tend to build complementary enterprises in two main ways:

1. They intensify their production through vertical integration. In a grazing context, a breeding operation might develop a seedstock enterprise, add a feedlot or direct market their product.
2. They diversify their production by adding a new enterprise. For example, a cattle operation might develop an agritourism enterprise, to sell an experience, or add another agricultural enterprise that complements the cattle e.g. trade camels that are being used on the property, to control weeds such as Parkinsonia.

Figure 9: Camels used as a biological control for the weed Parkinsonia at Wambiana Station, Australia

A farm "turnaround" specialist in the 1940's, Howard Doane, believes it is better to vertically integrate one enterprise than to horizontally add more production enterprises, when the produce is sold conventionally. He indicates that the goal should be to get out of the commodity business, not to add more raw product commodities to your business (Nation A. , 2015).

Leakage

Innovative graziers look for leakage and untapped resources in their properties and businesses. For example, they may look for:

- Alternative uses for existing machinery and buildings. Multiple uses of these capital items allow you to get more value from them e.g. running a fabrication business in an underutilised shed.
- "Selling the experience": being in nature, having space away from other people and beautiful scenery are all experiences that can be sold without relying on rainfall or cattle prices.
- The inherent skills and interests of the people in the business may offer new opportunities.
- What services that are currently outsourced by a business could be developed into a business to supply that service to others? A start might be supplying to a family, neighbours and then neighbour's friends in a low-cost start-up.

Agistment / Custom Grazing

Agistment, or custom grazing, is renting or leasing some paddocks of a property to another person to run their cattle. It is a potentially successful enterprise that can easily be run alongside existing cattle enterprises that is often overlooked. Benchmarking has shown that agistment enterprises often have better gross margins than grazing cattle, due to the lack of capital tied up in owning the cattle (McCosker, 2014). It also does not require any additional equipment or skills. Agistment enterprises operate well by providing a regular source of income and can reduce the overheads through less staff. They can be operated counter-cyclically by having higher agistment numbers during good seasons and reducing agistment when seasons deteriorate to make room for own cattle.

Technology

Technology can often create the opportunity for a new enterprise. In any production system, there is a challenge, or bottleneck, that limits taking it to a new level. When a new piece of technology becomes available, it can completely change the paradigm. For example, the development of electric fences that are portable and inexpensive made controlled grazing achievable. Social media has allowed farmers to connect with consumers and has given them the ability to direct -market their produce. The question to ask is: "*What challenge, now seemingly impossible, would fundamentally change your enterprises if you could overcome it with technology?"*

Change of land use

Due to the extensive nature of northern Australian grazing operations, there exists opportunities for using some areas for more intensive uses. The appeal is that the underlying land resource has been secured at a "wholesale value" price and used for a "retail value"

purpose. An example are opportunities for mosaic agriculture using irrigation in northern Australia to grow crops for sale or feed for cattle (Grice, Watson, & Stone, 2013).

Case Study: Salatin Family of Polyface Farms (USA)

TIME Magazine refers to Joel Salatin as "The World's Most Innovative Farmer" (Walsh, 2011). Joel describes stacking complementary enterprises as one of the primary ways of increasing income from a farm.

He started with a "centrepiece" enterprise, which in his case was pastured broilers, as he liked raising chickens and it provided good cashflow. After that, all of his subsequent enterprises started out as "holons" that organically grew into "enterprises".

Holons have been defined as "independent dependencies" (Nation A. , 2007). In contrast to an enterprise, which exists to pay its own way, a holon exists to strengthen a pre-existing proven enterprise. In other words, a holon pays it way primarily by the service it provides to a cash producing enterprise, rather than through its own independent production sales.

Joel's first holon were beef cattle to knock down the tall grass and keep it short for his pastured broilers. In other words, the cows grass growth control "service" was the only income Joel initially sought from the cows. Over time, while still performing "service" to the broilers, the beef cattle grew into an income producing enterprise in their own right.

The cattle soon had their own holon, a rolling hen house (eggmobile) that followed the cattle through their pasture rotation to help control the flies and internal parasites. The profit from the eggmobile does not come from the eggs it produces but from the pasture sanitation "service" it provides. However, the eggs produced are also profitable because much of the feed required by free ranging chickens comes from the bugs they control, and the feed they get from seeds and maggots in the cattle dung.

Holons allows to test-drive a potential enterprise to see if it fits the operation without significant setup costs. Holons have can have great gross margins while they turn "trash into cash" but become an enterprise when starting to purchasing inputs, so getting the scale right is important.

Today Joel produces an income of $2,000,000 from 500 acres of owned land and 1,500 acres of leased land. He has family members, managers and interns working in the various enterprises of his business, which is alive with energy (Salatin, 2014).

Figure 10: Joel Salatin leading a "Lunatic Tour" of his farm and discussing the interrelationships between his enterprises

Succession

Assisting young employees or family members to build a holon that assists the business is great way to teach young people about business in a low risk environment. The independence it fosters can allow them to build confidence and learn the skills that will allow them to operate their own business in later years.

Point of controversy

Whilst alternative income streams might seem alluring, David Pratt of Ranch Management Consultants (USA) warns "*Our benchmarking results show that the most profitable ranches generally have two or three enterprises. Ranches with five or six enterprises are rarely profitable. Generally, the more enterprises someone has, the less profit they make and the more stress they feel"* (Pratt, 2013).

He suggests when you consider diversification, ask three questions:

1. Are we creating a new business or just another job? Unless it is a business, do not do it. The last thing needed is another job.
2. Does it compete with or complement another enterprise? If it competes, it will not increase profit.
3. Can it produce significant income? Doing a lot of small things will be tiring, but it will not increase profit. Highly profitable businesses do just a few things, but do them in a big way.

Further information

Vertical Farm Diversification by Howard Doane has some good principles on diversification. Doane was a farm "turnaround" specialist who saw profitability in taking farm produce at least one step further than the raw product stage (Doane, 1950).

Conclusion

The whole is greater than the sum of its parts

Whilst this report has broken down the topic of "Working with Nature for Sustainable Profits" into segments, the real power comes the synergies of each of those elements working together.

Very few elements in nature operate in a linear manner but rather operate in cycles that are dependent on other elements of nature. As a result, managers need to manage the whole of a business that includes the environment, the economics and the people. When these are managed well, they can build environmental, economic and human capital.

There are no silver bullets or quick fixes in agriculture. Similarly, there is no "*one-size-fits-all*" solution. Growth comes from individuals applying the principles and developing novel solutions for their business and natural resources.

Business Models

There are some business models that are developing increasing interest:

- **Systems Thinking** – The sense of urgency in organisations to fix problems quickly has led people to take short-sighted actions, resulting in unintended, adverse, and sometimes devastating effects. Systems thinking helps people to test their assumptions and beliefs so they can identify the unintended effects of their strategies and dig deeper for new long-lasting solutions to old problems (Saposnick, 2003).

- **Circular Economy** – This concept aims to decouple growth from the use of scarce resources through disruptive technology and business models based on longevity, renewability, reuse, repair, upgrade, refurbishment, capacity sharing and dematerialization. This will lead to companies gaining a circular advantage—driving both resource efficiency and customer value (Accenture, 2015). An example is re-engineering old conveyor belts to make livestock troughs, ute tray protectors and bases for troughs rather than using new resources.

A Stepwise Approach

Many people have a desire to improve their businesses but fear the implications of making the change. Often, taking small steps in the direction of the goal allows time to learn more about the system and provides an opportunity to develop skills in concert with the management changes.

A good example of this is a combination of two systems proposed by Terry McCosker and Ian Brathwaite. McCosker favours reducing the number of mobs on the farm and using time control grazing systems for better managing grazing. Braithwaite favours dividing breeding cows into calving windows so that you can better manage the body condition on those cows. McCosker has found a compromise – suggesting that managers fence their paddocks according to land type and initially use those paddocks to set-stock the cows in their various calving windows. With time and good record-keeping, managers will see which of those calving windows is least profitable and they can be removed, thus freeing up paddocks that would allow progression towards a rotational grazing system (McCosker, 2014).

Attitudes

The biggest change is often an attitudinal one. People have fixed paradigms or ways of thinking that need to be broken to allow a new view of the world. There are a number of training courses, related to agriculture, that can assist this process, including:

- "Grazing for Profit School" (RCS, 2016).
- "Holistic Management" (HM, 2016).
- "Sustainable Ranching" (Sustainable Ranching, 2016).
- "Systems Thinking Lectureship" (KIRRIM, 2016).

These courses help shift the focus from individual dollars-per-head returns to dollars-per-hectare returns that are a lot more holistic in nature.

Case Study: Lyons family, Wambiana Station

(Note: Author's family)

The following case study illustrates how information from each of the earlier chapters integrates in a management system.

The Lyons family were successful in purchasing cows from CSIRO's Belmont Research Station following its closure. These Brahman cows have produced up to 12 calves in 12 years which is rare in a northern Australian environment and indicates superior adaptation and fertility. By expecting the cows to produce a calf each year and culling the cows that did not do so, nature effectively selected the superior cattle.

The cows also had high ranking Estimated Breeding Values (EBVs). The Jap Ox Index for the Brahman Breed takes into account EBVs for fertility, growth and carcass traits for a self-replacing herd breeding steers for the Jap Ox market. The average EBV value for the breed is +22 and these cows ranged up to a Jap Ox Index of +66 for one cow in the top 1% of the breed. She possesses the sort of genetics that are profitable and adapted to the natural environment but she is 13 years old and unlikely to have many more calves.

To multiply the genetics nature had selected, an In Vitro Fertilisation (IVF) program was undertaken to increase the number of progeny produced by this cow.

Using the same selection index, semen was selected from a bull with a Jap Ox Index of +50, also placing him in the top 5% of the breed. The bull had also been genomically tested and is homozygous polled meaning that all of his progeny will be polled (born naturally without horns).

After fertilising the follicles to become embryos, the embryos were transferred into the family's non-pregnant cows. These cows were otherwise due to be sold as they were not pregnant however by becoming recipients through the IVF process, they were able to be value-added.

The result of this process in 2014 using 10 donor cows and two bulls was 51 live calves that are all polled with excellent EBVs and will be adapted to their environment and raised in that environment by recipient cows that grew up in that environment.

In summary, the program worked with cows that nature had tested and proved were fertile and adapted to their environment, augmented this with technology by using a selection index, poll gene testing and IVF and then tapped into an unutilised resource being non-pregnant cows, to be the recipients and raise the embryos.

While this is just one example, this type of holistic, integrated thinking and working with nature offers a profitable future for northern Australian beef producers.

Figure 11: Michael Lyons with fertile, adapted, polled heifers from their IVF program, Australia

Recommendations

- Take a whole-of-system approach to profitability and sustainability. Plan the way forward and look for the synergies in the production system.

- Keep in mind the key drivers of profitability in Northern Australia – managing grazing and genetics well. View these like compound interest – the more reinvested, the greater the long-term returns. Good management of grazing will increase the vigour and biodiversity of pastures with each season. Good management of genetics will lead to each generation of the herd being better than the previous generation.

- Grazing animals have two roles – one is to produce a product to sell and the other is to improve the environment from which they graze.

- Develop strategies for selecting cattle that are adapted to the environment. Stick to a plan and the cattle that are suited will reproduce and thrive. Select replacements from these cattle. The cattle that are not adapted should be removed and allows moving a herd more quickly towards the wider goal.

- Find a level of grazing intensity that fits with goals. Do not let stocking rate exceed carrying capacity and plan to allow plants to recover after grazing. Starting more extensive than is needed may occur, but it's a start.

- Consider increasing the proportion of polled cattle in the herd. Animal welfare, staff welfare and gross margin profitability trends support polled cattle.

- Look for opportunities to diversify. Consider the passions that could be incorporated into the business. Also look for "leakage" in the business – what resources are currently being underutilised or wasted in the business?

- Engage in training to build skills in new areas. Learn from others as changes are implemented. Be surrounded by positive people who are prepared to change.

- Do something. A rudder can't give any direction to a boat without some motion. Similarly, in business, try a new idea and monitor the result. Other decisions to refine direction can always be made.

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Plain English Compendium Summary

Project Title:	Working with nature for sustainable profit
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Objectives	Identify strategies to improving profitability and sustainability by working with nature, in the following areas: 1. Selection of fertile, adapted cattle; 2. Optimal grazing management; 3. Polled cattle (born naturally without horns); and 4. Complementary enterprises.
Background	Profitability in the Northern Beef Industry has been difficult to achieve over the last decade. This is not sustainable. This report aimed to identify strategies which are within the control of the manager and which can be used to improve profitability whilst also improving the environment?
Research	Adoption of research and development that aligns low cost production and improving the environment is essential for true sustainability. Innovations described in this report in the areas of genetic selection for fertility and adaptation, grazing systems that incorporate grazing and recovery periods and a focus on polled cattle for improved welfare are key factors considered in this report.
Outcomes	This report highlights the importance of looking at the "whole" (environment, economics and people), rather than the isolated "parts," when making decisions about strategies for the business and environment.
Implications	Changing strategies to work with nature will require attitudinal changes and training.
Publications	• September 2015 - Nuffield National Conference – Albury, NSW